THE ECONOMIC IMPACT OF OKLAHOMA TOBACCO SETTLEMENT SPENDING ON RESEARCH

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ABSTRACT

This article estimates the economic impact in Oklahoma of spending on medical research financed by the Oklahoma Tobacco Settlement Endowment Trust (TSET). This is first done by the popular approach of input-output modeling, to estimate the impact of this spending on economic activity. It is then estimated via consideration of potential benefits to Oklahoma consumer welfare. Summary results are that the modest multiplier impact of this spending is amplified by the large extent to which TSET investments have helped state researchers obtain federal grant financing. Welfare benefits seem to be large and reflect innovative and translational research contributions. **JEL Classification**: I18, L38, L88

INTRODUCTION

Oklahoma's Tobacco Settlement Endowment Trust (TSET) was created by a constitutional amendment, passed by the voters as State Question 692, on November 7, 2000. It is financed by a portion (currently 75%) of the payments Oklahoma receives every year from tobacco manufacturers, through Oklahoma's participation in the Tobacco Master Settlement Agreement, negotiated between 46 state attorneys general and the four largest US tobacco manufacturers.[1] In its creation the Oklahoma TSET was mandated to fund:

1. Clinical and basic research and treatment efforts to prevent and combat cancer, and other tobacco-related diseases.
2. Cost-effective tobacco prevention and cessation programs.
3. Programs designed to maintain or improve the health of Oklahomans or to enhance the provision of health care services to Oklahomans, with particular emphasis on such programs for children.
4. Programs and services for the benefit of the children of Oklahoma, with particular emphasis on common and higher education, before- and after-school programs, substance abuse prevention and treatment programs, and services designed to improve the health and quality of life of children.
5. Programs designed to enhance the health and well-being of senior adults.

Within this mandate the current TSET strategy is to focus on the leading causes of preventable death in Oklahoma: cancer, attributable to tobacco use; and heart disease, attributable to obesity and tobacco use. Total TSET expenditures for FY2014 will be approximately $42.96 million of which $10.02 million, or 23.3%, is programmed to be spent on research. The TSET's budget allocation for research in FY13 was also 23.3%.

This paper estimates and assesses the economic impact of this TSET research spending in Oklahoma. It first does this through the use of standard techniques of input-output analysis, to estimate the contribution of TSET research spending on the overall economic activity in the state. It then explores some top-level perspectives on the value of health research in Oklahoma, which provide insight into the payoff that consumers may be getting from this research investment.

Medical Research Spending in Oklahoma as Compared to Other States

Any assessment of the role of research in the state's economy should start by noting that Oklahoma has consistently ranked toward the bottom of the 50 states in terms of research and development spending. In 2010, the most recent year for which these data were available, Oklahoma ranked 47th of the 50 states in research spending per dollar of GDP (70 cents spent on research for every $100 of state domestic product). Oklahoma was above only Arkansas, Louisiana, and Wyoming. In 2009 Oklahoma was ranked 45th and from 2004 through 2008 it was ranked between 45th and 46th. Oklahoma's academic, *i.e.*, university, spending on research and engineering made up just under one third of total research spending and its rank in academic research spending per dollar of state domestic product has also been stably at approximately 45th.[2]

The question of whether Oklahoma should be committed to achieving a higher ranking on these indices is essentially a political one. The answer depends on voters' and policymakers' perceptions of the value of research spending. However, the experience of other states suggests that a strong research environment is generally associated with stronger growth in high-tech industries, which is associated with clean industry, desirable jobs, and higher standards of living. At the national level, a substantial portion of research and "high-tech" spending is in medicine, and this would also be expected to support a more attractive environment for medical practice and innovation in the state.

At the University of Oklahoma, which conducts over half of the academic research and development in the state, approximately 40% of R&D spending is in the life sciences, which matches the life-science proportion of total academic research spending for the state as a whole.[3] This is well below the 57% national average for life sciences research, a category that includes medicine, biology, botany/horticulture/agriculture, and related sciences, but does not include environmental research. Further darkening the picture for medical research in Oklahoma, only 26% of academic research done in the life sciences (state-wide) is medical research, as compared to a national average of 55%.[4] Hence, the proportion of academic research and development funding allocated to medical research in the state comes out to around 10%, as opposed to a national average of around 31%.[5]

Thus, relative to the size of the Oklahoma economy, Oklahoma's overall level of spending on research and development is small. Its level of spending on academic research and development is also small and, within the category of academic research spending, its spending on medical research is also small. To the extent that research spending helps improve the quality of medical training, helps attract better physicians, helps respond to the health research needs of the community, and helps translate research from outside the state for within-state application, this low level of spending is a concern.

ESTIMATING THE IMPACT OF TSET RESEARCH FUNDING ON ECONOMIC ACTIVITY IN OKLAHOMA WITH INPUT-OUTPUT ANALYSIS

TSET funding for research is allocated and managed through the research operations of the Stephenson Cancer Center (Stephenson), which includes the Oklahoma Tobacco Research Center (OTRC), and the Oklahoma Center for Adult Stem Cell Research (OCASCR). Table 1 shows TSET research spending (historical and budgeted) from FY 2012 through FY 2014. Researchers have been able to leverage TSET funding to bid for National Institutes of Health (NIH), and other federal and foundation grants. The budgeted spending by year from those sources is also shown on Table 1. Note that grant funding, particularly from the NIH, often comes in the form of large, multi-year awards. Table 1 reflects only budgeted spending by fiscal year. Since Stephenson and OCASCR activities are currently in expansion, total amounts awarded by year (including multi-year awards) are higher than is shown on this table.

The standard approach for estimating the impact on economic activity within a state that is attributable to this kind of spending is via input-output (I-O) analysis. This involves detailed economic modeling to estimate the effects of stimulus programs, regulatory changes, and business relocations. These models, most commonly used by businesses and regional economic development authorities, are built using census and other survey data on revenue levels, sales channels, and purchasing channels, by industry.[6] They incorporate a tracking of how the production in one industry tends, on average, to draw from and consume the output and intermediate goods produced by other industries. They also track the geography of the flow of goods and the extent to which final goods produced in one county consume intermediate goods produced in that same county, in that same state, or in the same country. The art of I-O model construction is in the estimation of results where data are missing and in the reconciliation of contradictory input data. Subaggregated census data and sales tax data are used for these reconciliations.[7]

The two predominant I-O models used in the United States are the Regional Input-Output Modeling System (RIMS II) and IMPLAN (IMpact analysis for PLANning). RIMS II is maintained by the Bureau of Economic Analysis in the U.S. Department of Commerce. IMPLAN was originally developed by the US Forest Service (largely for USDA applications). IMPLAN is now very widely used, even by the Bureau of Economic Analysis that maintains RIMS, and is maintained by MIG, Inc. (previously known as the Minnesota IMPLAN Group, Inc.) A key advantage of IMPLAN over RIMS II is that it provides explicit modeling of economic flows via transfer payments and subsidies, in addition to economic flows attributable to the purchase and sale of labor, goods, and services.

Regional development economists at Northeastern State University used IMPLAN Version 3 for this analysis. Since IMPLAN matrices are estimated and released to users with some time lag, and the most recently available for this study were based on 2011 data. Thus, these same matrices were used to estimate impacts in FY 2012, 2013, and 2014.

Through the use of input-output analysis, the impact of TSET spending is captured by treating TSET research funding, plus NIH and foundation grant money leveraged off of TSET funding, as a purchase of research and development services (NAICS 5417, IMPLAN Sector 376). These purchases have a direct effect in that they increase the revenues of the organizations financed, and thereby directly affect gross state product. They have indirect effects, in that those industries receiving TSET funding will normally purchase items from other industries in the state, and thereby stimulate those industries. Finally, increased payroll in the affected industries will lead to increased demand in other industries through the spending behavior of employees, an induced effect.

A multiplier matrix simply tracks, by industry, the effect that a $1 purchase in one industry will tend to have on each industry sector. These matrices have one row per sector with one column within each row for each sector-to-sector interaction. The analyst needs data on the value added, payroll, and employment effects attributable to a $1 impact per industry. The analyst can then use a multiplier matrix for each county or region to calculate indirect and induced effects.

For research and development services, a $1 increase in Oklahoma research spending is associated with a 39 cent indirect effect, attributable to increases in spending for Oklahoma-based research-related firms (summing across all other sectors in Oklahoma) and a 41 cent induced effect of additional Oklahoma spending attributable to the additional employment and salaries for these firms.[7] The total effect of this $1 is thus $1.80 in increased economic activity.

Since not all of this spending, by IMPLAN Sector 376 and by sectors affected by IMPLAN Sector 376, will go to Oklahoma firms, one can separate the $1.80 total effect into a value added component and a residual component. The value added component is that portion of the total economic activity stimulated that goes to Oklahoma firms. The residual component goes to business operations outside of Oklahoma. The multiplier measuring the Oklahoma impact of each additional dollar spent on Oklahoma research is $0.93 and the multiplier for the non-Oklahoma portion of this impact is $0.87.

To see how this works, suppose TSET-funded research activity requires the purchase and installation of a new imaging machine. Some 20% of the components for this machine may be manufactured in Oklahoma, with 80% manufactured in other states or other countries. This 20%, less any imports to Oklahoma for the manufacture of these components, along with all Oklahoma-based transportation, installation, and set-up costs, would be counted as Oklahoma value added. The 80% would be included in total impact but would not be counted as Oklahoma value added. The numbers used for the multiplier analysis are not based on a specific tracking of TSET-funded purchases. Rather they are based on estimated industry averages for spending patterns by sector. A listing of these effects, together with estimates of the total employment, Oklahoma value added, and total dollar impact of TSET research spending is provided on Table 2.

The convention in economic impact analyses like these, which use IMPLAN or RIMS II multipliers, is to emphasize the total effect of the subject increase or decrease in spending. This is because the total effect describes the total amount of money that the policy change will cause to be spent by Oklahoma firms or entities. The impact of TSET research spending on Oklahoma-based industrial activity is, however, better estimated by reference to the value-added totals on the table.

The implication of these results, in terms of impact on state-level industrial activity, is that the TSET investment has been multiplied by roughly a factor of 4. This is because for each dollar TSET has invested in research, Oklahoma investigators have been able to obtain $3 in federal or foundation grant funding to extend or expand that research.

ESTIMATING THE VALUE OF MEDICAL RESEARCH IN OKLAHOMA

The input-output analysis of the previous section was used to estimate the impact of TSET research spending on state-level economic activity. The analysis of this section explores how one can estimate, or at least think about, the value to consumers of TSET research spending. Thus, while the analysis of the previous section was aimed at measuring an impact on gross state product, the analysis of this section tries to provide insight regarding an impact on state-level welfare and well-being.

Policy oriented research, such as economic cost-benefit analysis, needs to estimate the value of an investment at a level of aggregation and abstraction appropriate to the decision being made. At the level of a procedure, if a doctor is deciding whether or not to run a test for a patient, her estimation of costs versus benefits should be defined in terms of the expected treatment outcomes for her patient. At the level of a staffing decision, if a project manager is deciding whether or not to hire an additional employee, she bases her decision on the expected contribution versus cost of that employee. At the level of an organizational expansion decision, if a pharmaceutical company is deciding whether or not to fund an additional project, it trades off the costs versus benefits of that level of the project. At the legislative level, if a state is deciding on an appropriate level of research funding, then its leaders need to evaluate the benefits versus costs of increased or reduced funding relative to the level of the aggregate budget. Since an estimation of the value of medical research in Oklahoma is, by its nature, an aggregate-level assessment, any such assessment will necessarily involve some abstraction.

Numerous estimations of the value of medical research, at the aggregate level, have been made. An index of this literature, published in the Bulletin of the World Health Organization (2004), lists 31 "key studies" on this topic.[9] A widely cited and influential analysis was provided by Kevin Murphy and Robert Topel (1999), economists from the traditionally conservative University of Chicago School of Business.[10] Their summary finding is that, from 1970 through 1998 in the United States, improvements in healthcare and clinical practice, combined with gains (or losses) attributable to lifestyle and nutrition, added about as much to our overall well-being as all other improvements in U.S. material wealth combined.[11] Given that real per-capita GDP increased by 79% during this period, this is a dramatic claim.[12] Nevertheless, when one considers the enormous improvements in treatment for cancer and heart disease that were achieved during these years, it is clear that the magnitude of the benefits from health care innovation over those decades was very large.

The Murphy and Topel estimation was made at the aggregate level, by comparing health gains for a population-average individual to health research spending, and then estimating the portion of those gains, about one-third, attributable to health treatment innovation. An alternative estimation, constructed by summing estimates of costs and benefits across individual health research programs, and looking at gains for the 1992-2005 timeframe, was conducted for Australia (Access Economics, 2008). This estimated $2.17 in benefit for every $1.00 spent in health research. A related discussion of the controversy over the competing priorities of traditional research versus diffusion in clinical practice and public health innovation is provided by Rust et al. (2010).

Referring to the general tenor of these studies, the return on investment that they estimate is indeed remarkable. To put the scope of these advances in perspective, note that this period saw the advent of colorectal screening (late 1960s through early 70s, an advance that has given us a 40% decline in mortality since 1975),[13] the invention and introduction of the CT and MRI scans (mid 70s), the introduction of chemotherapy after cancer surgery (mid 70s), a virtual cure for testicular cancer (various discoveries now yielding a 95% cure rate), lumpectomy for breast cancer (late 70s), mammography (late 70s), laparoscopic surgery (early 90s), the discovery that melanoma is linked to sun exposure (70s-90s), and dramatic improvements in chemo and radiation therapy (throughout this period). Between 1970 and 2005, the life expectancy of the average American increased by 6.6 years; with 4.7 of these years, over 70% of the increase, being due to reductions in deaths from cardiovascular disease.[14]

In recent years, the level of total U.S. research and development has hovered at around 2.5% of GDP.[15] At the national level, approximately 25% of this spending is in academic R&D and approximately 40% of that 25% is in academic medical R&D. Thus approximately 10% of all U.S. R&D spending, an amount equal to 0.25% of U.S. GDP, is allocated to medical research and development at academic institutions.[16] Attributing any substantial portion of this increase in life expectancy to such a small-percentage investment of GDP implies high returns on investment.

Judging Efficiency at the Individual Program Level

Given that one accepts the cost-effectiveness of some public funding for medical R&D, in general, it is still natural to be concerned about the particulars of the allocation and management of such funds. This is the program oversight responsibility that is normally handled at the executive or legislative level of public resource management. For observers who are far removed from the operations of individual research projects, managerial effectiveness is hard to judge. Naturally, individual programs normally define performance metrics and one can use those in an evaluation. An equally valid and perhaps more common approach is to compare the performance of a program to some external benchmark, such as the performance of a similar program in other states. Since special circumstances do exist and do arise, these types of evaluations are subject to error, but they can still be useful.

An itemized analysis of the managerial effectiveness of the TSET would be too detailed for this current paper but it should be noted that this approach, of yardstick competition, has been integral to the TSET strategy for research funding. The TSET's core research initiatives have been in the funding of the Stephenson Cancer Center (Stephenson) and the Oklahoma Center for Adult Stem Cell Research (OCASCR). In both cases, the plan has been that researchers will leverage TSET funding to engage in competitive bidding for external funds. As shown in Table 1, both the Stephenson and the OCASCR have been successful in doing this, obtaining more than $3 of external money for every $1 of state money provided by the TSET. This indicates that third-party evaluators have been judging TSET-funded projects as promising enough to provide external funding at a 3-to-1 ratio. This provides a substantial third-party vote of confidence for TSET funding priorities and TSET project management.

Like yardstick competition, another commonly advocated approach is to use market forces for program evaluation. Variations on this approach assume that worthwhile R&D projects will, at least to some extent, be able to obtain private financing. The bulk of pharmaceutical and medical device development funding is provided by this means. The idea is that the years of monopoly pricing that may be made available by patent protection will provide sufficient incentive for private investment for the development of these products.

A well-documented problem with this market-based approach is that, although it can be useful for providing incentives for product development (the ‘D’ in R&D), it does not provide much incentive for the foundational research that makes product development and innovation possible.[17] The problem is that, if a company is not able to protect the information it generates and sell it as a product, there will be insufficient incentive to invest. The research has to be marketable. Thus, for example, it is easier to find private funding for pharmaceutical research projects than for research on how to effectively organize quit-smoking campaigns. It’s also easier to fund applications of gene therapy than basic research in gene therapy.

Research Financing and the Transfer of Technology to the State

The standard explanation for the underfunding of medical research (and research in general) is that research projects that are worthwhile may not be research projects that will be profitable. This is because many more people, companies, states, or even countries may benefit from a research project than those who paid for it. As mentioned above, no matter how important a discovery may be, if a company cannot market that discovery, the investment in making that discovery will not be profitable.[18] A classic example is the discovery of DNA. Although many will benefit, there is no marketable or patentable product coming directly from such a general discovery. Just as the inability to capture the benefits of research may discourage businesses from investing in activities deemed too far from marketability, state legislators and other leaders may be discouraged from investing in research that provides general, as opposed to state-specific, benefits.

On the other hand, by investing at the state level in research and development a state may increase its capacity to take advantage of advances made elsewhere. Thus, the process can work in reverse. This is to say that, Oklahoma researchers, in addition to advancing their fields in ways that help cancer or public health research outside of Oklahoma, may also help the state of Oklahoma be better able to import and take advantage of discoveries made elsewhere. Hence, it is not clear that the potential for technology transfer will always cause an underfunding of research. In a state like Oklahoma, where the ratio of research and development expenditure to overall economic activity is low, it is very possible that an expansion of local research provides spillover benefits that outweigh spillover losses.

This analysis is written to provide insight and perspective on the overall effectiveness of the TSET research mission. Any kind of critical examination of specific aspects of the management of TSET funds is beyond its scope. Those interested in such detailed evaluations would need to obtain information on individual TSET projects and could, for example, interpret or estimate the extent to which this research is serving the specific needs of Oklahoma. Some of the TSET projects, especially those involving adult stem cell research and general oncology practice, are more in the categories of pure research, and these are activities for which the TSET would expect substantial federal grant funding assistance. Other projects, such as OTRC projects on the epidemiology of tribal smoking in Oklahoma and cigarette taxation at tribal smoke shops in Oklahoma, are more specific to Oklahoma but may also attract federal dollars. Others, such as an investment made by the OTRC in data capture for some community clinics, are oriented toward specific Oklahoma applications that, at least in the near term, are less likely to attract federal dollars.

SUMMARY

As a simple metric this study finds that, for each dollar of TSET funding, the Oklahoma researchers hired and projects launched with these funds are obtaining approximately $3 of additional grant funding from external, mostly National Institutes of Health, sources. This commitment of external funding suggests that the projects launched by TSET funding have been viewed, by external evaluators, as worthwhile and likely to bear fruit. The ability of TSET researchers to leverage their funding to obtain federal grant money has also multiplied the impact of TSET research spending on Oklahoma economic activity, with $1 of TSET investment (after accounting for the $3 of federal grant funding it stimulates) tending to generate roughly $4 in total Oklahoma-based research spending.

Input-output analysis of the impact of TSET spending on Oklahoma economic activity found that the total impact is nearly double this direct effect. Thus a dollar of TSET funding for research, which yields about $4 in total research funding, is estimated to yield roughly $7.30 in total economic impact. As discussed in the body of this paper, however, the conventional interpretations of such economic impact multipliers can be misleading. This is because the impact on Oklahoma state product, i.e., the impact on Oklahoma GDP, is less than the total economic impact of these programs. After discounting the extent to which increased Oklahoma spending is served by out-of-state suppliers, the net impact of TSET spending on Oklahoma state product, of $3.72 per dollar of TSET spending, is close to the above $4 of direct impact. One can thus think of the stimulus effect of TSET spending on research as being roughly equal in magnitude to the sum of direct TSET funding plus leveraged dollars in federal and foundation grants that are brought to Oklahoma because of TSET research funding.

The input-output analysis was used to estimate the impact on economic activity that is attributable to TSET spending. Since this economic activity contributes to overall state product, the stimulative impact of this spending is commonly thought of as a benefit. Alternatively, one can interpret the benefit of a program in terms of the value of the goods and services it provides or, in this case, its estimated contribution to Oklahoma health and welfare.

Estimating the market value of basic research is a notoriously difficult problem. Take for example, the discovery DNA. Since the results of this discovery are provided free-of-charge to researchers working on downstream applications, the discovery has no observable market price. Still, nearly all would agree that the discovery of DNA was valuable.

To discuss the benefit of TSET research spending in Oklahoma, this paper thus explored two perspectives. The first compared Oklahoma spending on medical research as a share of gross state product to national levels of spending. This established that Oklahoma is consistently low in medical research funding. This suggests that increases in Oklahoma spending may stimulate the importation of advances made elsewhere for applications in Oklahoma, and that additional spending may also help improve the profile of the state as a destination for health care researchers and professionals.

The second perspective looks at the value of medical advances to society. Here one sees that general spending on medical R&D has yielded a very high return on investment. Thus, it seems likely that, given the validation implicit in the ability of TSET-funded projects to obtain large amounts of external support, TSET research spending is likely to provide a high return on investment.

These are perspectives, not measurements, of the likely effectiveness of TSET spending on research. They are necessarily abstract, aggregate-level ways of looking at what kind of return Oklahoma can expect to get to get from the TSET medical research spending program as a whole. Micro-level assessments of the value of individual TSET projects would require review at the project level. This paper has not attempted such project-level evaluations.

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ENDNOTES

* Laux is a current recipient of Oklahoma TSET funding and the research for this paper was originally commissioned as an input-output analysis to measure the impact of TSET research funding on Oklahoma economic activity. The decisions to expand this effort, to include commentary on the potential welfare impacts of TSET research spending, and to refine the analysis for publication, were made by the authors.

[1] For information on the Master Settlement Agreement see the website of the National Association of Attorneys General, http://www.naag.org/tobacco.php (referenced on 3/12/2014).

[2] The 2009-2010 numbers come from National Science Foundation, 2013a (NSF 2013a). Pre-2009 numbers are from State Science and Technology Institute (SSTI), 2012, which sources Census Bureau special tabulations (2011) of the 1989–2008 business information tracking series. Data for FY 2011, are available for academic R&D spending from the National Science Foundation and for state economic activity levels from the Bureau of Economic Analysis. Using these 2011 data, Oklahoma ranked 47th among the states in terms of dollars spent in academic R&D per dollar of gross state product.

[3] From NSF, 2013b, Table 15.

[4] Almost 90% of the academic R&D in the medical sciences reported to the National Science Foundation by universities in Oklahoma was attributed to the University of Oklahoma (OU). Within OU, 47% of total reported life sciences R&D was in the medical sciences. Thus, even within OU, the percentage allocation to medical sciences is below the national average.

[5] *Op. cit.*, NSF, 2013b. This calculation requires a compilation of data for all Oklahoma Universities from Table 15.

[6] The break out of which components of business output and purchasing fall within which industry is tracked by North American Industry Classification System (NAICS) code. The census and other surveys then acquire and tabulate data by NAICS code.

[7] For an introduction to input-output analysis, see Miller and Blair, 2009. A handbook covering the details of RIMS II is available from the U.S. Department of Commerce, Bureau of Economic Analysis, 1997.

[8] The induced effect, as estimated, takes increased salaries, from both the direct effects on research spending and the indirect effects, into account.

[9] Buxton et al., 2004.

[10] Murphy and Topel's analysis, "The Economic Value of Medical Research," was first published by the Lasker Foundation, in 1999, http://www.laskerfoundation.org/reports/pdf/economicvalue.pdf. It was later published as Murphy and Topel, 2003. Murphy and Topel, 2006, provides an update on these arguments. Mushkin, 1979, is another influential work on the value of medical research. While Murphy and Topel base their estimates on willingness to pay per life year gained, Mushkin's work is based on productivity gains, and estimates a 47% average return on investment from medical research conducted between 1930 and 1975.

[11] Murphy and Topel, 1999, p 3.

[12] This, along with many other economic data series, is available from the Federal Reserve Bank of Saint Louis, in their "FRED" collection of economic data. The FRED label for this specific series is "USARGDPC", accessed on 25 Nov 2013 at http://research.stlouisfed.org/fred2/series/USARGDPC.

[13] http://www.cancerprogress.net/timeline/major-milestones-against-cancer, visited 13 March 2014. This website is maintained by the American Society of Clinical Oncology.

[14] NIH Research Portfolio Online Reporting Tools, "Heart Disease," http://report.nih.gov/nihfactsheets/ViewFactSheet.aspx?csid=96, visited 13 March 2014.

[15] SSTI, 2012.

[16] National Science Board. 2012. Note that this is 40% of academic R&D in all fields and thus the bases for these calculations are different than for those referenced in footnotes 1, 2, and 4.

[17] For a classic paper on this, see Arrow, 1962. Griliches, 1984, provides a general introduction to this line of research.

[18] Ibid., Arrow, 1962.

TABLE 1: TSET AND RELATED EXTERNAL RESEARCH SPENDING				
($'s, millions)				
		FY12	FY13	FY14*
Stephenson, Total		19.8	27.9	29.1
	TSET	4.2	7.4	6.8
	NIH/Foundations	15.6	20.5	22.3
OCASCR, Total		2.1	7.6	7.6
	TSET	2	2	2
	NIH/Foundations	0.1	5.6	5.6
Grand Total		21.9	35.5	36.7
*Based on mid-year receipts.				

TABLE 2: TSET ECONOMIC IMPACT									
Economic impact of TSET dollars spent on research (employment, $'s millions)									
	FY12			FY13			FY14		
	Employ-ment	$ Value Added	$ Total Efffect	Employ-ment	$ Value Added	$ Total Efffect	Employ-ment	$ Value Added	$ Total Efffect
Direct	149	10.3	21.9	242	16.7	35.5	249.9	17.3	36.7
Indirect	74.2	4.8	8.5	120	7.8	13.8	124.3	8.1	14.2
Induced	71.9	5.2	9.0	117	8.4	14.5	120.6	8.7	15.0
Total	**295.2**	**20.3**	**39.4**	**479**	**33.0**	**63.8**	**494.7**	**34.1**	**66.0**