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Highlights

- From FY 2007 through FY 2011, USTAR received $66.6 million in state funding and $27.0 million in federal pass-through funding for a total of $93.6 million. USTAR has leveraged these funds with $69.7 million in external research grants and contracts.
- Through June 2011, USTAR had recruited more than 40 top researchers to the University of Utah and Utah State University and created 21 research teams. These innovators have generated a portfolio of intellectual property that includes 121 disclosures. From these disclosures 46 provisional patents have been filed, two patents have been issued, and four new Utah companies created.
- From FY 2007 through FY 2011, USTAR research teams spent $143.3 million in support of USTAR research projects. The cumulative effects of these expenditures on Utah's economy include a total of $112 million in labor earnings for Utah workers, $219.3 million in gross state product, and $9.9 million in state tax revenue over the five-year period.
- In FY 2011, USTAR research teams spent almost $52 million. The operations of USTAR research teams in that year supported 1,102 jobs in Utah and generated $41.9 million in labor earnings for Utah workers. Contributions to Utah's GSP totaled $80.9 million and fiscal impacts included $3.7 million in state tax revenue.
- USTAR's technology outreach efforts have assisted scores of companies, entrepreneurs and researchers throughout the state. Its Technology Outreach and Innovation Program (TOIP) has helped 18 Utah companies raise $25.6 million in private equity capital. The Technology Commercialization Grants Program (TCG) has resulted in 72 project prototypes, 73 disclosures or patents filed, and approximately $8.7 million in private equity investments for TCG applicants during its first two years of operation.
- In 2011, the economic impacts associated with TOIP and TCG included 91 jobs, $3.9 million in earnings for Utah workers, and $5.9 million in GSP.
- Through June 2011, approximately $195 million had been spent for construction of two research facilities at the U of U and USU campuses. These construction projects began in 2007 and have supported an average of 800 jobs annually. Additional economic impacts include $100.1 million in labor earnings for Utah workers and $167.8 million in GSP over the five-year period. The fiscal benefits include $12.5 million in state tax revenue and $2.1 million in local tax revenues.

The Estimated Economic Contributions of the Utah Science Technology and Research Initiative to the Utah Economy

Jan Elise Stambro, Senior Research Economist

Introduction

In March 2006 the Utah State Legislature passed Senate Bill 75 (SB 75), creating the Utah Science Technology and Research Initiative (USTAR). SB 75 provided money for investments in Utah's public research universities to promote the commercialization of innovative technologies, which in turn generates more technology-based start-up firms, creates higher paying jobs and expands Utah's tax base.

SB 75 provides funding to USTAR to (1) recruit top-level researchers to the University of Utah and Utah State University and assemble research teams that will create new businesses in Utah through commercialization of new, innovative technologies developed by these teams; (2) build research and development facilities that will be used by these research teams; and (3) provide technology outreach to encourage the development and commercialization of technologies within the private sector.

At the request of USTAR's Executive Director, BEBR has (1) provided a comprehensive study of USTAR's economic impacts on the state of Utah from FY 2007 through FY 2011 and (2) reviewed USTAR's performance against an economic prospectus based on actual state funding.

Revised Economic Baseline and Evaluation of USTAR'S Performance

Overview

In 2006, the state of Utah established the Utah Science Technology and Research Initiative (USTAR) with passage of Senate Bill 75 (SB 75). The overarching objective of the USTAR initiative was to foster the creation of new technology-based start-ups in Utah.

To achieve this objective, the state agreed to provide funding that would be used to attract top-level researchers to the University of Utah (U of U) and Utah State University (USU). These scientists would generate research dollars and establish research teams to develop new technological innovations, the commercialization of which would generate more technology-based businesses in Utah, thereby expanding the state's economic base. To facilitate this process, the state also agreed to fund the construction of state-of-

the-art interdisciplinary research and development facilities at both the U of U and USU campuses.

A precursor to SB 75 was the development of an economic prospectus by the Bureau of Economic and Business Research (BEBR) evaluating the program's potential long-term benefits to the Utah economy. These benefits included estimates of economic impacts generated by research team expenditures and creation of new technology start-up companies formed to utilize the technologies developed by the research teams.

The potential benefits associated with research team spending were estimated using an input-output model developed by the U.S. Department of Commerce, Bureau of Economic Analysis known as RIMS II. RIMS II multipliers were applied to local spending by the USTAR research teams to estimate the effects of spending on jobs, income and gross state product. Estimates of local spending were made using data on university spending patterns developed by BEBR in previous university studies. State and local tax effects were estimated using a model developed by BEBR.[1,2]

The potential benefits associated with the creation of start-up companies were estimated based on 20 years of data provided by the Offices of Sponsored Research and Technology Commercialization. From these data, BEBR developed a model to estimate the number of research disclosures, licenses, patents and companies generated per million dollars in research spending at the University of Utah. The model also estimated the time frame within which these activities should occur. These output measures provided a quantitative way to measure USTAR's performance.

The driving factor in the original model was the annual state funding commitment, which determined the rate at which new research teams were formed. In the original analysis, the state provided $4 million in funding during the first six months of the program and $25 million annually thereafter. State funds were used as seed money to hire research teams. These teams were expected to secure research grants to fund their research programs. From this research would flow disclosures, licenses and patents. Some number of these would be used to create new Utah businesses.

During its first five years of operation, USTAR was slated to receive a total of $107.0 million in state funding. This money would be used to form 23 research teams that in turn would generate almost $39 million in external research funding.

Technologies developed by research teams were projected to result in 96 disclosures. From these disclosures, a total of $248,041 in licensing revenue and nine Utah start-up companies were projected by year five. By the end of 2011, employment at these new companies was projected to be 138 workers.

The USTAR program has actually received less than the amount in the original prospectus. Changes in the amount and timing of state funding change the economic outputs of the model. It is within this context that a revised economic baseline was developed.

Revised Economic Baseline

Since its inception, USTAR has received significantly less state funding than originally planned. Using actual state funding data, BEBR developed a revised economic baseline using the output metrics defined in the original model. This new baseline—referred to in this study as the "revised economic baseline"—provides revised output estimates, including research team formation trends, external grants, disclosures, licenses and new company formation rates. These revised outputs are the expected outcomes given the actual level of state funding for USTAR from FY 2007 through FY 2011.

From FY 2007 through FY 2011 the state provided a total of $93.6 million to the USTAR program, including $66.6 million in state funds and $27.0 million in federal pass-through funding. This amount is about 13 percent less than was anticipated in the original 2005 economic prospectus.

Based on a funding level of $93.6 million, a total of 19 research teams should have been in operation by FY 2011. These teams should have generated a total of $35.1 million in research grants and contracts, which should produce 112 disclosures, 7 licenses, $432,222 in licensing revenue, and result in the formation of two Utah companies. Projected employment at these companies should total 10 workers in 2011.

Analysis of USTAR's Performance

USTAR is on track with, or outperforming the output measures developed in the revised economic baseline. Through 2011 USTAR had recruited more than 40 top research scientists to the U of U and USU and formed a total of 21 research teams. These innovators have come from leading institutions throughout the U.S., including Harvard, the Massachusetts Institute of Technology, UCLA and Case Western Reserve.[3]

During the first five years of the program, USTAR research teams have received $69.7 million in externally funded research grants and contracts—almost double the amount projected in the revised prospectus.

USTAR researchers have generated a portfolio of intellectual property that includes 121 disclosures—159 percent of the revised projection. From these disclosures, 46 provisional patents have been filed, 2 patents have been issued and four new Utah companies created. In 2011, these four companies employed 13 people.

Table 1 shows a comparison of USTAR's actual five-year performance with the original 2005 economic prospectus and the 2011 revised economic baseline.

Economic Effects of USTAR Research Team Spending

Overview

A primary objective of the USTAR program is to facilitate economic development through the expansion of research programs at the U of U and USU and through commercialization of technologies developed in those research programs.

To this end, USTAR has established 21 research teams and recruited more than 40 top researchers to the U of U and USU. Thirteen teams are located on the U of U campus and the remaining 8 are on the USU campus.

The economic effects generated by these research teams flow to the state in two ways. First, the teams generate federal and private

research dollars to fund their research activities. As these dollars are used to pay the wages and salaries of the research team members and to purchase goods and services from Utah businesses, economic impacts are generated.

Table 1
USTAR Five-Year Performance Review

Measures	2005 Original Economic Prospectus	2011 Revised Economic Baseline	USTAR Actual Performance
State/Federal pass-through funding	$107,040,200	$93,602,100	$93,602,100
PI-generated funding	$38,977,205	$35,093,910	$69,736,870
Number of research teams	23	19	21
Number of disclosures	96	112	121
Licensing revenue	$248,041	$432,222	—
Number of Utah companies formed	9	2	4
Company employment	138	10	13

Note: Data are cumulative through the first five years of the program. Employment data provided by USTAR.
Source: Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2012.

The second way research teams impact the state's economy is through the development of novel research that leads to the formation of new Utah-based companies. These new companies provide economic benefits with their direct employment and wages.

Using multiplier analysis, the economic benefits of research team spending and of job creation at new companies can be estimated. These impacts have been measured using the RIMS II economic impact model.

The estimates presented in this analysis are economic contributions, as they take into account all money spent by the teams regardless of the source of that money. Therefore this study should be viewed as an economic contribution analysis rather than an economic impact analysis, since an impact analysis considers only money that flows to the state from outside sources.

Table 2
USTAR Research Teams External Grants and Team Spending: FY 2007–FY 2011

Fiscal Year	External Grants	Expenditures
2007	$282,690	$2,547,289
2008	$1,973,465	$15,443,841
2009	$16,501,459	$34,114,156
2010	$20,703,343	$39,215,226
2011	$30,275,913	$51,945,950
Total	$69,736,870	$143,266,462

Notes: (1) Research grants do not include approximately $24 million in awards committed but not yet received. (2) External grants include Uintah Impact Mitigation Special Services District Funds.
Source: Michael O'Malley, Marketing Director, USTAR, 2011.

Economic Effects of USTAR Research Team Spending

Since FY 2007, USTAR research teams have raised $93.7 million in external research funding. This total includes $69.7 million in grant awards received through the end of FY 2011 and $24.0 million in grant awards committed through FY 2014.

From FY 2007 through FY 2011, research teams spent approximately $143.3 million. This includes money spent for wages, salaries and benefits, equipment purchases and purchases of other goods and services made to support the teams' research activities. An estimated $106.6 million of all team expenditures were local.

Table 2 shows the amount of external research grants raised by USTAR teams each year since FY 2007 and the amounts spent by USTAR teams during each of those years.

The economic contributions of USTAR research have steadily increased. While research teams were established at both universities in 2007, the most significant economic effects occurred in FY 2011, driven by the formation of more research teams, an increase in the amount of external funding raised by the teams and, subsequently, an increase in the amount of money spent by the teams.

During FY 2007, eight USTAR teams were in operation—five at the U of U and three at USU. These teams spent approximately $2.5 million, which supported an estimated 57 jobs throughout the state of Utah, generated $2.1 million in earnings for Utah workers, and provided $181,884 in state tax revenue.

By FY 2011, 21 teams had been formed and were operating. Total spending by those teams increased to nearly $52 million ($30 million from external grants and $22 million in state and federal funding). This level of spending supported 1,102 jobs in Utah, generated almost $42 million in earnings, and provided about $3.7 million in tax revenue for the state of Utah.

As shown in Table 3, the activities of USTAR team operations have generated more than $112.8 million in earnings for Utah workers from FY 2007 through FY 2011. The contribution to Utah's gross state product has been $219.3 million. The state has garnered almost $9.9 million in tax revenue.

Based on the economic effects of USTAR research team spending in FY 2011, every $1.0 million in research expenditures supported 21.2 jobs in Utah, generated $807,126 in earnings for Utah workers and $1.56 million in gross state product, and produced $70,627 in state tax revenue (Table 4).

Table 3
USTAR Research Teams
Summary Economic Effects of Team Spending: FY 2007–FY 2011

Fiscal Year	Number of Teams	Jobs	Earnings	Gross State Product	State Tax Revenues	Local Tax Revenues
2007	8	57	$2,079,148	$400,774	$181,884	$31,083
2008	11	292	$10,595,376	$21,439,518	$926,883	$158,401
2009	17	713	$26,408,040	$51,566,799	$2,310,175	$394,800
2010	20	882	$31,831,691	$61,344,070	$2,784,636	$475,884
2011	21	1,102	$41,926,178	$80,923,394	$3,667,702	$626,796
Totals	21		$112,840,433	$219,274,555	$9,871,280	$1,686,964

Note: Impacts include direct, indirect and induced effects.
Source: Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2012.

Company Formation and Employment

In addition to the impacts generated by USTAR team spending there are the impacts associated with new companies that have been created through the commercialization of USTAR research. Based on information provided by USTAR, a

total of four new companies have been formed or moved to Utah as a direct result of the USTAR program. These companies include Thera Target, Headwaters Clear Carbon Solutions, Metallosensors and Space Environment Technology. In 2011, these four companies employed a total of 13 employees.[4]

Table 4
Economic Effects per $1.0 Million of Research Spending: FY 2011

Economic Measure	$1.0 million in research spending generates...
Jobs	21.2
Earnings	$807,126
Gross State Product	$1,557,867
State Tax Revenue	$70,627
Local Tax Revenue	$12,067

Source: Calculated by the Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2012.

Economic Impacts of USTAR Outreach Activities

Overview

Establishing a regional technology outreach program was a critical piece of USTAR's enabling legislation. To this end, USTAR has developed its Technology Outreach Innovation Program (TOIP). This regional program is led by directors located throughout the state of Utah. Each director heads an Outreach Center located at one of the state's institutions of higher education.

The objectives of the Outreach Centers are myriad. TOIP teams work with companies, entrepreneurs, faculty and other economic development stakeholders to promote activities that drive economic growth. These include assisting individuals in launching new companies, raising private equity and providing business development assistance. Since 2008, USTAR's TOIP teams have completed more than 300 projects and have been instrumental in helping 18 companies raise $25.6 million in private equity.

Table 5
USTAR Outreach Activities
Economic Impacts of Private Equity Capital and Follow-on Financing: FY 2008–FY 2011

Fiscal Year	Jobs	Earnings	Gross State Product	State Tax Revenue	Local Tax Revenue
2008	57	$2,440,866	$3,637,437	$213,527	$36,491
2009	131	$5,987,686	$8,719,210	$523,803	$89,516
2010	131	$7,591,011	$8,437,001	$664,062	$113,485
2011	91	$3,890,053	$5,873,190	$410,358	$70,129
Totals		$19,909,616	$26,666,838	$1,811,750	$309,621

Source: Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2012.

In FY 2009, USTAR launched the Technology Commercialization Grant program (TCG), which links regional higher education institutions with local innovators in an effort to commercialize promising new technologies. To date, 87 projects have been approved, with the typical grant in the range of $30,000. In two years, the impact of the program has been considerable. By the end of FY 2011, it had generated 73 disclosures and patents, created 15 new companies and helped raise more than $8.7 million in private equity investment.

Economic Impacts of USTAR Outreach Activities

The full effects of USTAR's outreach efforts are difficult to measure; however, the impacts associated with private equity investments and TCG spending can be quantified using input-output analysis. These impacts have been estimated using direct-effect multipliers in RIMS II.

From FY 2008 (the first year a private equity investment was made in a TOIP client) through FY 2011, USTAR has played a role in helping 82 Utah companies raise a total of $34.3 million.[5] The impacts of private equity, and other follow-on funding, raised through the TOIP and TCG programs are shown in Table 5 and include a total four-year earnings impact of almost $20 million and contributions to Utah's GSP of $26.7 million. The tax impacts include $1.8 million in state tax revenue and $309,621 in taxes for local governments.

Economic Impacts of USTAR Research Facility Construction

Overview

USTAR funding supports construction of state-of-the-art interdisciplinary research and innovation facilities at the U of U and USU. Since inception, USTAR has initiated construction of two research and development facilities: the USTAR BioInnovations Center at USU and the James L. Sorenson Molecular Biotechnology Building (Sorenson Center) at the U of U. The BioInnovations Center was completed in January 2011 and the Sorenson Center opened in January 2012.

Engineering and design for both projects began in FY 2007. Through FY 2011, building costs for the centers totaled approximately $195.0 million. The largest share of financing for these facilities came from issuing general obligation bonds ($156.0 million). The phasing and building costs for each building are presented in Table 6.

Table 6
USTAR Research Facilities
Design, Engineering and Construction Expenditures: FY 2007–FY 2011

Fiscal Year	U of U Sorenson Center	USU BioInnovations Center	Total Spending
2007	$932,821	$149,684	$1,082,505
2008	$632,136	$862,911	$1,495,047
2009	$8,603,287	$10,481,965	$19,085,252
2010	$48,243,322	$38,821,750	$87,065,072
2011	$78,698,388	$7,265,357	$85,963,745
Totals	$137,109,954	$57,581,667	$194,691,621

Source: Michael O'Malley, USTAR Marketing Director, USTAR, 2011.

Economic Impacts of Construction Spending

The economic impact estimates shown here were developed using RIMS II final-demand multipliers for Utah's construction industry.

From FY 2007 through FY 2011, construction spending for USTAR research facilities supported an average of 801 jobs annually, generated $143.2 million in earnings for Utah workers and $238.2 million in GSP for the state of Utah. The resulting fiscal benefits include

almost $12.5 million in state taxes and $2.1 million in taxes for local governments.

The construction impacts for each building are shown in Tables 7 and 8. Table 9 shows total impacts.

Summary Economic Effects of the USTAR Program: FY 2007–FY 2011

The USTAR program has been exceptionally successful in fostering economic growth in the state of Utah. Table 10 summarizes the economic effects generated by USTAR's three program missions—research team spending, outreach activities and research facility construction.

In year five of the program (FY 2011) USTAR's activities (research, outreach and construction) supported 2,930 jobs throughout the state and generated $109.1 million in earnings for Utah workers. Gross state product increased by almost $192 million. The effect on state tax revenue was $9.6 million.

As shown in Table 11, construction generated the largest impacts in FY 2011 (as it did in previous years). Most of the construction has been completed, so going forward the impacts of the program will be generated by research team spending and outreach.

Table 7
USTAR Research Facility Construction Impacts: FY 2007–FY 2011
University of Utah
James L. Sorenson Molecular Biotechnology Center

Fiscal Year	Jobs	Earnings	Gross State Product	State Tax Revenue	Local Tax Revenue
2007	20	$686,183	$1,141,306	$30,027	$10,258
2008	13	$464,999	$773,418	$40,678	$6,952
2009	182	$6,328,578	$10,526,122	$553,624	$94,612
2010	1,002	$35,487,788	$59,025,704	$3,104,472	$530,542
2011	1,590	$57,890,534	$96,287,478	$5,064,264	$865,463
Totals		$100,858,082	$167,754,028	$8,793,065	$1,507,827

Source: Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2012.

Table 8
USTAR Research Facility Construction Impacts: FY 2007–FY 2011
Utah State University BioInnovations Center

Fiscal Year	Jobs	Earnings	Gross State Product	State Tax Revenue	Local Tax Revenue
2007	4	$110,108	$183,138	$9,632	$1,646
2008	18	$634,757	$1,055,772	$55,529	$9,490
2009	221	$7,710,533	$12,824,684	$674,517	$115,272
2010	807	$28,557,279	$47,498,411	$2,498,191	$426,931
2011	147	$5,344,397	$8,889,164	$467,528	$79,899
Totals		$42,357,074	$70,451,170	$3,705,397	$633,238

Source: Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2012.

Table 9
USTAR Research Facilities
Total Construction Impacts: FY 2007–FY 2011

Fiscal Year	Jobs	Earnings	Gross State Product	State Tax Revenue	Local Tax Revenue
2007	24	$796,291	$1,324,444	$39,659	$11,904
2008	31	$1,099,756	$1,829,190	$96,207	$16,442
2009	403	$14,039,111	$23,350,806	$1,228,141	$209,884
2010	1,809	$64,045,067	$106,524,115	$5,602,663	$957,473
2011	1,737	$63,234,931	$105,176,642	$5,531,792	$945,362
Totals		$143,215,156	$238,205,197	$12,498,462	$2,141,065

Source: Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2012.

Table 10
USTAR Summary Economic Effects: FY 2007–FY 2011

Fiscal Year	Jobs	Earnings	Gross State Product	State Tax Revenue	Local Tax Revenue
2007	81	$2,875,439	$5,325,218	$251,543	$42,987
2008	380	$14,135,998	$26,906,145	$1,236,617	$211,334
2009	1,247	$46,434,837	$83,636,815	$4,062,119	$694,200
2010	2,822	$103,467,769	$176,305,186	$9,051,361	$1,546,842
2011	2,930	$109,051,162	$191,973,226	$9,609,852	$1,642,287
Totals		$275,965,205	$484,146,590	$24,181,492	$4,137,650

Source: Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2012.

Appendix A: Economic Impact Modeling

Economic impacts are the changes in the size and structure of a region's economy that occur when goods and services are purchased from vendors within the region with money generated outside the region. In the strictest interpretation, economic impacts occur only when "new" money enters the regional economy and is then spent locally. Such an inflow has the potential to expand the size and strength of the region's economy. Money spent outside the region is considered "leakage" and does not generate economic growth within the region. Likewise, purchases of goods and services by local residents from local vendors do not increase the economic base of the region; they simply reshuffle existing resources.

Various models have been built to evaluate the economic impacts that occur with changes in regional exports. One of the most commonly used models for regional impact analysis is the single region input-output (I-O) model.

Input-Output Models

I-O models capture business-to-business purchases within a region. If an export base industry purchases raw materials, equipment or other inputs from local producers, this effectively increases the size of the region's export base; these are the indirect effects. These inter-industry linkages are captured in an I-O model. I-O models also capture induced spending generated when households supported by the direct and indirect activities purchase goods and services within the region. One of the most commonly used I-O models is RIMS II (Regional Input-Output Modeling System).

Estimating Economic Impacts and Effects Using RIMS II

The economic impact and effect estimates presented in this report were generated using RIMS II. RIMS II is the updated version of the Regional Input-Output Modeling System developed by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). RIMS II is based on an accounting framework called an input-output table, which shows the input and output structure of approximately 500 industries in the U.S. The BEA's regional economic accounts are used to adjust the national I-O table to show a region's industrial structure and trading patterns. RIMS II multipliers can be estimated for any region in the U.S. that is composed of one or more counties, and for any industry or group of industries in the national I-O table.

Table 11
USTAR Economic Effects: FY 2011 by Program Mission

Measure	Research	Outreach	Construction	Total
Jobs	1,102	91	1,737	2,930
Earnings	$41,926,178	$3,890,053	$63,234,931	$109,051,162
Gross State Product	$80,923,394	$5,873,190	$105,176,642	$191,973,226
State Tax Revenue	$3,667,702	$410,358	$5,531,792	$9,609,852
Local Tax Revenue	$626,796	$70,129	$945,362	$1,642,287

Source: Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2012.

Table 12
Total USTAR Economic Effects on Utah's Economy

Fiscal Year	State and Federal Funding	External Grant Awards	USTAR Companies Formed	Jobs	Earnings	State Tax Revenue
2007	$15,000,000	$282,690	0	81	$2,875,439	$251,543
2008	$15,000,000	$1,973,465	0	380	$14,135,998	$1,236,617
2009	$15,421,500	$16,501,459	3	1,247	$46,434,837	$4,062,119
2010	$24,543,000	$20,703,343	1	2,822	$103,467,769	$9,051,361
2011	$23,637,600	$30,275,913	0	2,930	$109,051,162	$9,609,852

Source: Bureau of Economic and Business Research and USTAR.

The RIMS II method for estimating regional I-O multipliers can be viewed as a three-step process. In the first step, the producer portion of the national I-O table is made region-specific by using six-digit NAICS location quotients (LQs). The LQs estimate the extent to which input requirements are supplied by firms within the region.

RIMS II uses LQs based on two types of data. BEA's personal income data (by place of residence) are used to calculate LQs in the service industries and BEA's wage and salary data (by place of work) are used to calculate LQs in the nonservice industries.

In the second step, the household row and the household column from the national I-O table are made region-specific. The household row coefficients are adjusted to reflect regional earnings leakages that result when individuals working in one region reside in another. The household column coefficients are adjusted to account for regional consumption leakages stemming from personal taxes and savings.

In the last step, the Leontief inversion approach is used to estimate the multipliers. This inversion produces output, earnings, employment and value-added (or gross state product) multipliers which can be used to trace the impacts of changes in final demand, by industry, within a specific region.[6]

Estimating Fiscal Impacts

The fiscal impacts presented in this analysis were estimated by quantifying the relationship between earnings and selected state and local tax collections in 2007–08 using data published by the U.S. Census Bureau. These relationships are expressed as ratios that represent the effective state and local tax rates. These ratios are applied to the total earnings impact estimates.

To estimate the impact on state tax revenue, BEBR quantified the relationship between earnings and the following taxes: individual income tax, state sales tax and other miscellaneous taxes. The ratio used to estimate state tax revenue was 8.74 percent.

To estimate the impact on local tax revenues, BEBR quantified the relationship between earnings and local sales taxes and other miscellaneous taxes. The ratio used to estimate local tax revenue impacts was 1.50 percent.

The fiscal impact estimates generated in this report are broad measures. This methodology assumes a linear relationship between state and local taxes and earnings. While this assumption may hold with respect to state income tax collections and to a lesser degree, sales tax collections, the relationship between earnings and corporate income tax and property tax (which was not included in the analysis) is less obvious.

Terms Used in This Report

Terms are presented in groups within a logical rather than alphabetical order. The definitions presented here are consistent with measures developed by the Bureau of Economic Analysis.

Economic Impact Analysis estimates the impact of dollars generated outside the region (new dollars) on the region's economy.

Economic Contribution Analysis shows the economic contribution of purchases made within the region without regard to the source of the money used to make those purchases.

Direct Impacts are the changes in economic activity within the region during the first round of spending. Typically these include the direct employment and direct spending in the region by the business or industry under study.

Indirect Impacts are the changes in sales, labor income and employment within the region in backward-linked industries that supply goods and services to the business or industry under study.

Induced Impacts are the increased sales within the region from household spending of the income earned for both the business or industry under study and supporting businesses.

Total Impacts are the sum of direct, indirect and induced effects or impacts.

Multipliers capture the size of the secondary effects in a given region, generally as a ratio of the total change in economic activity in the region relative to the direct change. Multipliers express the degree of interdependency between sectors in a region's economy.

Measures of Economic Activity:

Earnings are the sum of wage and salary disbursements, supplements to wages and salaries, and proprietors' income. Earnings are an economic "flow," meaning they can be summed from year to year to estimate total impacts over time.

Jobs is a measure of the number of jobs required to produce a given volume of sales or production. Jobs include full-time and part-time workers as well as the self-employed. Jobs are a "stock," meaning they are a point-in-time estimate and cannot be added over time.

Value-Added/ Gross State Product is the sum of total income and indirect business taxes and is equivalent to the gross state or regional product measure. Value-added is the most commonly used measure of the contribution of a region to the national economy as it avoids double counting of intermediate sales and captures only the "value added" by the region (or business) to final products.

Appendix B: Data Development

The primary data used to estimate the economic impacts of the USTAR program were provided by USTAR. The methodology used to estimate the potential outputs of the USTAR program (research dollars generated, number of disclosures, licenses and new company formation) was developed by BEBR in 2005 for use in projecting impacts of the USTAR program using hypothetical data. A detailed discussion of the original economic prospectus can be found online at ustar.usu.edu/files/uploads/EconomicProspectus.

Original 2005 Economic Prospectus

The original assumptions about team formation and external funding used to populate the model were provided by the U of U. A steady stream of state money was core to those assumptions and determined the rate at which research teams would be formed and funded over a 25-year period.

Team spending patterns in the 2005 economic prospectus were estimated using information on research spending at the U of U and USU included in a study completed by BEBR in 2005. Using that data, BEBR estimated the local industry composition of purchases made by the research teams. The economic impacts generated by those purchases were estimated using RIMS II multipliers.

Data provided by the University of Utah's Technology Commercialization Office and Office of Sponsored Projects was used to estimate the relationship between research spending at the U of U, number of disclosures, timing of those disclosures, number of licenses flowing from those disclosures and number of licenses leading to the formation of a new Utah company. Employment trends were estimated using 20 years of employment data on U of U spin-offs compiled from numerous reports completed by BEBR. A detailed analysis of this process is provided in the 2005 economic prospectus.

The construction impacts in the original economic prospectus were developed using RIMS II and information provided by the U of U and USU about the anticipated construction costs of four new research facilities; two at the U of U and two at USU.

Revised Economic Baseline

The amount of state money received by USTAR has been lower than the amount used to form the assumptions in the 2005 study. Therefore, revisions to the original prospectus were made using the actual amount of state funding for the program. The relationships developed in the original economic prospectus (as discussed above) were used to develop the revised output measures based on actual state funding and actual expenditures by USTAR research teams.

The primary data used to populate the revised model were provided by USTAR and included information about state funding, external research funding, disclosures, licenses and new company formation.

The economic impacts of USTAR research teams were estimated using RIMS II and research team expenditures provided by USTAR. The team spending patterns were based on detailed research spending data provided by the U of U for a study completed by BEBR in 2011.

The construction impacts of the two research facilities built as part of the USTAR mission were estimated using RIMS II and actual construction spending data provided by Utah contractors to USTAR.

Economic Impacts of USTAR Outreach Activities

In this study the economic impacts of USTAR outreach activities are limited to activities that can be quantifiably measured—in this case, new dollars flowing into the state. USTAR's outreach activities have helped Utah companies raise private equity and other types of follow-on funding. To the extent that this money is spent locally, the state benefits through increased employment, earnings and tax revenue.

To estimate the potential impacts of this money, BEBR and a USTAR consultant contacted USTAR's clients that received private equity and other types of funding as a result of USTAR's assistance and asked for information about changes in employment and spending that resulted from the investments. The economic impacts of those changes were then estimated using RIMS II.

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Endnotes

1. Crispin, Jan Elise. "The Economic Impact of Utah's Public Research Universities," Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2005.

2. Crispin, Jan Elise. "The Economic Impact of Sponsored Research at the University of Utah: 2010," Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, 2011.

3. USTAR Annual Report, 2011. Accessed at: www.innovationutah.com.

4. Employment information for these companies was provided by USTAR.

5. The $34.3 million includes private equity, loans, and SBIR grants.

6. *Regional Multipliers, A User Handbook for the Regional Input-Output Modeling System (RIMS II)*, U.S. Department of Commerce, Bureau of Economic Analysis, Economic and Statistics Division, March 1997.

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