

# Texas as a “State of Minds”

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An Assessment of the Potential Impact of Increasing the Number of Tier One Universities on State and National Business Activity



*Prepared as a Public Service by*

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# Introduction



## Introduction

- **Residents, new and old alike, often refer to Texas as a “state of mind.”** There is little doubt that this large and rugged land that was once an independent country has a personality and character all its own. In the future, however, it is critical that Texas enhance its current economic base and evolve in a manner that can consistently achieve and sustain global business leadership. The state that carved its early success out of a vast base of natural resources has adapted to new realities, but much remains to be done. **To assure future prosperity, the “state of mind” must become the “state of minds” – the very best and brightest for generations to come.**
- **Education is a key factor of success not only for individuals, but also for local and state economies.** In an increasingly competitive US and international market, nationally recognized, top-quality academic research universities are critical to securing a highly skilled workforce, creating and dispersing knowledge, cultivating entrepreneurship and associated capital investment, attracting activity in high-growth sectors, and promoting economic development.
- Texas, home to some 24 million people and growing, lags behind other populous states in the number of Top Tier, nationally recognized research universities. As a result, the state and local economies are unable to realize the full economic potential of the state’s university system. In fact, **Texas lags its primary competitors both in per-capita output of technology-oriented goods and services and in the growth rate for these sectors. In other words, a notable gap exists, and it is getting wider over time.**



- Top Tier universities typically involve larger and more highly compensated faculties; additional research and associated activity funded primarily through federal and other external sources; a greater volume of spin-off companies, venture capital sources, and licensing opportunities; and a more highly qualified workforce to support technology-oriented growth.
- Texas is presently losing critical young talent as top high school graduates leave the state to attend recognized universities in other states. In fact, an estimated 10,000 high school graduates per year leave the state to attend doctoral granting universities in other states, more than double the approximately 4,000 attracted to Texas. A disproportionate share of these students normally remains near the area where they attend college. The reversal of this “brain drain” is critical to the future of Texas. In key workforce categories (particularly in science and engineering), Texas lags other states such as California and Massachusetts, thus hampering the outlook for future performance.
- In short, **nationally recognized research universities attract the world’s most talented students and faculty and produce significant economic impacts through research, spin-off enterprises, and enhanced competitiveness in locating emerging technology clusters.**
- A proposed Texas constitutional amendment, **Proposition 4, would create a National Research University Fund, among other things, to help fund state universities meeting certain quality requirements for the purpose of becoming nationally recognized research institutions.** Started through the transfer of existing assets of the Higher Education Fund, worth roughly \$450 million, the National Research University Fund is expected to reach \$2 billion by the time the first emerging institution becomes eligible to receive distributions, allowing for a total of \$25 million per year for qualifying universities.



- The University of Texas at Austin and Texas A&M at College Station are the only public schools currently classified as Tier One universities. (Rice University in Houston, a relatively small private institution, is also nationally recognized.) Seven public universities have been classified as “emerging research universities” with the potential of receiving the above funds including:
  - Texas Tech University,
  - University of Texas at Arlington,
  - University of Texas at Dallas,
  - University of Texas at El Paso,
  - University of Texas at San Antonio,
  - University of Houston, and
  - University of North Texas.
  
- Overall, the advancement of some of these institutions to Tier One standing would generate a large potential economic impact for the state. **Texas has a number of positive attributes and is projected to achieve ongoing expansion under current conditions. The incremental benefits of pursuing an aggressive strategy to promote high-quality educational institutions, however, are quite substantial and worthy of aggressive pursuit.**
  
- In the present study, The Perryman Group (TPG) quantifies the potential effects of a concerted effort to develop additional Tier One universities on the Texas economy. This analysis is provided as a public service to illustrate the importance of this critical investment in the “intellectual infrastructure” of the state.



## HIGHLIGHTS OF STUDY FINDINGS

- While there is no single universal definition of a Tier One university, membership in the Association of American Universities (AAU) is one common criterion. **Among the 60 US universities with memberships in the AAU, three are located in Texas, of which two are large public universities:** The University of Texas at Austin, Texas A&M University, and Rice University.
- **Texas has not kept pace with other large states in the number of Tier One universities. Texas’ adverse ranking has notable negative consequences for the economy including lost opportunity for billions of dollars in research funding and an out-migration of the bright high school graduates, as well as disadvantages in generating startup firms in emerging fields and attracting major clusters of technology-oriented production.** In addition, the lack of nationally recognized research universities has even been shown to diminish university attendance more generally.
- **Aside from the economic contributions of running the actual institution, Tier One universities spend millions of dollars annually on research, much of which is funded from outside sources. They are leaders in innovative ideas and new creations and discoveries. They partner with local businesses and produce graduates that create a highly trained workforce in the area.** The Perryman Group analyzed the incremental benefit of the potential enhancement of the state’s position in Tier One universities.
- To illustrate the benefits of securing a greater number of nationally-recognized research universities, TPG developed the following three scenarios related to the number of institutions achieving Tier



One status and the related change in per-capita output in emerging sectors.

- In **Scenario I**, it is assumed that (1) Texas is able to add two typical Tier One universities by 2035, which will bring the state to the national average on a per-capita basis and (2) the resulting benefits lead to closing half the gap with California in per-capita output in emerging sectors. In this case, **incremental business activity in Texas as of 2035 includes \$161.1 billion in total spending each year, \$81.8 billion in annual output, and 344,393 permanent jobs. The State government would gain more than \$4.2 billion in annual fiscal revenues, with local tax authorities seeing benefits of about \$1.3 billion per annum.**
- In **Scenario II**, it is assumed that (1) Texas is able to add three typical Tier One universities by 2035, which will bring the state to the average of the ten largest states (excluding Florida) on a per-capita basis and (2) the resulting benefits lead to closing the current gap with California in per-capita output in emerging sectors. In Scenario II, **gains in Texas business activity as of 2035 rise to \$320.5 billion in spending each year, \$162.8 billion in annual output, and 684,954 permanent jobs. Similarly, fiscal revenues expand to \$8.4 billion for the State and nearly \$2.6 billion for local governments.**
- In **Scenario III**, it is assumed that (1) Texas is able to add four typical Tier One universities by 2035, which will bring the state approximately to the average of California and Massachusetts on a per-capita basis and (2) the resulting benefits lead to per-capita output in emerging sectors equivalent to the average for California and Massachusetts. In this instance, **TPG found overall gains in incremental business activity by 2035 of \$603.3 billion in total spending per year, \$306.6 billion in output, and 1,289,419 permanent jobs, which allows revenues to the State and**



**local governments to expand by \$15.9 billion and almost \$4.9 billion per annum, respectively.**

- Proposition 4 permits resources to be available to the seven emerging universities to work toward Tier One recognition without any additional tax dollars being required. It is appropriate to note, however, that the peer groups of nationally-recognized institutions receive substantially more State money than is currently provided to the Texas schools, and such funding would likely be necessary to sustain national research leadership. Assuming that the level of support per student rose to the average of the peer institutions, the State would gain \$17.25 for every dollar committed under Scenario I, \$23.02 for every dollar under Scenario II, and \$32.51 for every dollar under Scenario III. The payoffs to the economy as a whole are even more dramatic, ranging from \$334.55 in gross product per dollar of State funding in Scenario I, to \$443.83 in Scenario II, and \$626.93 in Scenario III.
- **In summary, if four of the seven emerging research universities could attain Tier One status by 2035, the impact on the Texas economy (in constant 2009 dollars) could reach up to \$603.3 billion in total spending per year, \$306.6 billion in output, and 1,289,419 permanent jobs. Even if only two are successful, incremental activity would include an estimated \$161.1 billion in total spending each year, \$81.8 billion in annual output, and 344,393 permanent jobs.**
- Using existing funds to further the goal of achieving nationally recognized (Tier One) status of high-performing universities would lead to enhanced opportunities for individuals, facilitate the economically and socially desirable goal of increasing the education level of the state residents, and generate sizable economic gains. If the program is successful, the payoff to the investment of public resources is enormous.



- Texas will always be a “state of mind.” As a “state of minds,” however, it is characterized by **much greater prosperity and competitiveness on a sustainable basis. The importance of Proposition 4 as an initial catalyst to this outcome cannot be overemphasized.**

## THE PERRYMAN GROUP’S PERSPECTIVE

- TPG brings a wealth of relevant experience to this endeavor. Dr. M. Ray Perryman, founder and president of the firm, developed the Texas Econometric Model and the US Multi-Regional Impact Assessment System (which includes a submodel reflecting the unique industrial composition and character of the state) about 30 years ago and has maintained, expanded, and updated them on an ongoing basis. These models have been used in hundreds of applications across a broad spectrum and have an excellent reputation for reliability.
- The firm has more than 25 years of experience in assessing the economic impact of corporate expansions, regulatory changes, real estate developments, and myriad other types of events affecting business activity.
- TPG has conducted hundreds of impact analyses for the US and Texas economies as well as all Texas metro areas. Impact studies have been performed for hundreds of clients including many of the largest corporations in the world, governmental entities at all levels, educational institutions, major health care systems, utilities, and economic development organizations. Moreover, the firm has completed numerous studies regarding the economic impact of higher education institutions (such as The University of Texas at Austin, Texas A&M University, The University of Texas Medical Branch, M.D. Anderson, Texas State Technical College, the University of Kansas Medical School, The University of Texas Health Science Center at San Antonio, The University of Texas at



Tyler, The University of Texas at San Antonio, Baylor College of Medicine, and Baylor University) as well as research facilities and programs (Sematech, Texas Institute for Pre-Clinical Studies, Texas Institute for Genomic Medicine, Texas Medical Center, National Biodefense Laboratory, Texas Technology Initiative) and several research parks. TPG has also evaluated the potential impacts of major technological trends, such as convergence, genomics, and nanotechnology, on overall activity.



## Texas’ Current Standing



# Texas’ Current Standing

## CURRENT TIER ONE INSTITUTIONS

- While there is no single universal definition of a Tier One university, membership in the Association of American Universities is one common criterion. The Tier One designation represents institutions that dominate in research funding, endowment assets, and doctorates awarded. These foremost research institutions attract the most talented students and faculty, resulting in increased positive impacts for the states in which they are located.
- **Among the 60 US universities with memberships in the AAU, three are located in Texas, of which two are large public universities.**
  - University of Texas at Austin
  - Texas A&M University
  - Rice University
- **These universities make important contributions to the local and state economy through numerous channels** including
  - retaining and attracting outstanding young people to contribute to the state’s future prosperity,
  - adding to the local employment base,
  - creating new business opportunities,
  - producing innovative discoveries and technologies,
  - generating research investments, and
  - contributing to competitiveness for desirable economic activity.
- **Nationally recognized research universities tend to attract talented students.** The estimated median SAT scores (cumulative



verbal and math scores only) for Tier One universities around the nation in 2007 was 1,290 (1,405 for private and 1,202 for public institutions). Texas Tier One universities had an estimated median score of 1,280 compared to 1,049 for all universities in Texas. Texas’ Tier One public universities had an estimated median score of 1,205 compared to an average of 1,001 for other public universities in Texas. While SAT scores are only one measure of quality, Tier One universities consistently average higher SAT scores, one indication of the caliber of students they attract. They also tend to enroll a high percentage of students from the top 10% of their classes relative to other schools.

- In addition, **these individuals often remain in the area after they graduate.** Only 15% of Rice freshmen, for example, are from Harris County, while 33% of the alumni live in Harris County, thus leading to a net influx of highly educated workers.
- **Research institutions also play a key role in the growth of high-tech industries** in the area, as seen with electronics and software in Austin or the diverse mix of emerging growth sectors in the Silicon Valley area of California and the Boston urban region. Major research universities often partner with local firms to facilitate the creation of industry clusters. As an example, the University of Texas at Austin has agreements with Texas businesses generating in excess of \$9.5 million annually in licensing income. **The venture capital required to commercialize research also tends to concentrate around Tier One universities.**

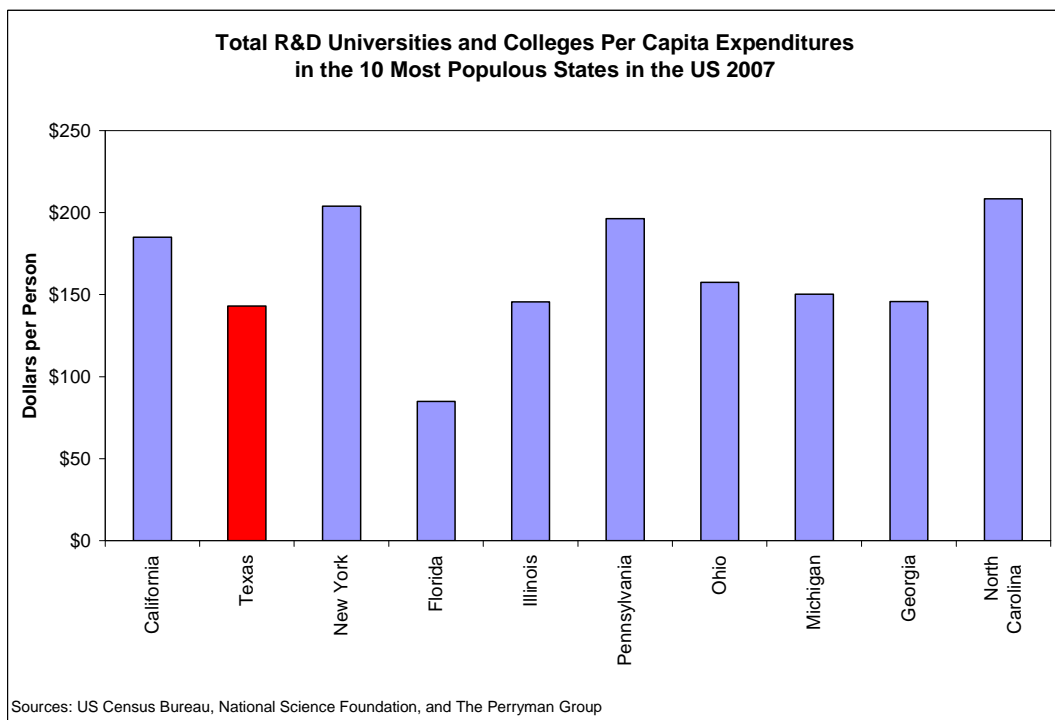
## RESEARCH FUNDING

- An important aspect of having a top tier university system is research expenditures. Not only do research expenditures benefit the institution itself, they also benefit the surrounding community,



particularly if they are derived from federal grants or other external sources.

- While universities of all sizes engage in research, Tier One typically involves research budgets topping \$100 million. In fact, federal academic research expenditures at AAU members totaled \$17.2 billion in FY2007, 57% of all federally funded research provided to colleges and universities throughout the nation. Money invested in research has a multiplying effect throughout the local economy emanating both from the spending itself and its capacity to catalyze new forms.
- **Texas currently lags other areas in this arena.** Among Tier One universities in Texas, the per capita research expenditures in 2007 totaled \$143 per person, ranking it at the lower end of per-capita research expenditures in the most populous US states. Only Florida, which has a notably different economic base, was significantly lower.



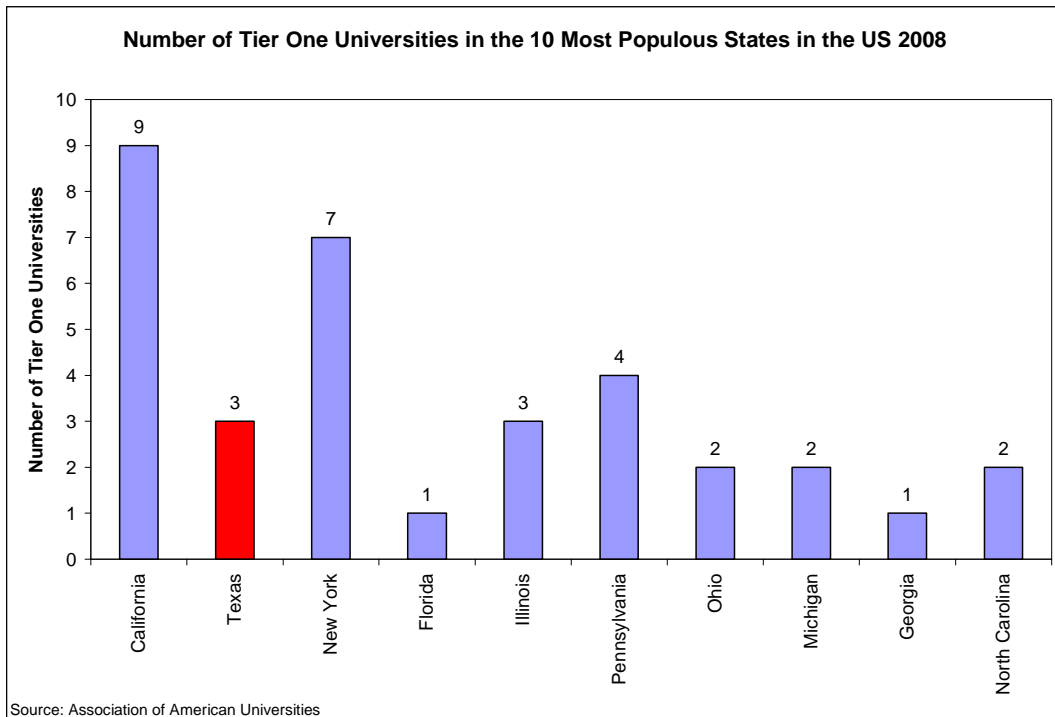
- One analysis, based solely on population proportion to the US, found that Texas bypasses \$3.7 billion annually in federal research and development funding and venture capital investment relative to its “fair share” on a demographic basis. Increasing the number of Tier One universities would help to bring outside research and development funding for Texas more in line with the proportion of the state’s population, thus increasing research expenditures and benefiting the local and state economies.

## TEXAS TIER ONE UNIVERSITIES COMPARED TO OTHER KEY STATES

- **Texas has not kept pace with other large states in the number of Tier One universities.** California, with the nation’s largest population, is home to nine Tier One universities and New York, with the nation’s third largest population, is home to seven. Pennsylvania, holding the sixth largest population, has four Tier One universities, while Texas, the second most populous state, has only three, the same number as the fifth most populated state in the nation. In fact, Massachusetts, a much smaller state that is a primary competitor for major corporate activity, also has three such institutions.

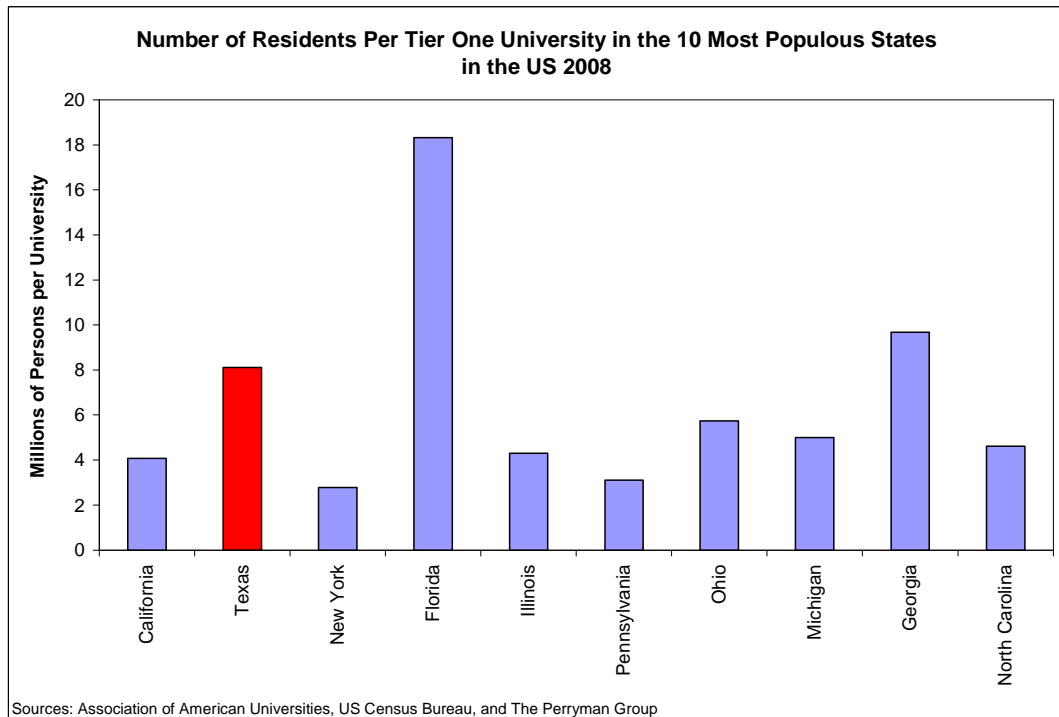


## Texas as a “State of Minds”



- The number of residents per Tier One university in Texas is high, over 8,000,000, ranking it third to last of the ten most populous states, demonstrating the lack of top tier universities in Texas in relation to the size of the population.





- As will be demonstrated in detail below, **Texas’ adverse ranking in terms of nationally recognized, Tier One, research universities has notable negative consequences for the economy including lost opportunity for billions of dollars in research funding and an out-migration of the bright high school graduates, as well as disadvantages in generating startup firms in emerging fields and attracting major clusters of technology-oriented production.** In addition, the lack of nationally recognized research universities has even been shown to diminish university attendance more generally.

## TEXAS HIGHER EDUCATION

- There are currently 143 institutions of higher learning, both public and private, in the state of Texas. Yet, a large and growing population and a currently low ranking educational attainment, compared with the national average, has highlighted the



significance of higher education for Texas individuals and the state economy.

- The Texas Higher Education Coordinating Board has set goals to increase postsecondary education throughout the state. More high performing, nationally recognized research universities will help obtain those goals and keep the best students in Texas.
- In 2000, the state adopted *Closing the Gaps by 2015: The Texas Higher Education Plan*, meant to close the gap between Texas colleges and universities and higher education institutions in other top performing states as well as close the gap between educational attainment of different ethnic groups within the state.
- In a study several years ago, The Perryman Group estimated that achieving these goals would result in billions of additional spending throughout the state as well as over one million new jobs by 2030. Overall, the state’s return on higher education investment through *Closing the Gaps by 2015* would be \$8.08 for every \$1 invested.
- Clearly, **growing all types of colleges and universities will positively impact the economy and personal accomplishments of individual Texans. Transforming currently emerging universities into nationally recognized research (Tier One) universities will result in even greater gains.**



## Impact of Research Institutions



# Impact of Research Institutions

## IMPACT OF RESEARCH INSTITUTIONS ON ECONOMIES

- **The impact of research institutions on economies is immense.** Tier One research universities are often large, creating **thousands of jobs in the local economy**. Spending generated through faculty/staff, students, and visitors contribute greatly to the local economy.
- Tier One universities **draw in talented students from around the world, many of whom remain in the local area after graduation** and play important roles in business formation and economic growth. For example, Massachusetts is home to an estimated 6,900 Massachusetts Institute of Technology (MIT) alumni firms. While only 10% of MIT freshmen are from Massachusetts, more than 38% of the software, biotech, and electronics companies founded by MIT graduates are located in Massachusetts.
- The University of California San Diego, just one of six AAU ranked campuses of the University of California system, has annual research expenditures of nearly \$800 million, generating 373 new inventions, 64 patents, and 85 license agreements.
- **Nationally recognized research universities also attract highly talented faculty.** On average, each full-time faculty position at the University of Virginia generates some \$100,000 in sponsored research funding, the majority of which comes from sources outside the state. Patent income in 2004 to 2005 at the university generated in excess of \$6 million in revenue. Patent revenue is reinvested in faculty as well as faculty entrepreneurial efforts throughout the community.



- **Aside from the economic contributions of running the actual institution, Tier One research universities spend millions of dollars annually on research, much of which is funded from outside sources. They are leaders in innovative ideas and new creations and discoveries. They partner with local businesses and produce graduates that create a highly trained workforce in the area. The implications of a greater concentration of such academic enclaves are explored below.**



# Impact of Increasing the Number of Tier One Universities on the Texas Economy



# Impact of Increasing the Number of Tier One Universities on the Texas Economy

- As noted, a **proposition on the ballot in November would allow existing funds to be used to further the goal of transforming high-performing universities in the state into nationally recognized (Tier One) universities.**
- The Perryman Group analyzed the incremental benefit of the potential enhancement of the state’s position in Tier One universities.

## IMPACTS MEASURED IN THIS STUDY

- The methods used in this study include dynamic input-output assessment, which essentially uses extensive survey data, industry information, and a variety of corroborative source materials to create a matrix describing the various goods and services (known as resources or inputs) required to produce one unit (a dollar’s worth) of output for a given sector. Once the base information is compiled, it can be mathematically simulated to generate evaluations of the magnitude of successive rounds of activity involved in the overall production process. (A more detailed explanation of the methods and terms used in this study may be found in Appendix A.)
- Impacts are expressed in terms of key measures of business activity (described more fully in Appendix A). In essence, total



expenditures (or total spending) reflect every dollar that changes hands in the local area as a result of the stimulus. Gross product (or output) is the amount of new production of goods and services that will come into the relevant area as a result of the new activity.

Personal income is dollars that end up in the hands of people in the area; the vast majority of this derives from the earnings of employees, but payments such as interest and rents are also included. Job gains are expressed in either person-years of employment (for a temporary effect such as construction) or permanent jobs (for an ongoing impact). In the present instance, only permanent changes are considered although it is recognized that other benefits (such as the construction of new facilities) will occur.

- For the emerging research universities to evolve from their present status to Tier One will require a substantial time period. Thus, the present analysis focuses on the incremental benefits in 2035. All values are expressed in constant (2009) dollars and, where appropriate, adjusted for anticipated baseline gains in productivity as estimated in the Texas Econometric Model. It should be noted, of course, that benefits begin to accrue as the institutions move toward nationally-recognized research status.
- In order to assess the implications of additional Tier One universities, it is initially necessary to establish a benchmark for comparison. For this purpose, TPG used a group consisting of public university AAU members other than very large state institutions with much higher enrollment levels than the seven emerging universities in Texas. These peer institutions, a total of twenty-one, have almost exactly the same average number of students, thus allowing comparisons of the current status of the Texas schools in key performance metrics (research funding, faculty, doctoral students, quality of undergraduates, etc.). In this way, it is possible to compare the typical emerging Texas university



to the typical Tier One institution of comparable size to determine the incremental activity that needs to occur to achieve this stature.

- **The gains measured in the current analysis are only those that are incremental as a result of the enhanced university status. Specifically, these benefits include**
  - **a larger number of faculty members per student due to the increased emphasis on research and graduate education;**
  - **a higher level of research per faculty member, with a greater percentage of the funds coming from external sources;**
  - **incremental startup companies resulting from the greater research emphasis;**
  - **enhanced production of existing firms due to the availability of new technologies and processes; and**
  - **economic development resulting from a more highly skilled workforce and greater opportunities for effective collaboration between universities and industry.**
  
- Note that no incremental impacts are assumed for increased enrollment, as it is not apparent that the size of the student body will be affected by the efforts to achieve Tier One status over and above that which would occur as a result of normal demographic patterns. The effects of achieving a higher number of undergraduate students and a greater concentration in graduate programs are implicit reflected in the outcomes noted above.
  
- One of the channels of economic impact measured by TPG was that associated with the incremental increase in faculty needed to reach the level typical for Tier One universities of comparable size. Specifically, the emerging research universities would need to increase faculty by about 67% to be on a par with their nationally recognized peers. This incremental payroll leads to a larger impact on the economy. For this segment of the analysis, it was assumed



that average salaries would be equal to those at public Tier One universities in Texas, which are approximately equal to (slightly below) national norms once adjusted for cost-of-living differentials. The additional spending was assumed to be typical for the state in terms of allocation and was fully adjusted to reflect taxes and other leakages. It should also be observed that the increase in faculty would need to be supported by additional staff. Since much of this segment is likely to be supported by external research funding, however, it was not considered separately to avoid potential overlap in impacts.

- In addition to having a larger faculty, nationally recognized universities receive a much greater volume of research funding per faculty member. In particular, the average amount at the peer institutions is almost four times as great as currently observed at the seven emerging Texas universities. Moreover, the professors at Tier One schools derive a greater percentage of their funds from external sources (primarily federal grants). Using the peer group information and data compiled by the AAU, it is possible to determine the incremental funds entering the state as a result of enhanced research emphasis and, thus, to estimate its effects on the economy.
- As noted, **a greater volume of research leads to a larger number of startup companies.** Using data compiled by the Association of University Technology Managers (AUTM) and the incremental research outlays determined above, it is possible to estimate the incremental number of companies likely to be formed as a result of increased research funding. The information also permits estimates of (1) the attrition rate of the firms and (2) the proportion likely to remain in the state. In order to calculate the level in 2035, it was assumed that research funding would grow from current levels to the amounts in a typical peer Tier One university at a constant rate. Given the stimulus provided by Proposition 4, this pattern is likely



to be conservative. It was further assumed that the resulting firms would be of average size (as determined by data from the US Department of Commerce) and follow the current composition of technology-oriented firms within the state.

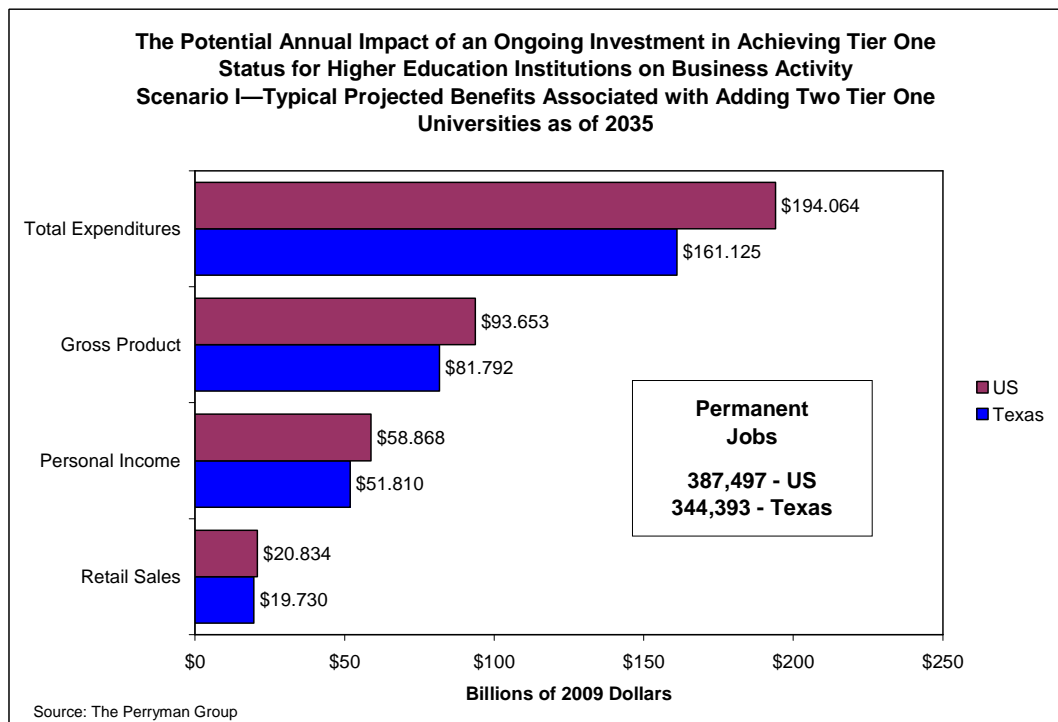
- In addition to fostering startups, the enhanced level of research also leads to new products and cost savings through improved processes for existing firms. While much of this benefit occurs outside the state, recent research at MIT and elsewhere suggests that a notable share occurs in the state of origin. This effect was measured using the pioneering and widely accepted work by Edwin Mansfield to measure the rate of return to academic research among existing firms on a conservative basis.
- Finally, the combination of an enhanced research environment and a higher quality workforce in key technological areas provides a competitive advantage in attracting new activity in emerging growth clusters. As noted earlier, Texas currently lags both California and (especially) Massachusetts in per-capita production of high-tech goods and services, and the gap is widening over time. Texas offers a better cost and overall business climate than either of these areas according to numerous measures. The shortfall is the result of a lesser commitment to research and the ability to provide concentrations of high-tech workers. In fact, the Austin area, which has been able to leverage the benefits of a major Tier One university, has achieved performance on a par with these areas. As a part of this analysis, the potential benefits of gaining “market share” in these critical sectors for future prosperity are examined. In each instance, only the increment above baseline projected growth is considered.
- To illustrate the benefits of securing a greater number of nationally-recognized research universities, TPG developed the following three scenarios:



- In **Scenario I**, it is assumed that (1) Texas is able to add two typical Tier One universities by 2035, which will bring the state to the national average on a per-capita basis and (2) the resulting benefits lead to closing half the gap with California in per-capita output in emerging sectors.
- In **Scenario II**, it is assumed that (1) Texas is able to add three typical Tier One universities by 2035, which will bring the state to the average of the ten largest states (excluding Florida) on a per-capita basis and (2) the resulting benefits lead to closing the current gap with California in per-capita output in emerging sectors.
- In **Scenario III**, it is assumed that (1) Texas is able to add four typical Tier One universities by 2035, which will bring the state approximately to the average of California and Massachusetts on a per-capita basis and (2) the resulting benefits lead to per-capita output in emerging sectors equivalent to the average for California and Massachusetts.



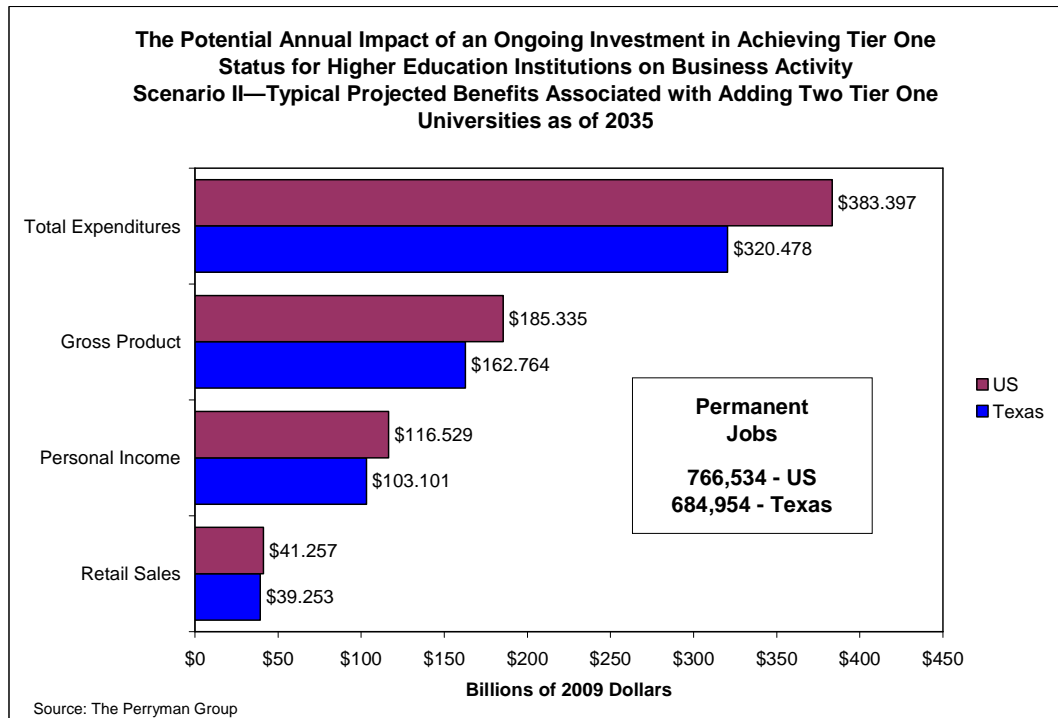
- Because some of the benefits from these investments occur in other parts of the country, both national and state impacts are presented.
  - **For Scenario I, incremental business activity in Texas as of 2035 includes \$161.1 billion in total spending each year, \$81.8 billion in annual output, and 344,393 permanent jobs. The State government would gain more than \$4.2 billion in annual fiscal revenues, with local tax authorities seeing benefits of about \$1.3 billion per annum.** As noted earlier, all monetary values are given in constant (2009) dollars.



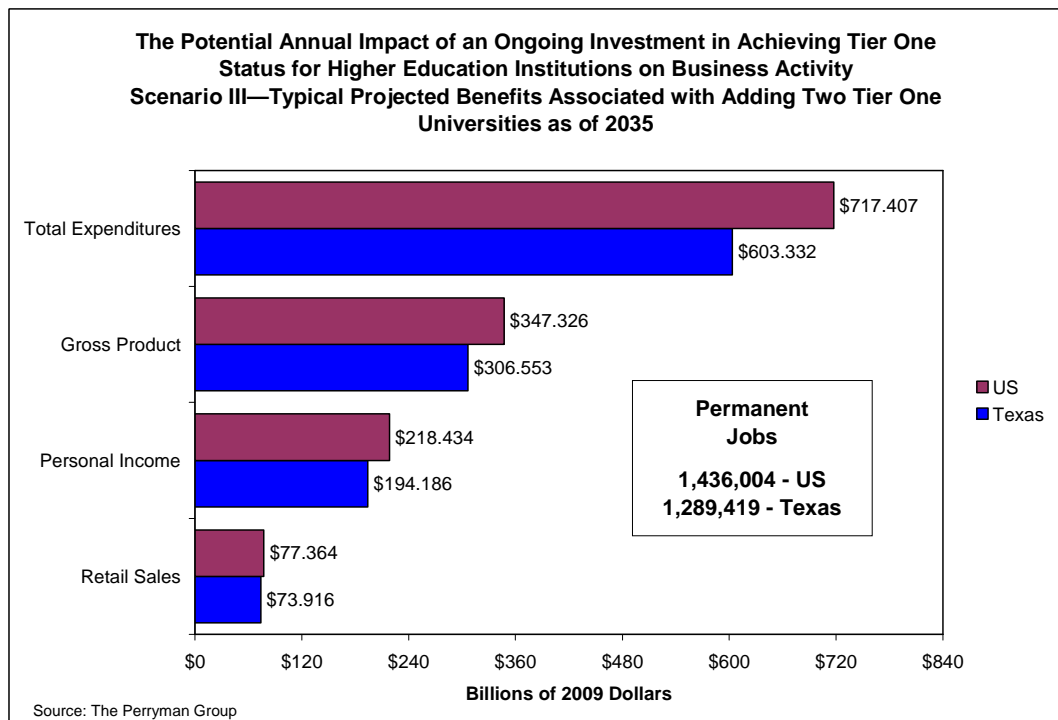
- See Appendix B for industry-level detail on all scenarios.



- In Scenario II, gains in Texas business activity as of 2035 rise to \$320.5 billion in spending each year, \$162.8 billion in annual output, and 684,954 permanent jobs. Similarly, fiscal revenues expand to \$8.4 billion for the State and nearly \$2.6 billion for local governments.



- **Scenario III yields overall gains in incremental business activity by 2035 of \$603.3 billion in total spending per year, \$306.6 billion in output, and 1,289,419 permanent jobs, which allows revenues to the State and local governments to expand by \$15.9 billion and almost \$4.9 billion per annum, respectively.**



- **Proposition 4 permits resources to be available to the seven emerging universities to work toward Tier One recognition without any additional tax dollars being required. It is appropriate to note, however, that the peer groups of nationally-recognized institutions receive substantially more State money than is currently provided to the Texas schools, and such funding would likely be necessary to sustain national research leadership. Assuming that the level of support per student rose to the average of the peer institutions, the State would gain \$17.25 for every dollar committed under Scenario I, \$23.02 for every**



**dollar under Scenario II, and \$32.51 for every dollar under Scenario III.**

- **The payoffs to the economy as a whole are even more dramatic, ranging from \$334.55 in gross product per dollar of State funding in Scenario I, to \$443.83 in Scenario II, and \$626.93 in Scenario III.**



## Conclusion



## Conclusion

- **The state currently lags behind other populated states in Tier One research universities.** As the second most populated state, Texas is home to just three Tier One universities, compared to nine in California and seven in New York.
- **The lack of Tier One universities throughout the state results in Texas receiving lower funding for research, an out migration of the top students graduating from high school, and missed economic opportunities.**
- Proposition 4, a currently proposed constitutional amendment, would create the National Research University Fund to invest in emerging research universities, helping them to reach Tier One status.
- **If four of the seven emerging research universities could attain Tier One status by 2035, the impact on the Texas economy (in constant 2009 dollars) could reach up to \$603.3 billion in total spending per year, \$306.6 billion in output, and 1,289,419 permanent jobs. Even if only two are successful, incremental activity would include an estimated \$161.1 billion in total spending each year, \$81.8 billion in annual output, and 344,393 permanent jobs.**
- **Using existing funds to further the goal of achieving nationally recognized (Tier One) status of high-performing universities would lead to enhanced opportunities for individuals, facilitate the economically and socially desirable goal of increasing the education level of the state residents, and generate sizable**



**economic gains. If the program is successful, the payoff to the investment of public resources is enormous.**

- **Texas will always be a “state of mind.” As a “state of minds,” however, it is characterized by much greater prosperity and competitiveness on a sustainable basis. The importance of Proposition 4 as an initial catalyst to this outcome cannot be overemphasized.**



## APPENDICES



## APPENDIX A: Methodologies



## Texas Econometric Model Methodology



## Texas Econometric Model

- The models used in developing the baseline forecast for this analysis are formulated in an internally consistent manner and are designed to permit the integration of relevant global, national, state, and local factors into the projection process. They are the result of more than 30 years of continuing research in econometrics, economic theory, statistical methods, and key policy issues and behavioral patterns, as well as intensive, ongoing study of all aspects of the global, US, and Texas economies.
- The remainder of this Technical Explanation describes the forecasting process in a comprehensive manner, focusing on both the modeling and the supplemental analysis. The overall methodology, while certainly not ensuring perfect foresight, permits an enormous body of relevant information to impact the economic outlook in a systematic manner.

### Model Logic and Structure

- The expanded version of the Texas Econometric Model, developed and maintained by The Perryman Group, revolves around a core system which projects output, income, and employment by industry in a simultaneous manner. For purposes of illustration, it is useful to initially consider the employment functions. Essentially, employment within the system is a derived demand relationship obtained from a neo-Classical production function. The expressions are augmented to include dynamic temporal adjustments to changes in relative factor input costs, output and (implicitly) productivity, and technological progress over time. Thus, the typical equation includes output, the relative real cost of labor and capital, dynamic lag structures, and a technological adjustment parameter. The functional form is logarithmic, thus preserving the theoretical consistency with the neo-Classical formulation.
- The income segment of the model is divided into wage and non-wage components. The wage equations, like their employment counterparts, are individually estimated at the three-digit North American Industry Classification System (NAICS) level of aggregation. Hence, income by place of work is measured for approximately 70 distinct production categories. The wage equations measure real compensation, with the form of the variable structure differing between “basic” and “non-basic.”
- The basic industries, comprised primarily of the various components of Mining, Agriculture, and Manufacturing, are export-oriented, i.e., they bring external dollars into the area and form the core of the economy. The production of these sectors typically flows into national and international markets; hence, the labor markets are influenced by conditions in areas beyond the borders of the particular region. Thus, real (inflation-adjusted) wages in the basic industry are expressed as a function of the corresponding national rates, as well as measures of local labor market conditions (the reciprocal of the unemployment rate), dynamic adjustment parameters, and ongoing trends.



- The “non-basic” sectors are somewhat different in nature, as the strength of their labor markets is linked to the health of the local export sectors. Consequently, wages in these industries are related to those in the basic segment of the economy. The relationship also includes the local labor market measures contained in the basic wage equations.
- Note that compensation rates in the export or basic sectors provide a key element of the interaction of the regional economies with national and international market phenomena, while the “non-basic” or local industries are strongly impacted by area production levels. Given the wage and employment equations, multiplicative identities in each industry provide expressions for total compensation; these totals may then be aggregated to determine aggregate wage and salary income. Simple linkage equations are then estimated for the calculation of personal income by place of work.
- The non-labor aspects of personal income are modeled at the regional level using straightforward empirical expressions relating to national performance, dynamic responses, and evolving temporal patterns. In some instances (such as dividends, rents, and others) national variables (for example, interest rates) directly enter the forecasting system. These factors have numerous other implicit linkages into the system resulting from their simultaneous interaction with other phenomena in national and international markets which are explicitly included in various expressions.
- The output or gross area product expressions are also developed at the three-digit NAICS level. Regional output for basic industries is linked to national performance in the relevant industries, local and national production in key related sectors, relative area and national labor costs in the industry, dynamic adjustment parameters, and ongoing changes in industrial interrelationships (driven by technological changes in production processes).
- Output in the non-basic sectors is modeled as a function of basic production levels, output in related local support industries (if applicable), dynamic temporal adjustments, and ongoing patterns. The interindustry linkages are obtained from the input-output (impact assessment) system which is part of the overall integrated modeling structure maintained by The Perryman Group. Note that the dominant component of the econometric system involves the simultaneous estimation and projection of output, income, and employment at a disaggregated industrial level.
- Several other components of the model are critical to the multi-regional forecasting process. The demographic module includes (1) a linkage equation between wage and salary (establishment) employment and household employment, (2) a labor force participation rate function, and (3) a complete age-cohort-survival population system with endogenous migration. Given household employment, labor force participation (which is a function of economic conditions and evolving patterns of worker preferences), and the working age population (from the age-cohort-survival model), the unemployment rate and level become identities.



- The population system uses Census information, fertility rates, and life tables to determine the “natural” changes in population by age group. Migration, the most difficult segment of population dynamics to track, is estimated in relation to relative regional and extra-regional economic conditions over time. Because evolving economic conditions determine migration in the system, population changes are allowed to interact simultaneously with overall economic conditions.
- Retail sales is related to income, interest rates, dynamic adjustments, and patterns in consumer behavior on a store group basis. Inflation at the state level relates to national patterns, indicators of relative economic conditions, and ongoing trends.
- A final significant segment of the forecasting system relates to real estate absorption and activity. The short-term demand for various types of property is determined by underlying economic and demographic factors, with short-term adjustments to reflect the current status of the pertinent building cycle. In some instances, this portion of the forecast requires integration with the Multi-Regional Industry-Occupation System which is maintained by The Perryman Group.
- The overall Texas Econometric Model contains numerous additional specifications, and individual expressions are modified to reflect alternative lag structures, empirical properties of the estimates, simulation requirements, and similar phenomena. Nonetheless, the above synopsis offers a basic understanding of the overall structure and underlying logic of the system.

### **Model Simulation and Multi-Regional Structure**

- The initial phase of the simulation process is the execution of a standard non-linear algorithm for the state system and that of each of the individual sub-areas. The external assumptions are derived from scenarios developed through national and international models and extensive analysis by The Perryman Group.
- Once the initial simulations are completed, they are merged into a single system with additive constraints and interregional flows. Using information on minimum regional requirements, import needs, export potential, and locations, it becomes possible to balance the various forecasts into a mathematically consistent set of results. This process is, in effect, a disciplining exercise with regard to the individual regional (including metropolitan and rural) systems. By compelling equilibrium across all regions and sectors, the algorithm ensures that the patterns in state activity are reasonable in light of smaller area dynamics and, conversely, that the regional outlooks are within plausible performance levels for the state as a whole.
- The iterative simulation process has the additional property of imposing a global convergence criterion across the entire multi-regional system, with balance being achieved simultaneously on both a sectoral and a geographic basis. This approach is particularly critical on non-linear dynamic systems, as independent simulations of individual systems often yield unstable, non-convergent outcomes.
- It should be noted that the underlying data for the modeling and simulation process are frequently updated and revised by the various public and private entities compiling them. Whenever those modifications to the database occur,



they bring corresponding changes to the structural parameter estimates of the various systems and the solutions to the simulation and forecasting system. The multi-regional version of the Texas Econometric Model is automatically re-estimated and simulated with each such data release, thus providing a constantly evolving and current assessment of state and local business activity.

### The Final Forecast

- The process described above is followed to produce the preliminary forecast. Through the comprehensive multi-regional modeling and simulation process, a systematic analysis is generated which accounts for both historical patterns in economic performance and inter-relationships and best available information on the future course of pertinent external factors. While the best available techniques and data are employed in this effort, they are not capable of directly capturing “street sense,” i.e., the contemporaneous and often non-quantifiable information that can materially affect economic outcomes. In order to provide a comprehensive approach to the prediction of business conditions, it is necessary to compile and assimilate extensive material regarding “what’s happenin’” both across the state of Texas and elsewhere.
- This critical aspect of the forecasting methodology includes activities such as (1) daily review of key financial and business publications and electronic information sites; (2) review of major newspapers in the state on a daily basis; (3) dozens of hours of direct telephone interviews with key business and political leaders in all parts of the state; (4) face-to-face discussions with representatives of major industry groups; and (5) frequent site visits to the various regions of the state. The insights arising from this “fact finding” are analyzed and evaluated for their effects on the likely course of the future activity.
- Another vital information resource stems from the firm’s ongoing interaction with key players in the international, domestic, and state economic scenes. Such activities include visiting with corporate groups on a regular basis and being regularly involved in the policy process at all levels. The firm is also an active participant in many major corporate relocations, economic development initiatives, and regulatory proceedings.
- Once organized, this information is carefully assessed and, when appropriate, independently verified. The impact on specific communities and sectors that is distinct from what is captured by the econometric system is then factored into the forecast analysis. For example, the opening or closing of a major facility, particularly in a relatively small area, can cause a sudden change in business performance that will not be accounted for by either a modeling system based on historical relationships or expected (primarily national and international) factors.
- The final step in the forecasting process is the integration of this material into the results in a logical and mathematically consistent manner. In some instances, this task is accomplished through “constant adjustment factors” which augment relevant equations. In other cases, anticipated changes in industrial structure or regulatory parameters are initially simulated within the context of the US Multi-Regional Impact Assessment System to estimate their ultimate effects by sector.



## Texas as a “State of Minds”

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Those findings are then factored into the simulation as constant adjustments on a distributed temporal basis. Once this scenario is formulated, the extended system is again balanced across regions and sectors through an iterative simulation algorithm analogous to that described in the preceding section.



## US Multi-Regional Impact Assessment System



## US Multi-Regional Impact Assessment System

- The basic modeling technique employed in this study is known as dynamic input-output analysis. This methodology essentially uses extensive survey data, industry information, and a variety of corroborative source materials to create a matrix describing the various goods and services (known as resources or inputs) required to produce one unit (a dollar’s worth) of output for a given sector. Once the base information is compiled, it can be mathematically simulated to generate evaluations of the magnitude of successive rounds of activity involved in the overall production process.
- There are two essential steps in conducting an input-output analysis once the system is operational. The first major endeavor is to accurately define the levels of direct activity to be evaluated. This process was described within the report. The second step is the simulation of the input-output system to measure overall economic effects.
- Once the direct input values were determined (as described within the report), the present study was conducted within the context of the US Multi-Regional Impact Assessment System (USMRIAS) which was developed and is maintained by The Perryman Group. This model has been used in hundreds of diverse applications across the country and has an excellent reputation for accuracy and credibility. In addition, the model has been in operation and continually updated for over two decades. The systems used in the current simulations reflect the unique industrial structures of the economies of the US and state of Texas.
- The USMRIAS is somewhat similar in format to the Input-Output Model of the United States and the Regional Input-Output Modeling System, both of which are maintained by the US Department of Commerce. The model developed by TPG, however, incorporates several important enhancements and refinements. Specifically, the expanded system includes (1) comprehensive 500-sector coverage for any county, multi-county, or urban region; (2) calculation of both total expenditures and value-added by industry and region; (3) direct estimation of expenditures for multiple basic input choices (expenditures, output, income, or employment); (4) extensive parameter localization; (5) price adjustments for real and nominal assessments by sectors and areas; (6) measurement of the induced impacts associated with payrolls and consumer spending; (7) embedded modules to estimate multi-sectoral direct spending effects; (8) estimation of retail spending activity by consumers; and (9) comprehensive linkage and integration capabilities with a wide variety of econometric, real estate, occupational, and fiscal impact models. The models used for the present investigation have been thoroughly tested for reasonableness and historical reliability.
- As noted earlier, the impact assessment (input-output) process essentially estimates the amounts of all types of goods and services required to produce one unit (a dollar’s worth) of a specific type of output. For purposes of illustrating the nature of the system, it is useful to think of inputs and outputs in dollar (rather than physical) terms. As an example, the construction of a new building will require



specific dollar amounts of lumber, glass, concrete, hand tools, architectural services, interior design services, paint, plumbing, and numerous other elements. Each of these suppliers must, in turn, purchase additional dollar amounts of inputs. This process continues through multiple rounds of production, thus generating subsequent increments to business activity. The initial process of building the facility is known as the *direct effect*. The ensuing transactions in the output chain constitute the *indirect effect*.

- Another pattern that arises in response to any direct economic activity comes from the payroll dollars received by employees at each stage of the production cycle. As workers are compensated, they use some of their income for taxes, savings, and purchases from external markets. A substantial portion, however, is spent locally on food, clothing, healthcare services, utilities, housing, recreation, and other items. Typical purchasing patterns in the relevant areas are obtained from the *ACCRA Cost of Living Index*, a privately compiled inter-regional measure which has been widely used for several decades, and the *Consumer Expenditure Survey* of the US Department of Labor. These initial outlays by area residents generate further secondary activity as local providers acquire inputs to meet this consumer demand. These consumer spending impacts are known as the *induced effect*. The USMRIAS is designed to provide realistic, yet conservative, estimates of these phenomena.
- The fiscal effects are measured through a model which is specifically tied to the State and local tax structures of Texas.
- Sources for information used in this process include the Bureau of the Census, the Bureau of Labor Statistics, the Regional Economic Information System of the US Department of Commerce, and other public and private sources. The pricing data are compiled from the US Department of Labor and the US Department of Commerce. The verification and testing procedures make use of extensive public and private sources. Note that all monetary values, unless otherwise noted, are given in constant (2009) dollars to eliminate the effects of inflation.
- The USMRIAS generates estimates of the effect on several measures of business activity. The most comprehensive measure of economic activity used in this study is **Total Expenditures**. This measure incorporates every dollar that changes hands in any transaction. For example, suppose a farmer sells wheat to a miller for \$0.50; the miller then sells flour to a baker for \$0.75; the baker, in turn, sells bread to a customer for \$1.25. The Total Expenditures recorded in this instance would be \$2.50, that is,  $\$0.50 + \$0.75 + \$1.25$ . This measure is quite broad, but is useful in that (1) it reflects the overall interplay of all industries in the economy, and (2) some key fiscal variables such as sales taxes are linked to aggregate spending.
- A second measure of business activity frequently employed in this analysis is that of **Gross Product**. This indicator represents the regional equivalent of Gross Domestic Product, the most commonly reported statistic regarding national economic performance. In other words, the Gross Product of, say, Amarillo is the amount of US output that is produced in that area. It is defined as the value of all final goods produced in a given region for a specific period of time. Stated



differently, it captures the amount of value-added (gross area product) over intermediate goods and services at each stage of the production process, that is, it eliminates the double counting in the Total Expenditures concept. Using the example above, the Gross Product is \$1.25 (the value of the bread) rather than \$2.50. Alternatively, it may be viewed as the sum of the value-added by the farmer, \$0.50; the miller, \$0.25 ( $\$0.75 - \$0.50$ ); and the baker, \$0.50 ( $\$1.25 - \$0.75$ ). The total value-added is, therefore, \$1.25, which is equivalent to the final value of the bread. In many industries, the primary component of value-added is the wage and salary payments to employees.

- The third gauge of economic activity used in this evaluation is **Personal Income**. As the name implies, Personal Income is simply the income received by individuals, whether in the form of wages, salaries, interest, dividends, proprietors' profits, or other sources. It may thus be viewed as the segment of overall impacts which flows directly to the citizenry.
- The fourth measure, **Retail Sales**, represents the component of Total Expenditures which occurs in retail outlets (general merchandise stores, automobile dealers and service stations, building materials stores, food stores, drugstores, restaurants, and so forth). Retail Sales is a commonly used measure of consumer activity.
- The final aggregates used are **Permanent Jobs** and **Person-Years of Employment**. The Person-Years of Employment measure reveals the full-time equivalent jobs generated by an activity. A person-year is simply the equivalent of a person working for a year. As an example, it could be a carpenter employed for five months, a mason for three months, and a painter for four months. In the case of a construction project, these are typically spread over the course of the construction and development phase. It should be noted that, unlike the dollar values described above, Permanent Jobs is a “stock” rather than a “flow.” In other words, if an area produces \$1 million in output in 1999 and \$1 million in 2000, it is appropriate to say that \$2 million was achieved in the 1999-2000 period. If the same area has 100 people working in 1999 and 100 in 2000, it only has 100 Permanent Jobs. When a flow of jobs is measured, such as in a construction project or a cumulative assessment over multiple years, it is appropriate to measure employment in Person-Years (a person working for a year). This concept is distinct from Permanent Jobs, which anticipates that the relevant positions will be maintained on a continuing basis.



**APPENDIX B:**  
**Detailed Tables**



**Table 1**  
**The Potential Annual Impact of an Ongoing Investment in Achieving Tier One Status for Higher Education Institutions on Business Activity in the US Scenario I—Typical Projected Benefits Associated with Adding Two Tier One Universities as of 2035—Detailed Industrial Category**

Category	Total Expenditures (2009 Dollars)	Gross Product (2009 Dollars)	Personal Income (2009 Dollars)	Employment (Permanent Jobs)
Agricultural Products & Services	\$2,744,875,580	\$726,943,481	\$495,088,868	3,316
Forestry & Fishery Products	\$84,763,679	\$77,787,126	\$28,849,808	150
Coal Mining	\$284,712,170	\$81,742,010	\$86,136,750	236
Crude Petroleum & Natural Gas	\$1,660,224,861	\$362,401,548	\$167,139,199	338
Miscellaneous Mining	\$73,483,198	\$28,819,487	\$16,941,236	73
New Construction	\$0	\$0	\$0	0
Maintenance & Repair Construction	\$2,913,610,490	\$1,638,005,615	\$1,349,818,790	7,986
Food Products & Tobacco	\$14,669,610,276	\$3,775,443,452	\$1,928,676,811	13,538
Textile Mill Products	\$147,276,730	\$34,269,578	\$28,995,089	280
Apparel	\$1,606,235,918	\$889,081,713	\$450,511,342	5,150
Paper & Allied Products	\$1,156,400,558	\$518,276,954	\$234,309,228	1,489
Printing & Publishing	\$1,598,633,362	\$782,123,183	\$510,509,470	3,627
Chemicals & Petroleum Refining	\$10,787,706,213	\$2,587,623,065	\$1,215,039,457	3,761
Rubber & Leather Products	\$1,419,426,353	\$596,093,747	\$348,473,601	2,912
Lumber Products & Furniture	\$508,362,663	\$181,193,781	\$129,181,219	1,125
Stone, Clay, & Glass Products	\$526,405,050	\$297,452,797	\$155,569,113	1,059
Primary Metal	\$1,610,096,503	\$472,902,863	\$352,005,620	2,225
Fabricated Metal Products	\$1,632,773,798	\$639,672,918	\$412,973,876	2,968
Machinery, Except Electrical	\$13,142,787,007	\$5,294,377,855	\$3,782,325,536	16,904
Electric & Electronic Equipment	\$14,226,901,769	\$8,684,109,981	\$5,191,656,249	18,097
Motor Vehicles & Equipment	\$5,773,913,720	\$1,459,076,713	\$947,912,351	5,625
Transp. Equip., Exc. Motor Vehicles	\$1,373,786,620	\$696,885,470	\$455,390,006	2,282
Instruments & Related Products	\$1,687,435,943	\$748,367,561	\$568,827,679	3,054
Miscellaneous Manufacturing	\$426,746,564	\$166,531,356	\$114,858,592	759
Transportation	\$4,900,265,311	\$3,286,078,005	\$2,173,294,747	12,615
Communication	\$14,416,145,412	\$8,804,419,275	\$3,758,889,149	13,949
Electric, Gas, Water, Sanitary Services	\$8,074,206,414	\$1,827,447,431	\$797,449,481	1,414
Wholesale Trade	\$5,721,745,506	\$3,869,906,343	\$2,231,422,552	10,474
Retail Trade	\$13,964,541,858	\$11,571,483,608	\$6,919,377,037	76,155
Finance	\$2,397,661,720	\$1,299,857,331	\$756,910,730	2,825
Insurance	\$2,625,050,337	\$1,571,491,235	\$939,499,383	4,745
Real Estate	\$15,677,425,987	\$2,425,957,577	\$390,874,628	1,456
Hotels, Lodging Places, Amusements	\$1,884,958,525	\$959,530,285	\$629,484,990	6,441
Personal Services	\$2,941,107,399	\$1,803,868,495	\$1,403,438,737	9,930
Business Services	\$24,720,526,223	\$15,851,842,346	\$12,931,041,585	66,056
Eating & Drinking Places	\$6,869,494,316	\$4,024,371,096	\$2,141,180,253	40,641
Health Services	\$4,743,344,050	\$3,319,442,744	\$2,806,619,515	19,463
Miscellaneous Services	\$4,847,926,107	\$2,074,592,935	\$1,798,499,198	18,036
Households	\$223,467,401	\$223,467,401	\$218,738,891	6,343
<b>Total</b>	<b>\$194,064,035,592</b>	<b>\$93,652,938,364</b>	<b>\$58,867,910,766</b>	<b>387,497</b>

SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group

**Table 2**  
**The Potential Annual Impact of an Ongoing Investment in Achieving Tier One Status for Higher Education Institutions on State Business Activity**  
**Scenario I—Typical Projected Benefits Associated with Adding Two Tier One Universities as of 2035—Detailed Industrial Category**

Category	Total Expenditures (2009 Dollars)	Gross Product (2009 Dollars)	Personal Income (2009 Dollars)	Employment (Permanent Jobs)
Agricultural Products & Services	\$2,277,965,514	\$607,676,218	\$413,861,239	2,772
Forestry & Fishery Products	\$50,332,840	\$46,616,441	\$17,289,176	90
Coal Mining	\$219,595,591	\$63,045,278	\$66,434,806	182
Crude Petroleum & Natural Gas	\$1,605,546,926	\$350,432,108	\$161,618,900	327
Miscellaneous Mining	\$61,547,281	\$24,145,146	\$14,193,467	61
New Construction	\$0	\$0	\$0	0
Maintenance & Repair Construction	\$2,710,570,654	\$1,525,149,117	\$1,256,818,001	7,436
Food Products & Tobacco	\$4,890,714,523	\$1,261,163,610	\$644,262,596	4,523
Textile Mill Products	\$82,247,946	\$19,109,119	\$16,167,987	156
Apparel	\$1,101,946,239	\$609,934,054	\$309,062,939	3,533
Paper & Allied Products	\$953,557,781	\$426,356,801	\$192,752,800	1,225
Printing & Publishing	\$1,386,442,123	\$677,514,364	\$442,228,930	3,142
Chemicals & Petroleum Refining	\$6,386,198,166	\$1,523,649,918	\$715,442,219	2,214
Rubber & Leather Products	\$1,206,552,053	\$506,863,467	\$296,309,996	2,476
Lumber Products & Furniture	\$354,532,535	\$125,786,516	\$89,678,884	781
Stone, Clay, & Glass Products	\$459,514,583	\$260,857,941	\$136,429,845	928
Primary Metal	\$1,157,398,418	\$341,905,016	\$254,497,268	1,609
Fabricated Metal Products	\$1,140,288,601	\$446,578,934	\$288,312,098	2,073
Machinery, Except Electrical	\$10,198,992,155	\$4,108,640,176	\$2,935,229,608	13,118
Electric & Electronic Equipment	\$12,533,817,822	\$7,652,384,699	\$4,574,855,786	15,947
Motor Vehicles & Equipment	\$2,903,391,244	\$733,339,824	\$476,425,861	2,828
Transp. Equip., Exc. Motor Vehicles	\$1,082,107,873	\$548,614,347	\$358,500,071	1,797
Instruments & Related Products	\$1,552,118,422	\$688,310,953	\$523,179,173	2,809
Miscellaneous Manufacturing	\$334,240,473	\$130,447,600	\$89,971,209	594
Transportation	\$4,281,718,610	\$2,872,645,333	\$1,899,865,122	11,028
Communication	\$13,662,235,187	\$8,343,561,139	\$3,562,134,026	13,219
Electric, Gas, Water, Sanitary Services	\$6,037,004,459	\$1,366,707,525	\$596,394,835	1,058
Wholesale Trade	\$5,408,829,278	\$3,658,223,184	\$2,109,364,156	9,901
Retail Trade	\$13,283,860,899	\$11,007,443,348	\$6,582,099,003	72,442
Finance	\$2,135,251,359	\$1,157,543,075	\$674,040,722	2,516
Insurance	\$2,427,541,671	\$1,453,262,895	\$868,817,824	4,388
Real Estate	\$15,383,099,564	\$2,380,763,569	\$383,592,893	1,429
Hotels, Lodging Places, Amusements	\$1,842,198,188	\$937,405,945	\$614,970,657	6,293
Personal Services	\$2,776,705,639	\$1,703,000,233	\$1,324,961,607	9,374
Business Services	\$23,722,973,545	\$15,215,787,725	\$12,412,183,995	63,406
Eating & Drinking Places	\$6,445,714,780	\$3,776,126,473	\$2,009,100,860	38,134
Health Services	\$4,568,213,856	\$3,196,893,432	\$2,703,002,938	18,744
Miscellaneous Services	\$4,293,506,553	\$1,838,047,073	\$1,593,433,650	15,979
Households	\$206,412,693	\$206,412,693	\$202,045,062	5,859
<b>Total</b>	<b>\$161,124,886,041</b>	<b>\$81,792,345,290</b>	<b>\$51,809,530,211</b>	<b>344,393</b>

SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group

**Table 3**  
**The Potential Annual Impact of an Ongoing Investment in Achieving Tier One Status for Higher Education Institutions on Business Activity in the US Scenario II—Typical Projected Benefits Associated with Adding Two Tier One Universities as of 2035—Detailed Industrial Category**

Category	Total Expenditures (2009 Dollars)	Gross Product (2009 Dollars)	Personal Income (2009 Dollars)	Employment (Permanent Jobs)
Agricultural Products & Services	\$5,365,919,311	\$1,424,977,881	\$970,489,046	6,500
Forestry & Fishery Products	\$166,631,224	\$153,471,485	\$56,919,736	297
Coal Mining	\$561,864,171	\$161,315,497	\$169,988,376	466
Crude Petroleum & Natural Gas	\$3,269,299,862	\$713,601,780	\$329,112,355	665
Miscellaneous Mining	\$141,736,895	\$55,593,096	\$32,679,816	140
New Construction	\$0	\$0	\$0	0
Maintenance & Repair Construction	\$5,763,726,621	\$3,241,635,027	\$2,671,309,449	15,804
Food Products & Tobacco	\$28,615,756,096	\$7,370,236,814	\$3,765,068,924	26,429
Textile Mill Products	\$276,622,428	\$64,338,066	\$54,435,665	526
Apparel	\$3,168,046,294	\$1,753,559,696	\$888,555,594	10,158
Paper & Allied Products	\$2,248,486,148	\$1,006,823,364	\$455,177,497	2,892
Printing & Publishing	\$3,149,280,163	\$1,540,126,927	\$1,005,275,637	7,143
Chemicals & Petroleum Refining	\$21,042,345,049	\$5,039,142,221	\$2,366,170,224	7,324
Rubber & Leather Products	\$2,774,846,389	\$1,165,422,721	\$681,300,638	5,693
Lumber Products & Furniture	\$961,422,160	\$342,104,413	\$243,901,669	2,124
Stone, Clay, & Glass Products	\$1,020,380,269	\$577,613,567	\$302,094,422	2,056
Primary Metal	\$3,133,529,197	\$922,420,186	\$686,604,199	4,341
Fabricated Metal Products	\$3,157,238,901	\$1,236,842,238	\$798,507,372	5,740
Machinery, Except Electrical	\$26,077,351,632	\$10,504,900,973	\$7,504,744,897	33,540
Electric & Electronic Equipment	\$28,209,294,609	\$17,220,870,512	\$10,295,221,983	35,887
Motor Vehicles & Equipment	\$11,342,053,910	\$2,865,802,152	\$1,861,813,862	11,049
Transp. Equip., Exc. Motor Vehicles	\$2,693,624,399	\$1,366,141,305	\$892,725,018	4,474
Instruments & Related Products	\$3,346,102,197	\$1,483,952,436	\$1,127,939,345	6,056
Miscellaneous Manufacturing	\$818,144,889	\$319,282,465	\$220,212,789	1,454
Transportation	\$9,683,362,674	\$6,494,879,555	\$4,295,481,593	24,934
Communication	\$28,728,018,688	\$17,544,622,605	\$7,490,362,456	27,797
Electric, Gas, Water, Sanitary Services	\$15,957,244,393	\$3,612,005,126	\$1,576,183,022	2,796
Wholesale Trade	\$11,301,882,072	\$7,643,995,575	\$4,407,596,106	20,689
Retail Trade	\$27,653,450,395	\$22,914,559,351	\$13,702,173,476	150,806
Finance	\$4,748,740,121	\$2,574,425,417	\$1,499,095,458	5,596
Insurance	\$5,197,457,331	\$3,111,468,440	\$1,860,158,439	9,395
Real Estate	\$31,042,141,721	\$4,802,438,241	\$773,777,453	2,883
Hotels, Lodging Places, Amusements	\$3,740,298,410	\$1,903,637,011	\$1,248,851,594	12,780
Personal Services	\$5,823,978,791	\$3,571,976,853	\$2,779,055,518	19,662
Business Services	\$49,272,399,151	\$31,599,034,423	\$25,776,715,370	131,676
Eating & Drinking Places	\$13,603,588,093	\$7,969,438,509	\$4,240,166,709	80,482
Health Services	\$9,393,624,385	\$6,573,734,742	\$5,558,153,473	38,544
Miscellaneous Services	\$9,504,604,528	\$4,045,947,502	\$3,507,499,335	35,174
Households	\$442,609,720	\$442,609,720	\$433,244,224	12,563
<b>Total</b>	<b>\$383,397,103,288</b>	<b>\$185,334,947,892</b>	<b>\$116,528,762,738</b>	<b>766,534</b>

SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group

**Table 4**  
**The Potential Annual Impact of an Ongoing Investment in Achieving Tier One Status for Higher Education Institutions on State Business Activity**  
**Scenario II—Typical Projected Benefits Associated with Adding Two Tier One Universities as of 2035—Detailed Industrial Category**

Category	Total Expenditures (2009 Dollars)	Gross Product (2009 Dollars)	Personal Income (2009 Dollars)	Employment (Permanent Jobs)
Agricultural Products & Services	\$4,508,816,260	\$1,204,079,216	\$820,044,790	5,492
Forestry & Fishery Products	\$99,857,744	\$92,620,672	\$34,351,294	179
Coal Mining	\$436,280,016	\$125,257,110	\$131,991,350	362
Crude Petroleum & Natural Gas	\$3,187,282,958	\$695,647,620	\$320,831,907	649
Miscellaneous Mining	\$121,145,444	\$47,527,106	\$27,938,298	119
New Construction	\$0	\$0	\$0	0
Maintenance & Repair Construction	\$5,389,455,661	\$3,033,093,236	\$2,499,458,012	14,787
Food Products & Tobacco	\$9,671,386,049	\$2,494,731,848	\$1,274,428,159	8,946
Textile Mill Products	\$159,852,169	\$37,133,382	\$31,418,084	304
Apparel	\$2,189,144,839	\$1,211,702,503	\$613,988,240	7,020
Paper & Allied Products	\$1,883,419,449	\$841,799,756	\$380,571,532	2,418
Printing & Publishing	\$2,752,786,010	\$1,345,018,034	\$877,923,654	6,238
Chemicals & Petroleum Refining	\$12,632,842,449	\$3,012,746,711	\$1,414,659,739	4,379
Rubber & Leather Products	\$2,389,308,594	\$1,003,753,496	\$586,789,564	4,904
Lumber Products & Furniture	\$691,430,436	\$245,117,832	\$174,755,566	1,522
Stone, Clay, & Glass Products	\$906,410,673	\$514,956,230	\$269,324,363	1,833
Primary Metal	\$2,288,076,634	\$676,569,168	\$503,604,798	3,184
Fabricated Metal Products	\$2,247,372,854	\$880,171,575	\$568,240,226	4,085
Machinery, Except Electrical	\$20,328,216,668	\$8,189,131,590	\$5,850,349,623	26,146
Electric & Electronic Equipment	\$24,976,349,917	\$15,249,888,693	\$9,116,902,021	31,780
Motor Vehicles & Equipment	\$5,762,130,274	\$1,455,387,008	\$945,515,276	5,612
Transp. Equip., Exc. Motor Vehicles	\$2,144,169,958	\$1,086,998,777	\$710,315,249	3,560
Instruments & Related Products	\$3,093,084,197	\$1,371,675,770	\$1,042,598,826	5,598
Miscellaneous Manufacturing	\$656,011,913	\$256,033,725	\$176,589,404	1,165
Transportation	\$8,512,608,890	\$5,711,686,272	\$3,777,505,491	21,928
Communication	\$27,265,441,620	\$16,650,772,929	\$7,108,749,351	26,382
Electric, Gas, Water, Sanitary Services	\$11,999,960,493	\$2,716,773,174	\$1,185,527,598	2,103
Wholesale Trade	\$10,753,538,744	\$7,273,061,267	\$4,193,712,077	19,685
Retail Trade	\$26,428,594,310	\$21,899,595,070	\$13,095,257,301	144,126
Finance	\$4,249,209,066	\$2,303,536,680	\$1,341,356,152	5,007
Insurance	\$4,829,836,659	\$2,891,407,470	\$1,728,597,322	8,731
Real Estate	\$30,600,652,087	\$4,734,647,228	\$762,854,851	2,843
Hotels, Lodging Places, Amusements	\$3,669,197,523	\$1,866,909,989	\$1,224,757,395	12,534
Personal Services	\$5,524,029,192	\$3,387,956,782	\$2,635,884,943	18,650
Business Services	\$47,352,605,723	\$30,373,287,803	\$24,776,820,208	126,569
Eating & Drinking Places	\$12,824,345,731	\$7,512,961,055	\$3,997,296,335	75,872
Health Services	\$9,089,224,503	\$6,360,725,893	\$5,378,052,520	37,295
Miscellaneous Services	\$8,453,300,828	\$3,599,227,777	\$3,120,230,563	31,290
Households	\$410,749,347	\$410,749,347	\$402,058,017	11,658
<b>Total</b>	<b>\$320,478,125,883</b>	<b>\$162,764,339,795</b>	<b>\$103,101,250,101</b>	<b>684,954</b>

SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group

**Table 5**  
**The Potential Annual Impact of an Ongoing Investment in Achieving Tier One Status for Higher Education Institutions on Business Activity in the US Scenario III—Typical Projected Benefits Associated with Adding Two Tier One Universities as of 2035—Detailed Industrial Category**

Category	Total Expenditures (2009 Dollars)	Gross Product (2009 Dollars)	Personal Income (2009 Dollars)	Employment (Permanent Jobs)
Agricultural Products & Services	\$9,944,090,982	\$2,647,422,673	\$1,803,041,811	12,076
Forestry & Fishery Products	\$310,390,654	\$286,823,591	\$106,377,564	555
Coal Mining	\$1,050,302,092	\$301,553,207	\$317,765,725	871
Crude Petroleum & Natural Gas	\$6,099,360,093	\$1,331,267,737	\$613,979,202	1,241
Miscellaneous Mining	\$259,384,244	\$101,746,452	\$59,810,566	256
New Construction	\$0	\$0	\$0	0
Maintenance & Repair Construction	\$10,797,788,526	\$6,075,127,763	\$5,006,284,199	29,618
Food Products & Tobacco	\$52,924,850,837	\$13,640,780,376	\$6,968,362,013	48,916
Textile Mill Products	\$493,286,610	\$114,679,486	\$97,028,901	939
Apparel	\$5,919,069,438	\$3,276,268,315	\$1,660,135,403	18,980
Paper & Allied Products	\$4,146,061,502	\$1,854,955,341	\$838,611,783	5,328
Printing & Publishing	\$5,877,599,700	\$2,873,294,314	\$1,875,464,105	13,327
Chemicals & Petroleum Refining	\$38,916,024,657	\$9,305,310,711	\$4,369,384,358	13,525
Rubber & Leather Products	\$5,142,379,930	\$2,159,972,944	\$1,262,710,011	10,552
Lumber Products & Furniture	\$1,726,213,325	\$613,228,349	\$437,198,160	3,807
Stone, Clay, & Glass Products	\$1,876,080,250	\$1,063,791,202	\$556,367,455	3,786
Primary Metal	\$5,782,993,909	\$1,705,907,735	\$1,269,793,788	8,029
Fabricated Metal Products	\$5,791,581,503	\$2,268,717,078	\$1,464,687,473	10,529
Machinery, Except Electrical	\$48,985,871,687	\$19,733,323,421	\$14,097,568,224	63,005
Electric & Electronic Equipment	\$52,958,413,600	\$32,332,624,125	\$19,329,542,158	67,380
Motor Vehicles & Equipment	\$21,112,816,114	\$5,333,984,787	\$3,465,307,886	20,566
Transp. Equip., Exc. Motor Vehicles	\$5,005,571,272	\$2,538,255,776	\$1,658,660,358	8,312
Instruments & Related Products	\$6,282,159,502	\$2,786,015,619	\$2,117,626,242	11,371
Miscellaneous Manufacturing	\$1,488,588,648	\$580,948,545	\$400,686,894	2,645
Transportation	\$18,123,266,614	\$12,157,936,313	\$8,040,825,253	46,675
Communication	\$54,174,747,357	\$33,084,416,094	\$14,124,799,031	52,419
Electric, Gas, Water, Sanitary Services	\$29,868,594,556	\$6,761,551,932	\$2,950,561,527	5,234
Wholesale Trade	\$21,144,329,923	\$14,300,839,449	\$8,245,991,734	38,706
Retail Trade	\$51,854,681,061	\$42,968,480,673	\$25,693,776,919	282,785
Finance	\$8,905,909,448	\$4,828,084,843	\$2,811,407,937	10,495
Insurance	\$9,744,666,659	\$5,833,666,284	\$3,487,595,580	17,615
Real Estate	\$58,203,493,830	\$9,002,650,440	\$1,450,523,178	5,405
Hotels, Lodging Places, Amusements	\$7,026,502,088	\$3,575,576,163	\$2,345,701,392	24,004
Personal Services	\$10,920,588,183	\$6,697,770,207	\$5,210,973,099	36,869
Business Services	\$92,934,016,358	\$59,605,681,088	\$48,622,962,826	248,383
Eating & Drinking Places	\$25,509,244,207	\$14,944,202,467	\$7,951,113,456	150,919
Health Services	\$17,615,510,338	\$12,327,437,184	\$10,422,962,059	72,280
Miscellaneous Services	\$17,660,953,653	\$7,481,391,856	\$6,485,743,316	65,040
Households	\$830,109,726	\$830,109,726	\$812,544,851	23,561
<b>Total</b>	<b>\$717,407,493,075</b>	<b>\$347,325,794,270</b>	<b>\$218,433,876,435</b>	<b>1,436,004</b>

SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group

**Table 6**  
**The Potential Annual Impact of an Ongoing Investment in Achieving Tier One Status for Higher Education Institutions on State Business Activity**  
**Scenario III—Typical Projected Benefits Associated with Adding Two Tier One Universities as of 2035—Detailed Industrial Category**

Category	Total Expenditures (2009 Dollars)	Gross Product (2009 Dollars)	Personal Income (2009 Dollars)	Employment (Permanent Jobs)
Agricultural Products & Services	\$8,451,115,976	\$2,259,063,182	\$1,538,547,436	10,305
Forestry & Fishery Products	\$187,563,364	\$174,199,776	\$64,607,472	337
Coal Mining	\$820,503,936	\$235,572,731	\$248,237,896	681
Crude Petroleum & Natural Gas	\$5,990,004,221	\$1,307,328,858	\$602,938,604	1,219
Miscellaneous Mining	\$225,924,616	\$88,635,970	\$52,103,694	222
New Construction	\$0	\$0	\$0	0
Maintenance & Repair Construction	\$10,143,017,579	\$5,709,367,206	\$4,704,874,695	27,835
Food Products & Tobacco	\$18,112,546,966	\$4,673,451,442	\$2,387,422,167	16,760
Textile Mill Products	\$294,637,377	\$68,433,485	\$57,900,694	561
Apparel	\$4,116,850,312	\$2,278,692,472	\$1,154,648,419	13,201
Paper & Allied Products	\$3,523,465,920	\$1,574,282,376	\$711,721,588	4,522
Printing & Publishing	\$5,174,216,569	\$2,527,815,535	\$1,649,962,299	11,724
Chemicals & Petroleum Refining	\$23,665,767,526	\$5,641,806,069	\$2,649,155,961	8,200
Rubber & Leather Products	\$4,480,372,128	\$1,882,252,338	\$1,100,355,845	9,195
Lumber Products & Furniture	\$1,278,543,012	\$452,913,006	\$322,902,126	2,812
Stone, Clay, & Glass Products	\$1,693,661,073	\$962,900,046	\$503,600,943	3,427
Primary Metal	\$4,283,954,592	\$1,267,843,213	\$943,720,110	5,967
Fabricated Metal Products	\$4,196,083,877	\$1,643,404,020	\$1,060,984,360	7,627
Machinery, Except Electrical	\$38,341,291,275	\$15,445,546,160	\$11,034,362,330	49,315
Electric & Electronic Equipment	\$47,098,865,345	\$28,758,736,819	\$17,192,950,788	59,932
Motor Vehicles & Equipment	\$10,826,340,123	\$2,734,470,458	\$1,776,492,143	10,544
Transp. Equip., Exc. Motor Vehicles	\$4,022,886,499	\$2,039,311,220	\$1,332,617,740	6,679
Instruments & Related Products	\$5,833,003,108	\$2,586,734,418	\$1,966,154,333	10,558
Miscellaneous Manufacturing	\$1,220,191,453	\$476,234,806	\$328,464,622	2,167
Transportation	\$16,019,519,160	\$10,749,418,596	\$7,109,281,881	41,268
Communication	\$51,483,561,745	\$31,440,068,244	\$13,422,774,173	49,814
Electric, Gas, Water, Sanitary Services	\$22,578,201,968	\$5,111,876,667	\$2,230,687,096	3,957
Wholesale Trade	\$20,236,779,523	\$13,686,937,139	\$7,892,010,187	37,045
Retail Trade	\$49,766,149,141	\$41,237,843,887	\$24,658,911,479	271,396
Finance	\$8,003,240,380	\$4,338,622,767	\$2,526,392,737	9,432
Insurance	\$9,095,084,365	\$5,444,813,616	\$3,255,124,136	16,442
Real Estate	\$57,614,840,984	\$8,912,262,424	\$1,435,959,709	5,351
Hotels, Lodging Places, Amusements	\$6,916,150,597	\$3,518,696,880	\$2,308,386,613	23,623
Personal Services	\$10,401,472,033	\$6,379,314,991	\$4,963,209,817	35,116
Business Services	\$89,428,222,698	\$57,364,421,532	\$46,794,669,317	239,044
Eating & Drinking Places	\$24,149,495,369	\$14,147,653,111	\$7,527,306,675	142,875
Health Services	\$17,116,470,891	\$11,978,222,942	\$10,127,698,187	70,232
Miscellaneous Services	\$15,768,437,118	\$6,680,448,111	\$5,791,391,837	58,078
Households	\$773,602,747	\$773,602,747	\$757,233,555	21,957
<b>Total</b>	<b>\$603,332,035,566</b>	<b>\$306,553,199,262</b>	<b>\$194,185,763,663</b>	<b>1,289,419</b>

SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group