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ABSTRACT

As a result of actual and anticipated growth in the level of entrepreneurial activities within the University of Maryland System (UMS), and corresponding growth in licensing and royalty revenues, a threshold policy was recommended in the Joint Chairmen's Report of 1996. Such a policy would establish a maximum threshold beyond which a portion of licensing and royalty revenues would accrue to the State of Maryland's General Fund. This analysis of the recommendation concludes that this proposed policy would negatively impact the expansion of technology commercialization, a key element of Maryland's strategic plan for economic development while raising only a minor amount of revenue for the State's General Fund. It suggests that the proposed policy change would have a negative impact because it would divert commercialization revenues from the technology transfer office, the inventor, or the University. This would diminish the resources available to faculty and universities and thus reduce their incentives for engaging in commercialization efforts. The revenue potential is small because few university patents or licenses generate sufficient revenue to reach a relatively high threshold. The average revenue from an active UMS license was $12,611 in 1994. If the threshold were low enough to impact most licenses, it would be a strong disincentive for commercialization. Further, the total level of UMS royalties ($945,876 in 1994) would remain small in comparison to other potential revenues sources. (JLS)

Implications of Proposed University of Maryland System Patenting Policy Change

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University of Maryland System Administration

by,

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Executive Summary

There has been a substantial increase in the level of entrepreneurial activities within the University of Maryland System (UMS) and with programs such as the Institute for Human Virology, further growth is anticipated. As a result of both actual and anticipated growth in entrepreneurial activity and the corresponding growth in UMS licensing and royalty revenues, the establishment of a maximum threshold beyond which a portion of licensing and royalty revenues would accrue to the State of Maryland's General Fund was recommended in the Joint Chairmen's Report of 1996. This study concludes that this proposed policy would negatively impact the expansion of technology commercialization, which is a key element of Maryland's economic development strategic plan, and raise a relatively minor amount of revenue for the General Fund.

The proposed policy change would have a (relatively small) negative impact on technology commercialization in Maryland because it would divert commercialization revenues from the technology transfer office, the inventor, or the university. This would diminish the resources available to and incentives for faculty and universities to engage in commercialization efforts. The revenue potential from the policy change would be minor because few university patents or licenses generate sufficient revenue to reach a relatively high threshold. The average revenue from an active UMS license was $12,611 in 1994. If the threshold was low enough to impact most licenses, it would be a strong disincentive for commercialization. Furthermore, the total level of UMS royalties ($945,876 in 1994 according to the Association of University Technology Managers) is small in comparison to other potential revenue sources. Even if UMS licensing revenues grew to the level of MIT, $4.5 million, State General Fund revenue potential would be minor.

The proposed policy change would divert resources away from technology commercialization at a time when Maryland is encouraging high technology innovation and commercialization to diversify the state economy away from declining defense industry and government employment and toward high technology industries, especially in the biosciences. Taxing successful commercialization efforts would send the wrong signal to UMS faculty, where expanding technology transfer is a key goal, and to the high technology community. The policy could also jeopardize Maryland's success in expanding commercialization activities.

TABLE OF CONTENTS

LIST OF TABLES

1.0 Introduction

There has been a substantial increase in the level of entrepreneurial activities within the University of Maryland System (UMS) over the past several years. The development of the Institute of Human Virology is expected to stimulate even more rapid growth in the level of entrepreneurial activity and technology commercialization in the state. As a result of both actual and anticipated growth in entrepreneurial activity and the corresponding growth in UMS licensing and royalty revenues, the establishment of a maximum threshold beyond which a portion of licensing and royalty revenues may accrue to the State of Maryland's General Fund has been recommended.

The University of Maryland System Office commissioned The Jacob France Center of the Merrick School of Business at the University of Baltimore (the France Center) to prepare a report on this proposed policy change. Specifically, the France Center was requested to:

1) Review the patent policies of other state university systems to determine if similar policies are in place in key regional or "best practice" universities;

2) Review existing studies of the economic impacts of state university systems to develop a framework to determine the economic implications of the proposed changes; and

3) Estimate some of the key repercussions of the proposed changes.

The France Center worked with representatives of the UMS to develop its research plan and strategy. The France Center's research effort consisted of a thorough review of the rules and procedures of regional and "best practice" state university systems; a review of available university economic impact studies, and a review of the economics and public policy literature on patent policy.

The findings outlined in this report are the result of the research and analysis of the France Center research team. In many cases, best judgments or estimates were made based on available research materials and the experience of the research personnel.

2.0 Technology Transfer Policies at Regional and Best Practice Institutions

In the first phase of this research project, the patent policies of key regional or "best practice" state university systems were reviewed to compare patent and technology transfer policies and guidelines and determine if other universities had policies similar to those being proposed for the UMS. The policies of the eleven key regional or "best practice" state university systems listed in Table 2-1 were reviewed with particular attention paid to rules governing the distribution of royalties. The sample of regional and "best practice" institutions was chosen based on discussions with UMS administrators, academic researchers, and technology transfer officials and on prior France Center research. [1] Because of the nature of the research question, only state university system policies were reviewed. While universities such as Harvard, Johns Hopkins, MIT, or Stanford are leading scientific research centers that have commercialized numerous technologies, they are private institutions, and thus, would not be required to provide a portion of licensing revenues to the government of their home state.

Table 2-1
State Universities Studied

University of Alabama at Birmingham	Pennsylvania State University
University of California at Berkeley	University of Utah
The University of Maryland System	University of Virginia
University of Maryland at Baltimore	Virginia Polytechnic Institute
University of Michigan	University of Wisconsin at Madison
University of North Carolina- Chapel Hill	

Technology transfer is the process by which ideas or inventions move from a laboratory to an individual or a firm and then to the marketplace. The process begins with an innovation or discovery which is made through university basic research. This innovation is then evaluated by the university's technology transfer office to determine its commercial potential. If further research is required, applied research can be performed at the university. Potentially interested companies are sometimes brought in during this phase to share the applied research and development costs. If the innovation is ultimately determined to have commercial potential, the university may then choose to patent the technology and/or directly license the technology to an interested company. Licensing, where companies pledge payments in return for the right to use an innovation, allows the university to share in the economic benefits derived by the developer of the innovation. In order to promote the development of an innovation by start-up companies, universities will sometimes waive licensing fees in return for an equity position in the company. The rules governing the technology transfer process are set by each university, with varying degrees of control by the state university system, state higher education commissions, or state Boards of Regents.

[1] See Clinch, Richard, Benchmarking the Economic Impact and Effectiveness of University Technology Transfer in Maryland, 1996.

2.1 Intellectual Property Guidelines

Inventions in the university environment can occur through such avenues as non-funded discoveries, as well as, research funded by government grants or industry-sponsored grants. Intellectual property rules govern the ownership, distribution and commercialization rights associated with a technology or discovery as well as royalty distribution guidelines. In state-funded university systems, general mandates governing research and commercialization are written by the governing board of the state university system, which in Maryland is the Board of Regents. In many states, such as Virginia, the state mandate is for the Board to adopt patent policies consistent with the policy guidelines promulgated by the State Council of Higher Education. However, in one of the university systems analyzed, the University of North Carolina System, the Board actually set a universal policy for all constituent institutions. In all other cases, individual campuses developed their own intellectual property guidelines that adhere to the general parameters set by the board.

All institutions analyzed, except for University of Wisconsin at Madison (UW-Madison) and University of North Carolina at Chapel Hill (UNC-Chapel Hill), have intellectual property policies that explicitly state university ownership of all inventions regardless of how they were funded. In addition, if any invention results from the use of university facilities or funds, the university generally retains ownership. This includes inventions produced by both visiting scholars and students. It is necessary, in nearly every case, for the inventor to relinquish ownership of his invention to the university in exchange for a share of the royalties (revenues) that accrue due to the commercial use of the patent. Portions of the royalties go toward the maintenance of the technology transfer office, thereby funding future patenting endeavors. The remaining revenues are divided between the inventor and the university (or, in some cases, an agency of the university created to manage these funds).

UW-Madison was the sole institution in this study not claiming ownership rights to the results of research performed by faculty, staff or students. Investigators can voluntarily notify the Wisconsin Alumni Research Foundation (WARF), an adjunct agency of the university, of their invention and WARF can decide whether or not to pursue a patent. However, WARF encourages inventors to utilize the agency's patenting expertise, and the agency has been highly successful in the patenting process as well as in reaping the financial benefits of commercialization.

UNC-Chapel Hill was the only institution to specifically state a policy regarding inventions made by University personnel or students on their personal time with no use of university facilities or funds. In this case, the property rights revert to the inventor, except when there is a conflict of interest with an applicable agreement between the School and a government agency. Inventions made on personal time must be disclosed, however, and if the inventor so desires, can be assigned to the institution in order to take advantage of the institution's technology transfer office.

The UMS system has intellectual property guidelines which are similar to the majority of the schools analyzed. UMS constituent institutions have the right to ownership of any inventions resulting from activities within the scope of the inventor's employment or from the use of university funds or facilities. "The University of Maryland System has a right to ownership of any invention in which it has an interest. [It] has an interest in all inventions of personnel which are conceived or first actually reduced to practice as a part of or as a result of: a University System Administration or

constituent institution administered program of research; activities within the scope of the inventor's employment by the...institution; or activities involving the use, to a substantial degree, of...institution time, facilities, or materials..."[2]

2.2 Royalty Distribution Policies and Guidelines

The goals of universities are numerous and include research, teaching, and service. Universities are major sources of fundamental knowledge underlying the new products and processes essential to economic competitiveness. There are rising pressures to keep productive researchers on campus faculties rather than on corporate payrolls, and universities have attempted to resolve these difficulties with good conflict of interest rules and fair intellectual property guidelines.

> These challenges are either embraced enthusiastically by administrators and faculty as representing new means of demonstrating the universities' responsiveness to national priorities or...as a necessary accommodation since no single institution can remain aloof and still compete for faculty or external funding. Universities have accepted...that they can contribute more effectively to enhanced international economic competitiveness and to the conversion of academic research into commercial products, as well as augment university revenues, by patenting research findings formerly disseminated as a 'public good' through journals...[3]

A key area of conflict between the many and changing goals of state universities is in providing rewards to university researchers for the commercialization of technology. Most universities see themselves as incubators for finding solutions to problems plaguing the populace, or simply finding ways to enhance the quality of life and health in America, as well as their own communities. Universities must balance the basic goal of advancing science, education, and the general public good with attracting and retaining skilled researchers.

An important part of intellectual property policy includes the distribution of royalties from patentable inventions. Royalty distribution policy, in almost all cases examined, was determined by each constituent institution and its technology transfer office using existing mandates by the governing board of the university system as a guide. Net royalties, after Office of Technology Licensing (OTL) cost recovery, are generally distributed to three recipients: the inventor, the inventor's department and/or the inventor's lab specifically, and the university. In addition, most policy documents (i.e. Michigan, California, North Carolina) state that any net income accruing to the university (as part of the overall royalty formula) will first go to the support of research.

Half of the schools investigated require that patenting and marketing expenses be paid back to the university from the first stream of revenues. The University of Alabama, for example, specifies a deduction of 15% of revenues for OTL overhead costs while others, like the University of Virginia, simply state "after ...the recovery of costs" leaving the exact percentage unknown and invention specific. The inventor receives the majority of the royalty revenue especially when total royalties are less than $100,000. The inventor's distribution ranges from 15% to 70%, depending on revenue (see Table 2-2). Two-thirds of the institutions analyzed then distribute the remaining revenue stream to two parts of the university: the inventor's department and the School. The inventor's department distribution ranges from 10% to 30% and the School receives between 21% and 68%. In one case,

[2] University of Maryland System Patent Policy

[3] Feller, Irwin, "University Patent and Technology-Licensing Strategies," in Educational Policy 4 , No. 4, 1990, p.328.

California, a portion of licensing revenues are returned to the state. In California, 25% of adjusted revenues (total revenues less payments to other universities and payments to inventors) are returned to the General Fund. The university keeps the remaining 75% of adjusted revenues for research support.

The UMS constituent institutions have the highest initial OTL overhead rate in the survey at 30% of gross royalties. The inventor's portion, 100% of the first $5,000 and 50% of net royalties thereafter, is higher than that of the other institutions. The Office of Technology Development, as an agency of the university, also participates in the distribution to a greater extent after royalty revenues exceed $100,000. In addition "any net revenue received on account of an invention, after sharing with the inventor, will be dedicated to research and to the promotion of patenting and patents."[4]

2.3 Distribution to the State

Our review of regional and "best practice" institutions found only one case in which a portion of licensing and royalty revenues accrue to the General Fund of the State. In California, 25% of adjusted revenues (total revenues less payments to other universities and payments to inventors) are paid to the state. The university keeps the remaining 75% of adjusted revenues for research support. In 1995, the state of California received $5.5 million of the University of California's total licensing and royalty revenues of $50 million. This was minor in comparison to the state appropriation of $1.9 billion for the University of California System. In all other cases, royalty revenues are specifically used within the university setting to cover the costs of the technology licensing effort, to reward the inventor, and to support the overall research and educational mission of the university.

While the UMS has a relatively high Office of Technology Licensing (OTL) overhead rate, 30% compared to 15% at most other universities, these resources are needed given the emphasis placed on expanding commercialization within the UMS. The share of royalties going to the inventors within the UMS system is higher than many other universities, but strong incentives are again consistent with the increased system-wide emphasis on commercialization. Diminishing the share of revenues going towards either the OTL or the inventor through some type of General Fund assessment may limit the overall system's capabilities to promote technology transfer, reduce overall incentives for commercialization, or research support. While there is precedent for this policy, it must be recognized that California is the national leader in technology commercialization. University of California licensing revenues are more than fifty times those of UMS. Furthermore, technology transfer officials in California feel that this policy hinders their overall technology transfer effort by limiting both OTL financial resources and university research support.

[4] University of Maryland System Patent Policy

Table 2-2 University IP and Royalty Rules

	IP Rules	Royalty Distribution Policy	Estimated Breakdown of Royalties
University of Alabama at Birmingham	Any invention which is the result of research carried on by any employee of the University or which relates to the inventor's field of work at the University or has been developed in whole or in part by the use of resources belonging to the University, shall be assigned to the University.	Each campus president is responsible for the development of internal distribution policies for royalties. It is the policy of the Board of Trustees to provide every reasonable incentive to faculty for the dissemination of inventions. Each campus president develops a policy on internal distribution of the University's share of royalties which will be reflected in the budget. After a deduction of 15% for overhead costs, plus a deduction for patenting and protection costs, the inventor receives 75% of royalties under $20,000; 50% of royalties between $20,000 - $100,000 and 30% of royalties over $100,000.	

		Net Royalty Dist.	
		Inventor	School
OTL Overhead	15%		
< $20,000		75%	25%
< $100,000		50%	50%
> $100,000		30%	70%

University of California at Berkeley	All employees, users of University facilities and those receiving gift, grant or contract funds through the University must make an agreement to assign inventions and patents to the University. Exemptions are possible. Those making the agreement shall promptly report and fully disclose the conception or reduction to practice of potentially patentable inventions to the Director of the Patent Office and complete any documents necessary to assure that title shall be held by the University or parties designated by the University.	Patent rights may be released to the inventor when the university elects not to file a patent application provided that no University facilities will be used to conduct further research on that invention. A 15% fee is first subtracted from gross royalties for administrative costs and the costs of patenting and protection. UC pays the inventor 50% of first $100,000 of cumulative net royalties, 35% of the next $300,000 and 20% of all additional royalties. One quarter of revenues after licensing costs and distributions to inventor are given to the state of California. The remaining 75% accrues to the university for the support of research.	

		Net Royalty Dist.		
		Inventor	School	State
OTL Overhead	15%			
First $100,000		50.0%	37.5%	12.5%
Next $300,000		35.0%	48.8%	16.3%
All Over $400,000		20.0%	60.0%	20.0%

University of Maryland System	UMS constituent institutions have the right to ownership of any invention resulting from activities within the scope of the inventor's employment and using any type of university funds or facilities.	The University System through its constituent institutions shall share with inventors any revenue received through patents. Any net revenue accruing to the University will be dedicated to research and the promotion of patenting and patents. The inventor receives the first $5,000 from the revenue stream and subsequent revenues are distributed 50% -50% between the university and the inventor. The university's share is divided between the department (85%); up to $100,000 and the OTD (15%) for additional patenting expenditures.	

		NetRoyalty Dist.	
		Inventor	School
OTL Overhead	30%		
First $5,000		100%	0%
All Above $5,000		50%	50%

Table 2-2 University IP and Royalty Rules (continued)

<table>
<tr><th></th><th>IP Rules</th><th>Royalty Distribution Policy</th><th>Estimated Breakdown of Royalties</th></tr>
<tr><td>University of Michigan</td><td>All patents and royalties that exist as a result of research by staff and supported by any funds (directly or indirectly) of the school are the property of the University.</td><td>In cases involving a mix of independent activity and University supported activity, the results will be owned as agreed upon in advance. If the University decides not to license the IP it may be reassigned to the inventor. Financial returns from royalties may provide the University with additional research funding support. The Technology Management Office (TMO) recovers its expenses for patent protection, marketing and licensing (between $8K - $15K) prior to distribution of royalties. Royalties are then shared as follows. First $100,000: 50% to inventor, 25% to dept., 25% to central admin. Second $100,000: 40% to inventor, 30% to dept., 30% to admin. Over $200,000: 1/3 to each of the above.</td><td>
<table>
<tr><th></th><th></th><th colspan="3">NetRoyalty Dist.</th></tr>
<tr><th></th><th></th><th>Inventor</th><th>Depmnt.</th><th>School</th></tr>
<tr><td>OTL Overhead</td><td>(1)</td><td></td><td></td><td></td></tr>
<tr><td>First $100,000</td><td></td><td>50%</td><td>25%</td><td>25%</td></tr>
<tr><td>Next $100,000</td><td></td><td>40%</td><td>30%</td><td>30%</td></tr>
<tr><td>Over $200,000</td><td></td><td>33%</td><td>33%</td><td>33%</td></tr>
<tr><td colspan="3">(1) OTL Recovers all costs first</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>University of North Carolina, Chapel Hill</td><td>Every invention that results from research carried out at a constituent institution or developed with the aid of university facilities or funds shall be the property of the constituent institution. This policy applies to every employee of each campus, including student employees.</td><td>Inventions made by university personnel or students on their personal time not involving any university facilities or funds are the property of the inventor except in case of conflict with any applicable agreement between the institution and the federal or state government or agency thereof. These inventions must be disclosed. If inventor so desires, inventions made on personal time may be assigned to the institution. Constituent institution may waive their rights to the invention if it is clearly non-patentable. Income earned by the institution shall be held in a separate trust fund to support research. Royalty revenues will be applied first to reimburse the University for licensing/patenting expenses incurred by it. Next, 20% of revenues will applied to the Invention Management Fund for maintaining patents and technology transfer. The inventor's share is 50% of the remaining revenues. In no case will the inventor receive less than 15% of the gross royalties. The remaining revenue received by the University will be dedicated to research purposes.</td><td>
<table>
<tr><th></th><th></th><th colspan="2">University</th></tr>
<tr><th></th><th>Inventor</th><th>Investment Mgmt. Fund</th><th>School</th></tr>
<tr><td>After costs</td><td>40%</td><td>20%</td><td>40%</td></tr>
</table>
</td></tr>
</table>

Table 2-2 University IP and Royalty Rules (continued)

	IP Rules	Royalty Distribution Policy	Estimated Breakdown of Royalties
Penn State University	Personnel have an obligation to promptly disclose inventions developed with University resources or within the scope of their employment. After completing an invention disclosure form, the IP office identifies interested companies. Inventors may petition the University for ownership when it would be advantageous to the transfer of the technology (i.e. if no-one is interested in the patent then inventors may petition for ownership.) Royalty distribution depends on whether the IP office or the Research Corporation Technologies (RCT) executes the license. The University is the licenser for employee patents whether the inventor files or the University files for patent.	The inventor receives a $1000 incentive payment at the time of filing. (PRC is the Pennsylvania Research Corporation, a non-profit subsidiary of Penn State dedicated to advancing scientific research. Revenues accruing to PRC are utilized to support research and a portion of the cost of operating the IP Office.) If the invention is licensed to an entity in which the inventor has a proprietary interest, he will not receive the inventor's share of the royalties. If the IP office finds a licensee, royalties are distributed as follows after recovery of any direct costs: 40% inventor, 20% originating administrative unit, and 40% Pennsylvania Research Corp. If the patent is filed by RCT, royalties are: 40% RTC, 25% inventor, 10% originating administrative unit, and 25% PRC.	
University of Utah	The University acquires and retains title to all inventions.	The inventor will receive 40% of the first $20,000 of net revenue, 35% of the next $20,000 and 30% of all additional net revenue. When economically feasible, the University also shares up to 25% of the income with the inventor's department(s) to fund further research within the departments.	
University of Virginia	The University claims any invention or discovery which is judged to be the product of University research, which is defined as any use of University facilities or is related in any way to duties for which the researcher has been compensated either by or through the University.	The inventor will receive 15% of gross royalties, license fees or other income after the UVA Alumni Patents Foundation recovers its costs. The remaining revenues vary in percentage of distribution depending on amount. Between 100% (at low revenue end) and 30% (at high end) of revenues go to inventor's research, the School receives between 0% and 40% and the Scholarly Activities Fund receives between 0% and 30%.	

	Net Royalty Dist.			
	Inventor	Depmnt.	School	RCT
IP Filing (1)	40%	20%	40%	
RCT Filing (1)	25%	10%	25%	40%
(1) OTL Recovers all costs first				

	Net Royalty Dist.		
	Inventor	Depmnt.	School
OTL Overhead (1)			
Less than $20,000	40%	25%	35%
$20,000 - $40,000	35%	25%	40%
More than $40,000	30%	25%	45%
(1) OTL Recovers all costs first			

		Net Royalty Distribution		
	Inventor	Department	School	Scholarly Act. Fund
<$100,000 (1)	15.0%	85.0%	--	--
$100-$300,000 (1)	15.0%	59.5%	17.0%	8.5%
$300,000 - $1 mil. (1)	15.0%	42.5%	25.5%	17.0%
> $1 million (1)	15.0%	25.5%	34.0%	25.5%
(1) OTL Recovers all costs first				

Table 2-2 University IP and Royalty Rules (continued)

	IP Rules	Royalty Distribution Policy	Estimated Breakdown of Royalties
Virginia Polytechnic Institute	Ownership rights reside with the university, unless there is convincing and explicit evidence that the IP was developed without the use of university resources or facilities. This applies to all employees and students.	Inventors are encouraged to disclose even when there is doubt as to the commercial potential of an invention. Revenues from successful commercialization shall be shared equally between the university and the inventor, after expenses for documented direct and indirect costs for patenting, marketing, and development have been deducted. At least 10% of the total net revenue goes to inventor's department with the rest assigned to VTIP (Virginia Tech Intellectual Properties, Inc.).	<table><tr><td></td><td></td><td colspan="2">University</td></tr><tr><td></td><td>Inventor</td><td>Department</td><td>VTIP</td></tr><tr><td>After Costs</td><td>50%</td><td>10%</td><td>40%</td></tr></table>
University of Wisconsin at Madison	UW does not claim ownership rights in patents generated during research by its faculty, staff and students unless funding agreements specify ownership rights. If WARF does not take the patent assignment, once voluntarily notified, the inventor may petition a federal agency for ownership. If project is federally funded, WARF must take patent ownership.	WARF gives 20% of the gross income from patents to inventors and 15% of the gross to the unit where the work was performed. Any amount over $50,000/year is retained by WARF and invested to produce additional income for departmental research purposes.	<table><tr><td></td><td></td><td colspan="2">University</td></tr><tr><td></td><td>Inventor</td><td>Department</td><td>WARF</td></tr><tr><td>After Costs</td><td>20%</td><td>15%</td><td>65%</td></tr></table>

3.0 Economic Effects of University Systems

The second phase of this research project consisted of a review of existing studies of the economic impacts of state university systems to develop a framework to determine the economic implications of the proposed changes. University systems have an important impact on state economies. University systems educate a state's workforce, create jobs, and provide an important spending stream. In addition, the technology transfer efforts of state university systems can directly create jobs through the commercial development of research innovations.

In order to examine the direct and indirect spending effects of university systems, studies prepared by eight universities and identified by the Association of University Technology Managers (AUTM) were reviewed.[5] The studies primarily analyze direct and indirect spending by universities as a measure of their economic impact. However, several schools also analyzed the effects of technology transfer, which is an emerging area of importance in the discussion of the economic impact of universities. These studies describe the cash flows from the school, its faculty and staff, the students, and visitors to the campus into both the local and state economy. In addition, the studies discuss the effects of technology transfer which include jobs created and increased disposable income entering the state's revenue stream. The University of Minnesota, however, states that the "greatest transfer of research knowledge and technology results from the education, training, and graduation of students."[6]

3.1 Effects of Direct and Indirect University Spending

University spending is a great contributor to a state's economy. For example, the University of Iowa annually leverages its $240 million state appropriation into approximately $1.4 billion in Iowa spending, $130 million in state tax revenues and 55,000 directly and indirectly created jobs.

Direct spending is comprised of several stages of university spending. Due to the labor intensive nature of higher education, the largest university expenditure is in the area of employee compensation. This works its way into the economy in the form of purchases for housing, food, transportation, services and savings. In-state university purchases, which range from 50% to 80% of total purchases, are a tremendous contribution to local economies. Finally, capital improvements in the physical plant of the university create construction jobs and material needs and, therefore, another stream of university spending into the community.

Indirect spending consists of student and visitor spending which contributes millions of dollars to the economy in the form of off-campus housing, food, clothing, entertainment, and hotel accommodations. In addition to visits by parents, friends and prospective students and their families, universities tend to be centers of cultural and sporting events which draw people from around the state, as well as from out-of-state. These events generate spending in the local communities above and beyond that of students and their guests.

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[5] Please see the accompanying bibliography for a list of studies reviewed.

[6] Minnesota High Technology Council, "Products of An Unheralded Industry," April 1993.

Table 3-1 University Direct and Indirect Spending, Tax Effects, and Tech Transfer Impacts

Institution	University Direct Spending (in millions of dollars)				University Indirect Spending (in millions of dollars)			Tax Effects (in millions of dollars)	Technology Transfer Effects
	Compensation	Purchases	Capital	Total	Student	Visitor	Total		
University of Alabama at Birmingham	484.1	336.3	43.4	863.8	118.4	35.6	154	74	In 1993, 8 patents issued and 47 licenses generating royalties.
University of California	3800	2800	759	7359	102[1]	11.5[2]	--	144[3]	In 1993, 99 patents issued and 452 licenses generating royalties.
University of Florida	986.1	567.2	58.3	1611.6	263.3	19.2	282.5	N/A	Patent applications: 445; patents granted: 272; since 1984 has received $28.4 million in royalties
University of Iowa	570	77.7	27.3	675	144	20.6	164.6	63.8	Invention disclosures: 64 Incubator has attracted $18 million in capital to area
University of Maryland[4]	893.8	501.3	N/A	N/A	163.1	22.2	185.3	N/A	In 1993, 24 patents issued and 68 licenses generating royalties.
University of Minnesota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	In 1993, 33 patents were issued and 55 licenses generated royalties
Mississippi State University	151.7	65.3	20	237	48.6	20.4	69	21.6	N/A
Rutgers, College of New Jersey	516.2	253.1	69.8	839.1	273.9	8	281.9	46	Total patent applications: 133; patents granted: 71; income from royalties nears $10 million

[1] For UC-Irvine only
[2] For UC-Santa Barbara only
[3] Effects for UC employees and retirees only
[4] Direct spending is from 1992 data; indirect spending from 1990 data

22

21

The universities analyzed for this study varied greatly in terms of the number of campuses and student enrollment. The universities' expenditures reflect these differences. As demonstrated in Table 3-1, the University of California has the greatest direct spending in the three areas of compensation, purchases and capital with a total of $7.4 billion whereas the smaller Mississippi State University, with only one campus, reported a total local spending of $237 million.

As demonstrated in Table 3-1, the overall level of indirect spending (student and visitor spending), also varies tremendously from university to university. Indirect spending levels ranged from a low of $69 million in indirect spending benefits from Mississippi State to much higher levels in Florida and New Jersey, where indirect spending is in the $280 million range.

The University of Maryland System mirrors the compensation expenditures of other large systems and has purchases within the range indicated in the matrix. Indirect spending at $185.3 million is also similar to the institutions analyzed.

The benefits accruing to a state do not stop with direct and indirect spending. Each state's economy benefits enormously from direct and indirect spending related to the university. Each dollar of direct and indirect university spending has a multiplied or "ripple" effects on the state economy. The multiplier concept can be described as follows. As new money enters the state economy through university spending, new purchasing power is created. More buying occurs at the individual and business levels. University employees, students and visitors spread their disposable income throughout the region. Producers respond by stepping up production, store-owners hire more workers, and state gross product and employment rise.[7] University-induced spending becomes income for a state's residents, which is in-turn spent and becomes income for other residents.

The multiplier used in each of the studies reviewed are presented in Table 3-2. The multiplier used by each school in their studies varies by the research methodology and economic model used. Overall spending multipliers ranged from a high of 3.4 for the University of California to a low of 1.39 for University of Florida. The multiplier used in the France Center's 1994 study of the economic impact of the UMS System, 1.75, was in the middle range of multipliers used in the studies analyzed.

[7] Albert E. Muir, "Inter-industry Analysis of the Impact of Federal Support for Academic Science on the Economy of New York State," Research in Higher Education, Vol. 18, No. 2, 1983, p.423.

Table 3-2
Economic Impact Multipliers and Total Economic Impacts

University	Multiplier	Total Economic Impact (in billions of $)
University of Alabama at Birmingham	2.44	$1.45
University of California	3.37	$12.00
University of Florida	1.39	$2.07
University of Iowa	1.94	$1.40
University of Maryland	1.75	N/A
University of Minnesota	N/A	$1.00
Mississippi State University	1.79	$0.51
Rutgers, State University of New Jersey	2.0	$2.06

3.2 Tax Effects of University Spending

University direct and indirect spending stimulates economic activity and creates jobs. This spending, economic activity and employment create tax revenues for the state in the form of income taxes, sales taxes, and property taxes. The state income tax withheld from university employees is significant, considering that a university is usually one of the largest employers in any state. Also, many university employees are well paid and able to afford homes, therefore adding to the revenue from property taxes. The sales taxes paid as a result of employee, student or visitor expenditures can be estimated from direct purchases. Indirect income, spending, and purchases will also occur as a result of these direct payments, described previously as the multiplier effect. The state will also collect income taxes from the people holding the jobs that a university indirectly created. By using estimates of effective tax rates, it is possible to estimate the total amount of sales, income, and property taxes that are generated from expenditures, jobs and property related to the university.

In many of the studies analyzed, tax effects took a prominent role in describing the economic benefits accruing to the state through the maintenance of a strong university system. For example, Rutgers evaluated the tax generated by employees' purchases, student and visitor purchases, and local property taxes generated by Rutgers employees and discovered that through taxes alone the University added $46 million to the state's tax revenues. Tax receipts displayed a range of $21.6 million in taxes in Mississippi to over $144 million in California.[8] Unfortunately, information on the tax impacts of UMS direct and indirect spending are not available at this time.

[8] See Table 3-1 for tax revenue information.

3.3 Technology Transfer Effects

The transfer of technology from the university setting into the commercial marketplace is one of the most important economic impacts of a university, since the economic benefits to the state can be substantial. Technology transfer from the university environment to the commercial sector is a powerful way to spur a state's economic development. "University research and technology transfer is a critical factor supporting the development of high technology industries...the presence of a research university [is] an important factor in supporting high technology development."[9] University inventions are embryonic. At the time a university is ready to hand its inventions off to industry, most have not even reached the prototype state. These inventions require substantial investment in product and market development. Thus, the task of the university in licensing these inventions is to find industrial licensees willing to make the high-risk investment.[10] Economic growth is created as research results in greater investment and jobs as companies commercialize, produce and sell products based on university inventions. Inventions by university employees have the potential to be patented and licensed to interested companies, generating revenues for the university as well as for the inventor. In addition, there can be university-industry research collaborations resulting in patentable inventions and new, marketable products. Start-up firms, based on the new technology and frequently located near the university, are also possible and create new jobs and revenues for the state.

Each institution's study that discussed technology transfer portrayed it as a cornerstone to the economic impact of the university on the state's present and future economy. For example, Lawrence Livermore National Laboratory (a federally funded research and development center at the University of California) helped create 30 spin-off companies, and a recent survey identified 18 San Francisco firms with ties to University of California that provide 5,000 jobs, a payroll of $300 million and annual sales of almost $1.1 billion.[11] At Rutgers, university income from royalties since 1989 is nearing $10 million. The University of Alabama at Birmingham is at the low end of the range (in 1993 data) with 8 patents and 47 licenses generating royalties while the University of California had 99 patents issued and 452 licenses during the same period. The University of Iowa, though in the middle of the patent and licensing range, has attracted $18 million in capital to its campuses through the installment of an incubator.

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[9] Richard Clinch, Benchmarking the Economic Impact and Effectiveness of University Technology Transfer in Maryland, Jacob France Center, 1996.

[10] Lori Pressman, Sonia K. Guterman, et al, "Pre-production Investment and Jobs Induced by MIT Exclusive Patent Licenses: A Preliminary Model to Measure the Economic Impact of University Licensing," MIT Technology Licensing Office, 1995, p.52.

[11] UC Means Business, The Economic Impact of the University of California, 1995.

3.4 The Economic Impact of University Systems

Universities are themselves an important contributor to the economic development of a state. Universities not only educate a state's workforce; they are an important source of employment, spending, and tax revenues. The commercialization of university research also directly creates jobs as licensed technologies are developed and/or start-up companies are formed based on university research.

Assessing a portion of university licensing royalties to be returned to the General Fund would diminish the funds available for an important engine of economic growth. Furthermore, since the state university system already receives a portion of its budget in the form of annual appropriations form the General Fund, this type of assessment would merely represent a relatively small offset of much larger state funding flows.

4.0 Fiscal and Economic Impacts of the Proposed Patent Policy Changes

The third and final phase of this research project is the estimation of some of the key repercussions of the proposed policy change. Entrepreneurial activities are increasing on the many campuses of the University of Maryland System, and the state has been successful in promoting the development of large-scale applied research efforts, such as the Institute for Human Virology. It is possible that these activities will generate increased revenues to the UMS in the form of licensing revenues. A re-examination of patent policy and the possibility of establishing a threshold beyond which revenues may accrue to the State of Maryland's General Fund has been recommended This is part of the state's need to find revenues during difficult economic times caused by federal cutbacks, downsizing in the defense industry, and slower economic growth.

Because both the overall level of royalty funding that would accrue to the state and the level of future commercialization activity are unknown, there is no method to accurately assess the overall economic impact of the proposed policy change. However, by analyzing available data on UMS technology transfer activities, it is possible to analyze the impact by looking at the number of licenses that would be affected and the potential fiscal impact. It is also possible to compute the economic impact of university spending relative to general government spending.

4.1 The Number of Licenses Impacted

The proposed policy changes would impact only a minority of the total licenses and options executed by the UMS system. The large majority of university licensing revenues are derived from a small number of the total licenses and options executed. This is because of the "hit and miss" nature of high technology products, especially in the area of biotechnology, where relatively few products are very successful and generate large economic and financial rewards. Many university discoveries are also in very narrow fields or represent small, incremental improvements over existing products, processes, or technologies. A study written by Irwin Feller, a leading economist on technology issues, has shown three dominant aspects of university patenting:

- There is a low rate of commercial utilization of university-held patents.
- There is a high percentage of revenues received from a select number of patents.
- There is an increasing pool of patents that singly yield modest, albeit collectively increasing revenues.

Feller cites data from the University of Wisconsin on the distribution of royalties. Of a total of 448 patents, ten patents held by Wisconsin's research agency, the Wisconsin Alumni Research Fund (WARF), produced approximately 90% of the $30 million in royalty income received between 1929 and 1985.[12] The Southern Technology Council report on technology transfer found that the median share of total revenues derived from the most remunerative license was 52.2% of total revenues for the 40 universities that participated in their survey.[13]

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[12] Irwin Feller, "University Patent and Technology-Licensing Strategies," Educational Policy 4, No. 4 (1990), p.332.

[13] The Southern Technology Council, Benchmarking University-Industry Technology Transfer in the South: 1993-1994 Data, pp. 13-14.

University reliance on a small number of licenses for a large share of total revenues is best exemplified by the impact of the relatively rare "blockbuster" discoveries on university revenues. The best example of a blockbuster patent is the Cohen-Boyer patent that was one of the theoretical underpinnings of biotechnology. This patent is actually a sequence of three patents which were developed by two scientists, Herbert Boyer of UC-San Francisco and Stanley Cohen of Stanford University. The universities have a unique arrangement for managing the licensing revenues accruing from the patent. All revenues go to Stanford, which manages the patent, with 15% of the revenues going to its Office of Technology Licensing for expenses. After any other expenses the remaining revenues are evenly shared by the two universities. Since 1988, the Cohen-Boyer patent has had gross royalties of over $124 million. Each year the amount of gross royalties has increased. In the latest fiscal year, ending in August 1995, gross royalties were just over $52 million. There are currently 351 licenses worldwide from the Cohen-Boyer patent with over 45 additional licenses granted this fiscal year alone. This has been one of the highest revenue generating patents in recent times. However, this discovery supported the development of the entire biotechnology industry. Few discoveries yield even a portion of the revenues associated with this

Because of the "hit and miss" nature of technology transfer, where relatively few innovations earn high rewards, the revenues from very successful commercialization efforts are needed to offset the costs of commercializing the larger numbers of less successful technologies.

The total number of active licenses, total licensing revenues, and average royalties per license for the institutions analyzed for the study are presented in Table 4-1. Data are for 1994 and were taken from taken from the AUTM Licensing Survey, Fiscal Year 1991- Fiscal Year 1994. Once a university invention is patented, it is available for licensing to outside commercial interests. Licensing agreements represent the outcomes of negotiations between universities and firms over the sharing of rights, rewards and risks. Many steps are needed before patents yield products; many conditions must be fulfilled before the products (and thus the patents) have economic value. Companies pay licensing fees, also called gross royalties, to the university for the use of the invention. The amount of total licensing revenues to the university depends on several factors: how many total patents are awarded, the range of their commercial applications and what economic advantage they have over existing processes.[14]

[14] Willard Marcy and Bernard Kosloski, "Study of Patents Resulting from NSF Chemistry Program," (New York: Research Corporation, 1982) as cited in Irwin Feller, "University Patent and Technology-Licensing Strategies," Educational Policy 4, No. 4 (1990), p.331.

Table 4-1
Royalties, Licenses, and Average Royalties per License
for Regional and "Best Practice" State University Systems

University	1994 Gross Royalties	Licenses Generating Royalties	Average Royalties per License
University of Alabama at Birmingham	$802,970	48	$16,728
University of California	$50,210,000	481	$104,386
University of Florida	$5,177,050	20	$258,852
University of Iowa	$630,298	37	$17,035
University of Maryland	$945,876	75	$12,611
University of Minnesota	$1,278,757	66	$19,375
Mississippi State University	$283,399	3	$94,466
Rutgers, State University of New Jersey	$2,452,000	58	$42,275

The average royalties per license for our sample ranges from a low of $12,611 for UMS to a high of $258,852 for the University of Florida. No data were available on the royalties for each active license for UMS. UMS has the lowest average royalties per license of the systems analyzed, indicating that the system has a relatively large number of active licenses, but that total royalties per license are relatively low. This may be due to the fact that UMS has rapidly increased licensing activity over the past several years. Because licensing revenues are dependent on product sales and it takes several years for new products to penetrate a market, many of the active licenses may be at the low end of their total royalty generation potential. Because of the relatively low level of royalties per license, it is unlikely that many licenses would meet whatever threshold was established for royalties to begin to accrue to the General Fund. Thus, the overall revenue generation possibilities of the proposed policy change are limited. Furthermore, the policy change itself may act as a disincentive for continued growth in commercialization activity since it would reduce benefits accruing to either the inventor or the university, thus diminishing potential economic gains from university commercialization to the state.

4.2 Potential Tax Impact

Because the level of the threshold beyond which royalty revenues would accrue to the state was not established and the percentage of revenues that would go to the General Fund was unknown, there was no way to estimate the total revenues that would accrue to the General Fund. However, estimates can be made based on total licensing and royalty revenues.

Because the University of Maryland System has only recently emphasized technology transfer, UMS institutions are in the middle to lower range of all universities in terms of overall licensing revenues. As demonstrated in Table 4-2, University of Maryland, College Park, with total 1994 licensing revenues of $671,749, was ranked forty-ninth out of the 120 institutions participating in the annual AUTM licensing survey. University of Maryland at Baltimore was ranked seventy-second, with 1994 licensing revenues of $274,127. Because of the relatively low levels of licensing revenues at UMS

institutions, the overall revenue generation potential of the proposed policy change is limited at the current time.

Table 4-2
Licensing Revenues

	FY 1994 License Revenues	AUTM Survey Rank
University of California System	$50,210,000	1
University of Wisconsin, WARF	$8,348,713	7
University of Virginia	$4,635,032	12
Rutgers, State University of New Jersey	$2,452,000	19
University of Utah	$1,938,828	23
North Carolina State	$1,632,000	27
University of Michigan	$1,529,000	30
University of North Carolina, Chapel Hill	$886,384	43
University of Alabama at Birmingham	$802,970	47
University of Maryland, College Park	**$671,749**	**49**
Virginia Polytechnic Institute	$626,838	53
Penn State University	$476,132	63
University of Maryland at Baltimore	**$274,127**	**72**

In order to estimate the fiscal implications of the proposed policy change, estimates of revenues based on 1994 **total** licensing revenues were made for three assumptions: 1%, 5%, and 10% of licensing revenues accruing to the state. As demonstrated in Table 4-3, total General Fund revenues would range from $9,500 to $95,000. This is a relatively insignificant amount of money when compared to $7.5 billion in General Fund expenditures in fiscal 1996. Even if UMS licensing revenues approached the $4.5 million of MIT, total General Fund revenues would be insignificant. Finally, because the UMS must already generate 69% of operating expenses internally (state support only accounts for 31% of higher education spending)[15], this policy would limit a potential funding source for higher education.

[15] Information provided by UMS.

Table 4-3
Fiscal Impact of Proposed Changes
Revenues Generated from an Assessment on All Licensing Revenues

Percentage of Total Licensing Revenues	Fund Revenues Generated
1%	$9,459
5%	$47,294
10%	$94,588

4.3 The Effects of the Government Multiplier vs. the University Multiplier

Licensing royalties left in the hands of the UMS have a much greater impact on the state's economy than if the these revenues were turned over to the General Fund. This is because the multiplier effects, or the impact of a spending stream on economic activity in the state, of university spending is higher than that of General Fund expenditures.

There is empirical evidence of the strength of the university's spending multiplier when compared to the multiplier for the state government, provided by the RIMS II Input-Output Model of Maryland. This model was developed by the U.S. Department of Commerce, Bureau of Economic Analysis and was implemented by a staff regional economist in the Jacob France Center. According to the methodology used by the RIMS II model, multipliers are derived for output, earnings, and employment for various sectors of the economy. As demonstrated in Table 4-5, the multiplier effects for university spending for output, earnings, and jobs creation exceed those for General Fund expenditures.

The RIMS II model calculated the following results. For each dollar spent by universities, statewide output increases by $2.38 and statewide earnings increase by $0.87. For each million dollars spent by universities in Maryland, 44.2 full time equivalent jobs are created. Because there was no multiplier for General Fund expenditures in the RIMS II model, the France Center used the multiplier for general household expenditures, on the grounds that state revenue dollars are either taken from households in the form of taxes or distributed back to households in the form of transfer payments (which account for the majority of state spending). For each dollar increase in the General Fund, statewide output increases by $1.27 and statewide earnings increase by $0.39. For each million dollars of General Fund expenditures in Maryland 17.6 full time equivalent jobs are created.

Table 4-5
Multiplier Effects of University v. General Fund Expenditures

	University Impact	General Fund Impact
Statewide Output per Dollar Spent	Increase by $2.38	Increase by $1.27
Statewide Earnings per Dollar Spent	Increase by $0.87	Increase by $0.39
Jobs Created per Million Dollars Spent	44.2 jobs	17.6 jobs

Therefore, the total impact of establishing a maximum threshold beyond which commercialization revenues may accrue to the State's General Fund would divert spending away from an area of the state economy with a high level of "multiplier effects" - university spending -into an area with lower impacts - General Fund (household spending). Thus, overall potential benefits to the state economy from the impacted spending stream would be reduced.

4.4 Summary and Conclusions

The proposed establishment of a threshold beyond which university commercialization revenues may accrue to the State of Maryland's General Fund rather than the technology transfer office, the inventor, or the university has only modest revenue generation potential because only a few university licenses generate a significant flow of revenues, and overall licensing and royalty revenues to UMS are tiny in comparison to overall state spending. Furthermore, the policy would divert spending into an area that offers the state less economic benefits (a lower "multiplier effect") than maintaining the current royalty distribution policy.

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