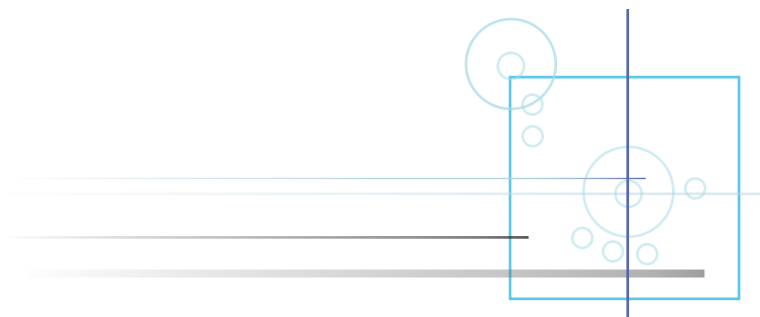




# A Continuing Record of Achievement

The Economic Impact of  
Ben Franklin Technology Partners 2002-2006



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## Executive Summary

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In 1982, the Pennsylvania General Assembly established the Advanced Technology Centers of the Ben Franklin Partnership to promote technological innovation and spur economic growth in the Commonwealth. Since then, in a series of subsequent legislative acts, the organization took its present-day shape as the Ben Franklin Technology Partners (BFTP). Over the years, BFTP has periodically supplemented its annual performance assessment with in-depth analyses of the impact of the program. With the arrival of its 25<sup>th</sup> anniversary since beginning operations, BFTP decided to undertake another in-depth evaluation of the impact of its funding and services on individual companies and the overall economy of Pennsylvania. This study continues BFTP's efforts to objectively measure the impact of the program and gather information that is useful for future strategy and program enhancement.

BFTP retained the Pennsylvania Economy League (through its southeastern Pennsylvania office, the Economy League of Greater Philadelphia)—a nonpartisan research organization—to conduct an independent, objective evaluation of the economic impact of the program from 2002 to 2006, focusing on its role in providing financing and related services to early-stage and established technology-based firms in Pennsylvania. This evaluation is one of a series conducted for BFTP utilizing similar quasi-experimental design methodologies, and the first completed by the Pennsylvania Economy League. The earliest of these studies was conducted in 1999, and covered the period from 1989 to 1996. The second analysis was completed in 2003, and extended the study period through 2001. A similar methodology to that used in each of the prior studies was used in examining the economic impact of BFTP from 2002 to 2006.

**Ben Franklin Technology Partners has substantially improved the business environment in which technology-based companies operate in Pennsylvania by providing necessary capital and access to technical expertise and business assistance.**

BFTP operates through four independent, nonprofit organizations established in different regions of the state to best serve companies across the Commonwealth. Each regional organization is an active participant in the business, academic and economic development community in its part of the state. Over the years, BFTP has helped identify needs within the specific counties each partner serves and has launched significant initiatives to promote innovation and growth in technology-based businesses. Through the injection of funds and the commitment of staff time, BFTP has improved and expanded the financial, physical and knowledge-based infrastructure available to technology-based companies across Pennsylvania.

**Ben Franklin Technology Partners has invested in thousands of technology-based companies located throughout the Commonwealth.**

BFTP's work has evolved over the past 25 years as a result of changing needs in the technology-based business community and the experience of the organization. But throughout, BFTP continues to retain its overarching mission: to provide companies with the financing and other resources they need to fuel innovation and growth in order to create high-value, sustainable jobs in Pennsylvania.

Since its inception in 1983, BFTP has invested in more than 3,000 companies. Many companies in the BFTP portfolio were at the earliest stages of development when they first sought assistance—when fundraising is most critical and most difficult to obtain. BFTP has often been the first institutional investor for firms, providing seed capital for initial product development and commercialization efforts. The program provides funds to companies selected through a competitive process that carefully considers the firm’s potential for success and job creation.

In addition to providing direct financing, BFTP helps companies secure additional capital from other sources. The BFTP brand and endorsement often provide businesses with entrée to venture capital firms, other financial institutions and private angel investors. BFTP sponsors venture forums and the staff provides personal introductions to contacts within the investment and banking community. Often, BFTP has helped to establish new sources of capital to fill existing gaps in the market.

Adequate financing is a necessary and critical ingredient for company success, but it is not the only necessity. Successful firms also require robust business plans, talented management and thorough execution. Applying years of experience and a tremendous network of resources, BFTP staff work with portfolio companies to address critical business issues, anticipate future opportunities and needs and accelerate companies’ paths to success. BFTP staff often coach the management teams of portfolio companies, providing business advice and guidance. In addition, BFTP links firms with a variety of expert service providers, including university faculty, accountants, attorneys, technical experts, market researchers, management consultants and other business professionals.

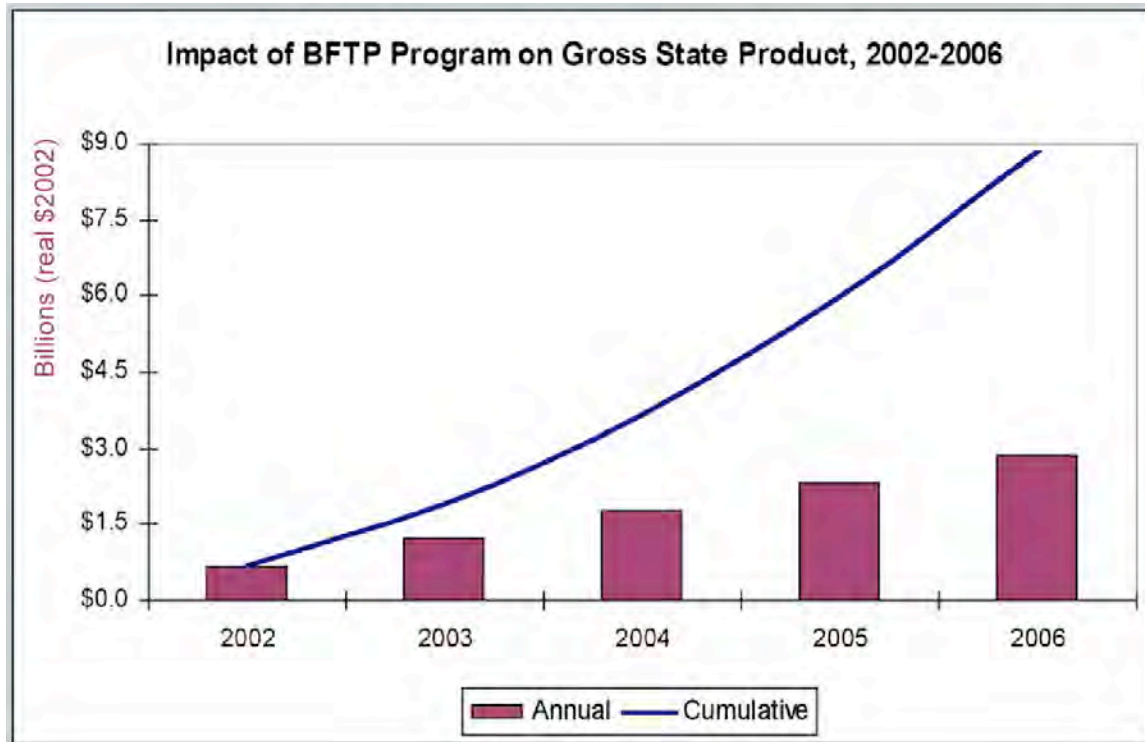
Companies and communities across the Commonwealth have experienced real benefits from the presence of and assistance provided by BFTP. Portfolio companies have developed new products, built management teams, established production capacity, identified new markets and achieved sales and profitability milestones. BFTP has significantly increased employment and income in the Commonwealth and expanded the state’s tax base.

**Ben Franklin Technology Partners remains a catalyst for technology-based entrepreneurship and technological innovation and a driver of economic growth.**

BFTP is among the most widely known and emulated state technology-based economic development programs, with a national and international reputation. BFTP provides capital and expertise to startups, early-stage and established companies and promotes the development of a statewide climate and infrastructure favorable to technology-based companies. In so doing, BFTP creates immediate economic gains while also building a foundation for continued economic growth.

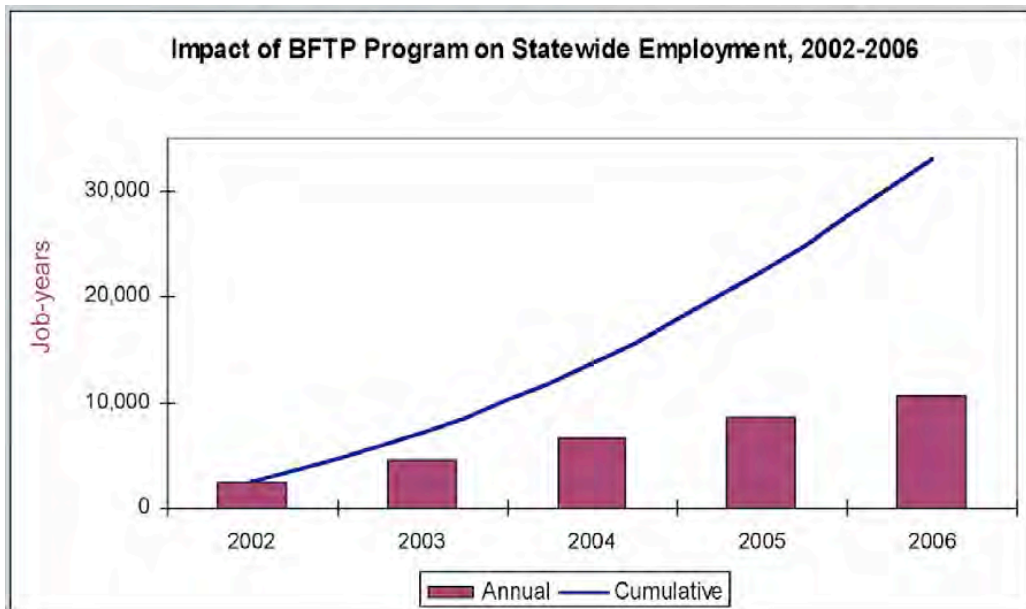
**BFTP-funded clients have created significant economic impact for the Commonwealth of Pennsylvania.**

- **BFTP boosted the Pennsylvania economy (Gross State Product) by \$9.3 billion from 2002 through 2006, or \$8.7 billion after adjusting for inflation.**



- Since 1989, BFTP has boosted the state's economy by more than \$17 billion.
- **From 2002 through 2006, the Commonwealth received more than \$517 million in additional state tax revenues as a direct result of BFTP. That represents a 3½-to-1 payback to the Commonwealth on its \$140 million investment during the same period.**

- From 2002 through 2006, BFTP clients employed, on average, five more people in each year following funding than they would have in the absence of BFTP investment.
- **From 2002 through 2006, BFTP generated 10,165 additional job-years\* in client firms. Those jobs are in industries that pay 33 percent more than the average salary in Pennsylvania.**
- Client impacts ripple throughout the Pennsylvania economy, contributing to higher Gross State Product and additional employment across the state. From 2002 through 2006, BFTP generated an additional 22,667 job-years in Pennsylvania beyond those in client firms. The result was that BFTP produced a total of 32,832 job-years in the Commonwealth between 2002 and 2006 that would otherwise not have existed.



- Since 1989, BFTP has generated 45,667 additional job-years in client firms.
- Since 1989, BFTP generated 80,160 additional job-years beyond those in client firms, for a total of 125,827 additional job years.

*\*Job-years are equivalent to the number of years of full-time work created by the program. For example, if a BFTP client firm employed three more workers for five years as a direct result of the program, that is expressed as 15 additional job-years.*

## Section One: Introduction

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***This study is intended to quantify the economic impact of the Ben Franklin Technology Partners (BFTP).***

***This report is divided into seven sections.*** Following this introduction, Section 2 reviews the mission of BFTP. Section 3 describes the types of companies in which BFTP invests. Section 4 presents an analysis of the impact of the program on BFTP clients during the period from 2002 to 2006, focusing on the degree to which BFTP clients have increased employment as a direct result of the assistance provided by BFTP. Section 5 presents an assessment of the impact of BFTP on the broader Pennsylvania economy over the period from 2002 to 2006. Section 6 describes the cumulative impact of BFTP since 1989. The final section summarizes the principal conclusions of the study. The Appendix provides a description of the methodology and data employed in the execution of this analysis.

In 1982, the Pennsylvania General Assembly established the Advanced Technology Centers of the Ben Franklin Partnership to promote technological innovation and spur economic growth in the Commonwealth. Since then, in a series of subsequent legislative acts, the organization took its present-day shape as the Ben Franklin Technology Partners. BFTP accomplishes its mission through a comprehensive set of activities, including investments in technology-based companies, provision of business and technical assistance, support of university-based centers of excellence, development of business incubators and research parks and the promotion of greater collaboration among businesses, academia and government.

Twice before, BFTP retained an independent, outside consultant to evaluate the economic impact of the program. With the arrival of the 25<sup>th</sup> anniversary since beginning operations in 1983, BFTP decided it was again appropriate to examine the impact of the organization on individual client companies and the overall economy of Pennsylvania. This evaluation addresses two interrelated areas of exploration:

- The impact that BFTP had on companies that received support.
- The impact that BFTP-funded client companies had on the economy of Pennsylvania.

As discussed in the sections that follow, this study is intended to provide empirical evidence about the program that addresses these areas.

Since its inception, BFTP has placed considerable attention on documenting its program impact. Along with other measures, that effort has centered on asking client companies to report the number of jobs that they created or retained as a result of receiving funding and/or services. Following guidelines approved by the Ben Franklin Technology Development Authority (BFTDA), participating companies are surveyed at regular annual intervals following BFTP investment for a period of up to five years.

To supplement client-reported impacts, this study compares the performance of BFTP clients directly to a control group of similar companies that did not receive BFTP assistance. Known as a quasi-experimental design, this approach enables program impacts to be isolated from other factors affecting company performance, including firm size, industry trends and general economic conditions in Pennsylvania. This comparative analysis provides a solid foundation for calculating the additional value added, employment and tax revenues in Pennsylvania that result from the program. This analysis examines the impact of BFTP's new client company investments between 2002 and 2006, and then considers the program's impact since 1989, the earliest year for which comprehensive data are available.

## Section Two: **Background**

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**The Ben Franklin Technology Partners (BFTP) was established to promote technological innovation and spur economic growth in the Commonwealth of Pennsylvania.** BFTP consists of four independent, nonprofit organizations established in different regions of the state:

- Ben Franklin Technology Partners of Central and Northern Pennsylvania (BFTP/CNP), based in University Park
- Ben Franklin Technology Partners of Northeastern Pennsylvania (BFTP/NEP), based in the Lehigh Valley
- Ben Franklin Technology Partners of Southeastern Pennsylvania (BFTP/SEP), based in Philadelphia
- Innovation Works, the Ben Franklin Technology Partner of Southwestern Pennsylvania (BFTP/IW), based in Pittsburgh

Together, these organizations' offices provide statewide coverage. BFTP undertakes a wide range of initiatives in areas related to their core mission and relevant to the needs of their respective regions. While subject to statutory requirements and BFTDA program guidelines, each of the independent organizations is responsible for setting its own strategic direction, defining specific activities and managing its own investment portfolio. The common goal of BFTP is to spur the growth of companies in technology-based sectors, leading to job creation and retention, and an increase in Gross State Product in Pennsylvania. BFTP accomplishes that goal through three major activities:

- 1. Financial investment.** Statewide, BFTP makes investments in technology-based companies, principally to help cover costs associated with commercialization activities. BFTP investments serve as a bridge between personal, friends and family funding and third-party capital. Financial investment activities include identifying potential investment opportunities, reviewing proposals, selecting promising projects and/or companies for investment, monitoring progress toward identified milestones and identifying opportunities for follow-on investment from outside investors.
- 2. Business and technical assistance.** BFTP also provides business and technical assistance to technology-based companies, spanning a wide range of services, from short-term technical problem-solving to ongoing business counseling over extended periods. Assistance may be provided by BFTP staff based on their own expertise and experience or through appropriate third-party service providers. The offices of BFTP draw on an extensive network of contacts within state and local economic development agencies, financial institutions, academic institutions and private consultants to provide needed services to clients.
- 3. Regional infrastructure building.** The offices of the BFTP organizations promote the development of the infrastructure needed to grow and sustain technology-based companies within their respective regions. Such efforts include the establishment or support of university-based centers of excellence, business incubators and research parks, venture capital funds, angel investor networks and other initiatives designed to address particular issues that may constrain the growth of technology-based companies.

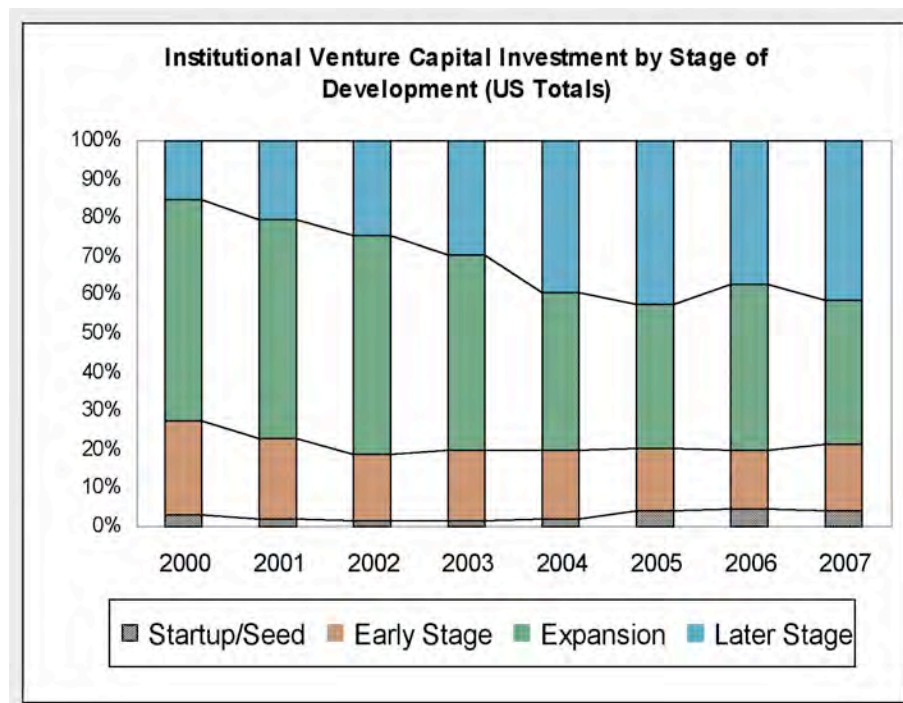


Changes in behavior and actions within firms are necessary ingredients for improved performance. BFTP expects that companies will modify their strategic and operating plans, make the necessary investments in R&D and capital equipment, upgrade worker skills and modify certain critical processes as a direct result of the assistance they receive. It is anticipated that such actions will yield a variety of performance improvements that, in turn, aid in increasing value added, sales and profitability. As a result, BFTP expects that growth in their clients' companies will produce broader economic benefits within the Commonwealth of Pennsylvania, including increased employment in high-wage jobs.

BFTP regional organizations have become a crucial part of the basic fabric of the business, academic and economic development communities in their coverage areas. Over the years, they have helped to identify specific needs within their respective regions and have launched various initiatives designed to promote innovation and the growth of technology-based businesses. BFTP has helped build and strengthen regional infrastructure and expand the financial, human and physical capital available to technology-based companies across the Commonwealth.

BFTP helps clients grow by providing them with capital as well as technical and business assistance. While BFTP involvement in various regional initiatives is significant, the bulk of organizational effort is focused principally on making investments in individual companies and providing related business and technical assistance. BFTP investment programs have been established in part to address the scarcity of seed financing provided by institutional investors to companies in Pennsylvania.

Although the amount of venture capital invested in the Commonwealth has grown significantly over the years, the share of venture capital allocated to seed investments by institutional investors has remained relatively low. In general, venture capital investing is heavily biased toward expansion and later-stage deals, rather than startup/seed and early-stage investments (as documented by the *MoneyTree Report*, a quarterly survey of venture capital investment activity produced in collaboration between PricewaterhouseCoopers and the National Venture Capital Association, based upon data from Thomson Financial).



Large institutional investors participate in the startup and early-stage markets less frequently, given their need to invest significant sums in a short period of time, to generate above-market rates of return, and the relatively high transaction costs and “hands on” management requirements (to enhance the chances of success) for early investments. While individual investors or angels are more likely than institutional investors to invest at the seed level, they tend to limit their investments to sectors that they know, and usually do not provide hands-on management counseling or other forms of business assistance. Thus, the BFTP regional organizations operate in the Commonwealth in a space that remains largely their own.

Each office’s staff conducts extensive outreach to ensure that companies in its region are aware of the program. BFTP staff meets with individual entrepreneurs and representatives of existing firms to review needs and discuss potential funding opportunities. If warranted, companies are encouraged to submit proposals. Funding awards are often provided in stages, corresponding to project milestones. Many companies are eligible for follow-on funding assuming satisfactory progress toward agreed-upon milestones.

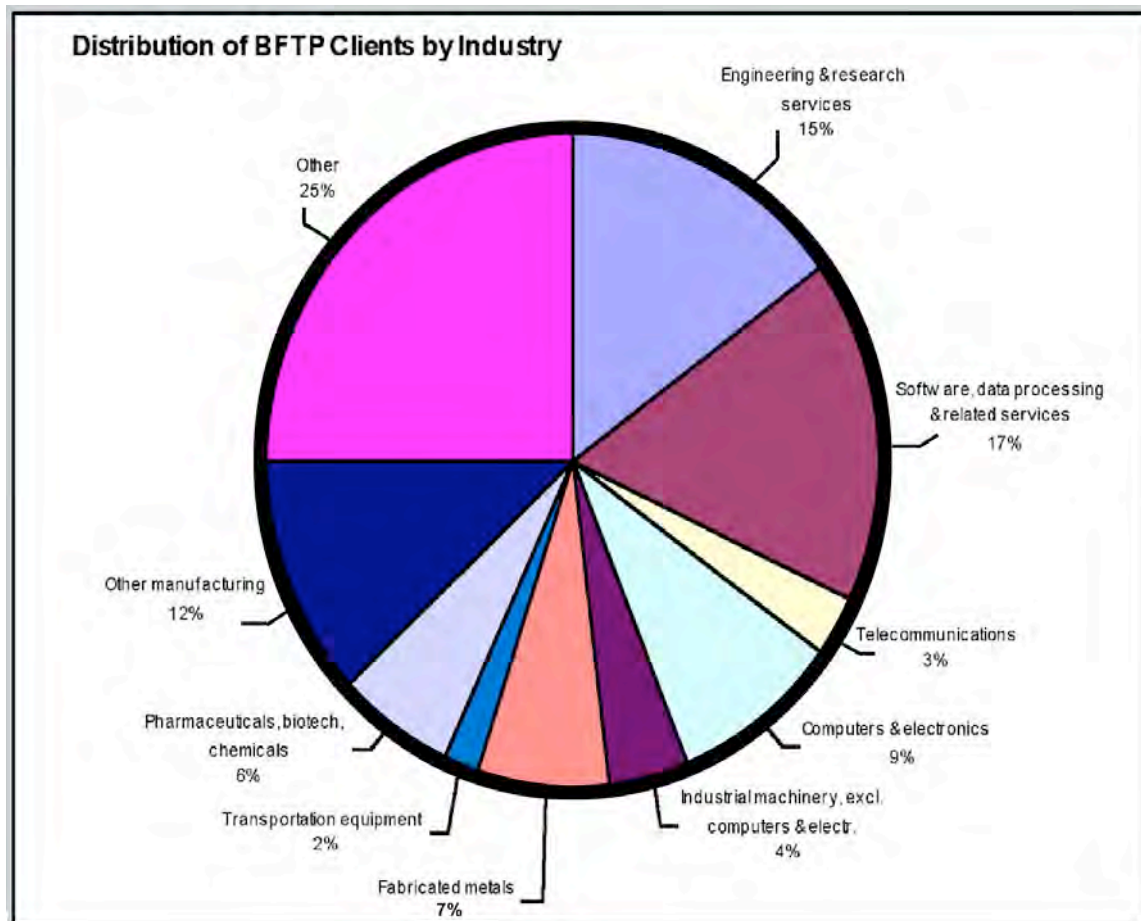
BFTP investments are made through a process that includes both staff and peer review, and considerable due diligence of the proposals that are submitted. While there is regional variation in the process, in most cases, third-party experts identified by the respective regional organization also review proposals submitted by applicants and assess the technical, business and commercial merits of proposed projects. Where necessary, companies are asked to clarify or further elaborate on different aspects of their proposals and, if necessary, to resubmit.

Companies are asked a series of questions concerning the objectives of the project, specific tasks and milestones, roles and responsibilities of participating organizations, qualifications of key personnel and expected results. Investments are made based on the recommendations of BFTP staff with input from the reviewers, subject to the availability of funds and final regional board approval. Regardless of funding decisions, all applicants are provided with feedback and recommendations regarding potential next steps.

## Section Three: Investment Portfolio, 2002-2006

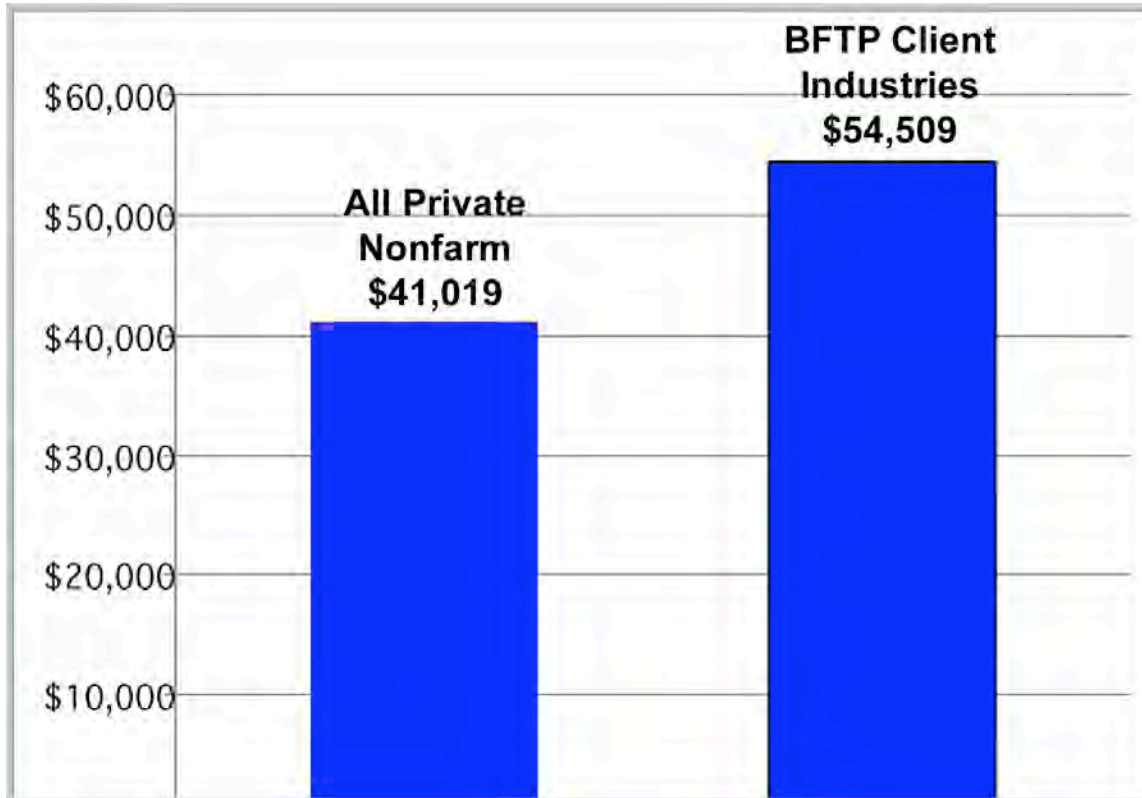
**BFTP works with individual entrepreneurs and early-stage and established companies in a wide range of technology-based industries.**

BFTP clients represent a wide range of industries, from computer software, hardware and telecommunications firms to a variety of fabricated metal and industrial machinery manufacturers to life sciences companies, including pharmaceutical manufacturers, biotech firms, instrumentation, robotics and medical device companies. These industries are technology-intensive in that they invest substantially in research and development, intellectual property, capital equipment and/or highly skilled labor. According to data maintained by the centers, BFTP invested in more than 500 companies and institutions between 2002 and 2006. While some funding has been provided to community colleges, universities and local economic development organizations for economic development infrastructure initiatives, the majority of funds went directly to entrepreneurs and early-stage and established companies.



BFTP clients are in industries that pay relatively high annual salaries and wages. Given the client industry profile of BFTP funded companies, the weighted-average annual salary for client industries is \$54,509, or 33 percent higher than the average for all private nonfarm industries in the Commonwealth.

***Average Annual Salaries in BFTP Client Industries and All Industries in Pennsylvania, 2006***



## Section Four: Program Impacts

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**To determine BFTP’s impact on funded client firms, the average change in the employment performance of participating companies was compared with the change in similar companies that did not receive assistance. To the extent that the two groups are similar, observed differences in performance can be attributed to the program intervention.**

Given the interests of stakeholders and the availability of data, the analysis was conducted on the impact of BFTP on employment within client firms. Using data from the Quarterly Census of Employment and Wages (QCEW), the analysis examined whether the number of employees in companies that received initial BFTP funding in 2002 or later grew more than similar, non-participating companies in the Commonwealth through 2006.

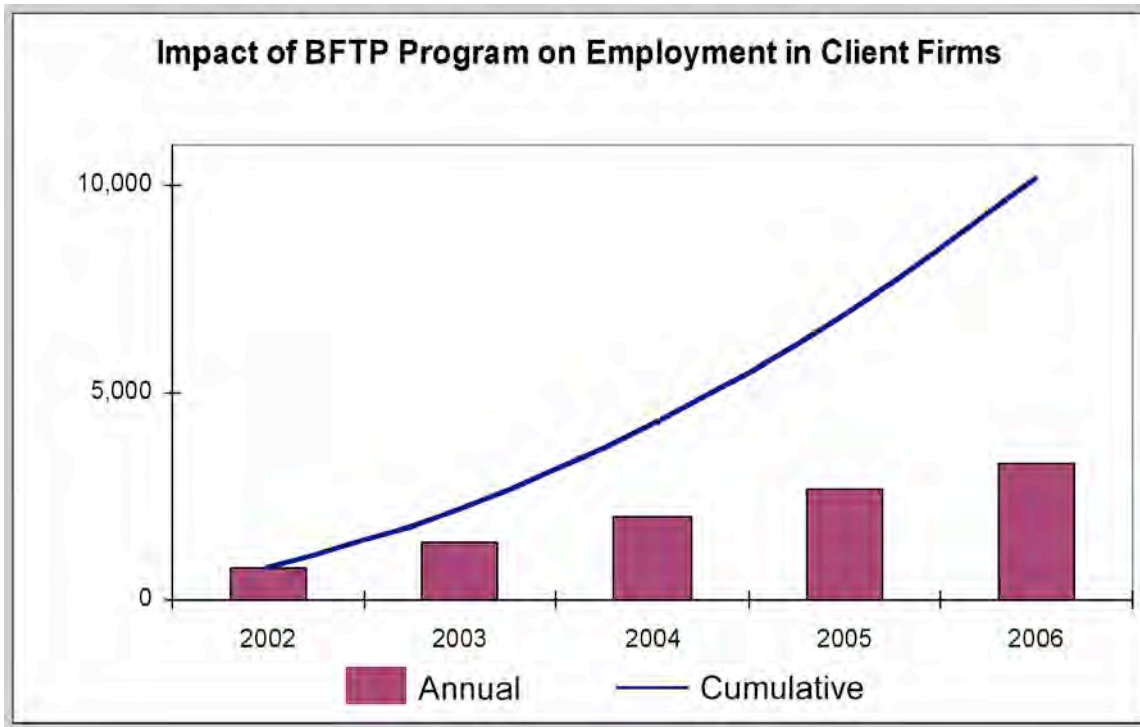
The issue of the validity of the comparison group is central to this type of evaluation design. Ideally, the comparison group should be similar to BFTP clients with respect to factors affecting changes in employment within firms. The only difference should be that BFTP invested in some companies and not in others. For this study, clients were individually “matched” with other companies in the same industry that had comparable employment in the year prior to BFTP funding. This is to ensure that the profile of the client group closely mirrored the matched comparison group. While the matching procedure was done very carefully, there is always the possibility that some differences exist between the two groups. As a result, statistical procedures were employed to further control for factors that may affect changes in employment within firms. Special attention was given to include variables to address potential selection bias and other unwanted differences between the two groups. The results demonstrate that BFTP has a direct, positive impact on employment within client firms. Using this quasi-experimental design, it was determined that:

**On average, during the period from 2002 through 2006, BFTP clients employed five more people in each year following funding than they would have in the absence of BFTP investment.**

Companies add and shed workers as a normal part of their business activities. Thus, it is important to consider the duration of jobs in assessing the impact of economic development programs. The best way to do this is to consider the employment impact of programs in terms of job-years, or the number of years of full-time work the program creates. For example, if a BFTP client firm employed three more workers for five years as a direct result of the program, that can be expressed as 15 additional job-years (three jobs times five years) that would not have existed in the absence of the program.

**In aggregate, BFTP generated 10,165 additional job-years in client firms between 2002 and 2006 as a result of new investment during the period.**

These are jobs held over time in client firms that would not have existed except for BFTP investment. Employment gains increase each year as new companies are added to the roster of BFTP clients and as existing clients continue to retain and create new jobs as a direct result of BFTP investments in earlier years. As a result, there were more jobs in BFTP-funded companies at the end of the period than the beginning.



| Impact of BFTP on Employment in Client Firms, 2002-2006 |                  |
|---|------------------|
| Additional job-years in client firms                    | 10,165 job-years |

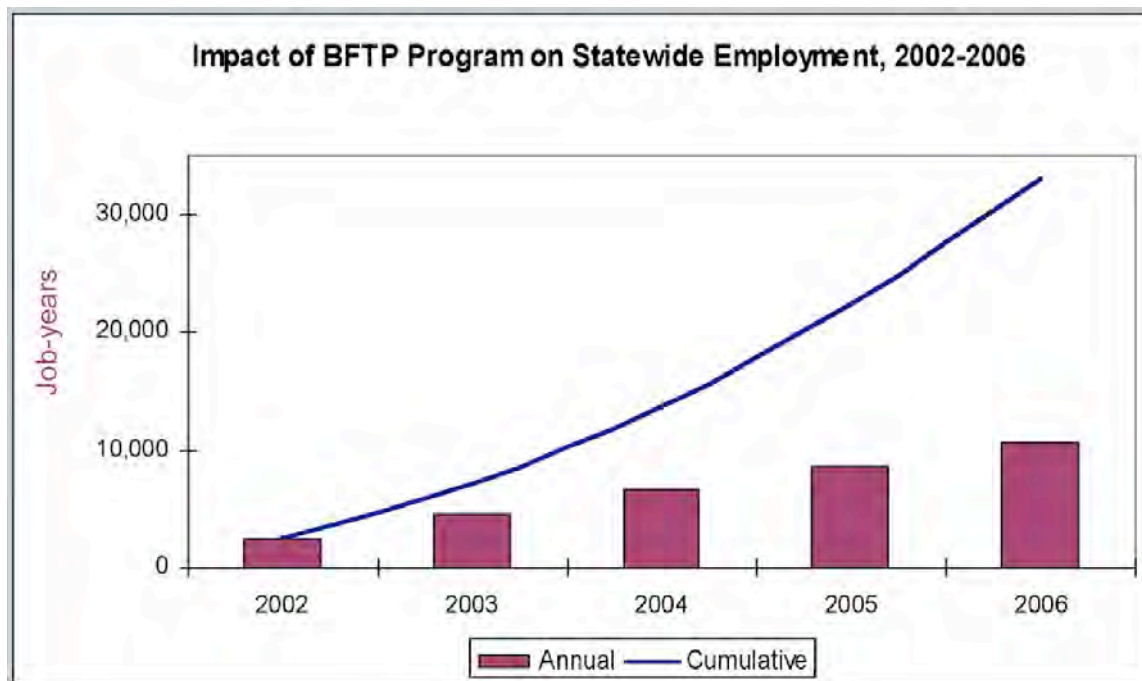
Finally, while the majority of BFTP clients added employees, fewer accounted for the bulk of net gains. The concentration of employment growth among a subset of firms is not surprising. History has shown that a relatively small percentage of firms and innovations achieve spectacular success, thus demonstrating the skewed nature of the returns to innovation and highlighting the risks of technological innovation and importance of maintaining a large investment portfolio.

## Section Five: Economic and Fiscal Impacts

The performance of BFTP clients has consequences for the broader Pennsylvania economy. Impacts on client firms ripple throughout the economy, giving rise to additional added value and employment across the state. The operation of BFTP client firms (“direct impact”) requires the purchase of goods and services from other firms, which, in turn, also purchase goods and services. Each additional round of spending (“indirect impact”) also generates income for employees associated with the respective firms; they, in turn, make purchases such as housing, food, clothing, entertainment and personal services (“induced impact”) to support their households. Lastly, all of the economic activity generated by BFTP investments affects state and local tax receipts in the Commonwealth. The direct, indirect and induced multiplier effects and fiscal (that is, tax) effects are calculated with the assistance of a macroeconomic model of the Commonwealth.

**BFTP generated a total of 32,832 additional job-years in Pennsylvania from client investments between 2002 and 2006.**

As noted in the previous section, BFTP generated 10,165 additional job-years in client firms between 2002 and 2006 as a result of new investment during the period. As these direct impacts rippled through the economy, an additional 22,667 job-years were generated in other companies and organizations across the state. A total of 32,832 job-years were created that would not otherwise have existed in Pennsylvania between 2002 and 2006 without the new investments made by BFTP in client firms during that period.

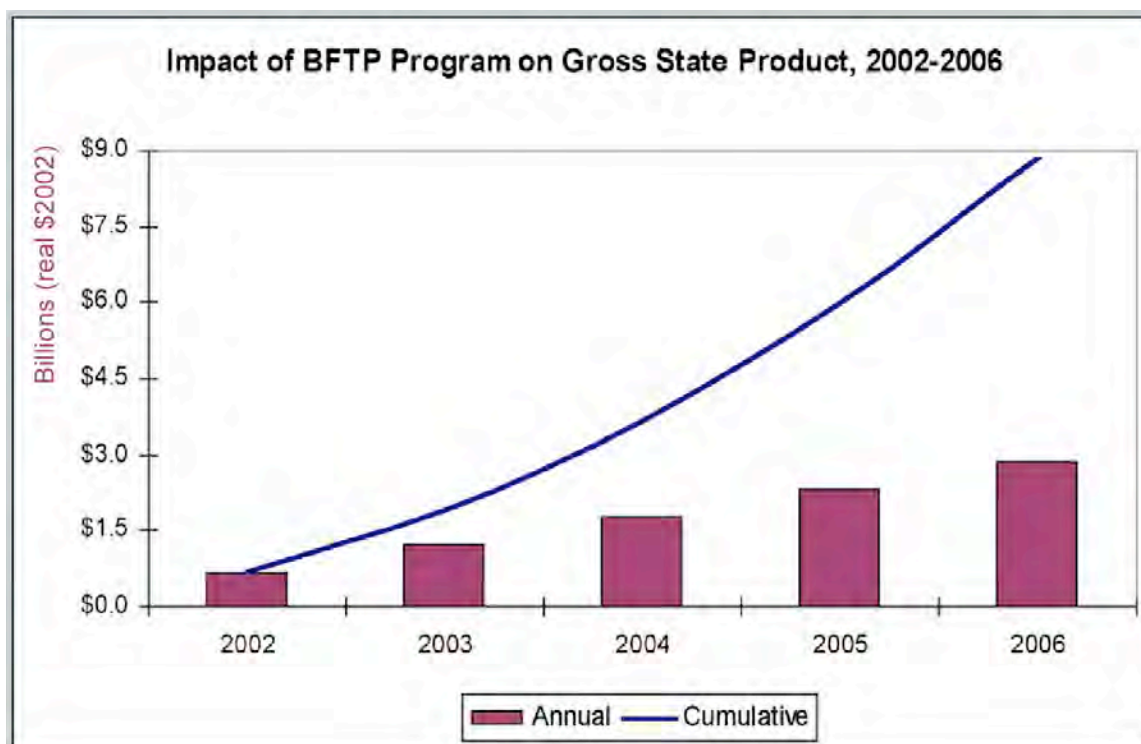


| Total Statewide Employment Impact of BFTP Program, 2002-2006 |                  |
|--|------------------|
| Total additional job-years in state                          | 32,832 job-years |

Gross State Product (GSP) is a measure of the total economic activity in the state. It is equal to the total output produced in Pennsylvania less the cost of intermediate goods and services. As a gauge of value added, GSP is roughly equivalent to employee compensation, business profits and other income in the state.

As a result of the direct impacts on clients and subsequent multiplier effects due to BFTP client-related investments made during the period, **BFTP boosted the Pennsylvania economy by \$9.3 billion between 2002 and 2006, equivalent to \$8.7 billion dollars on an inflation-adjusted basis.**

| Impact of BFTP Program on Gross State Product, 2002-2006 |               |
|--|---------------|
| Total additional GSP (nominal)                           | \$9.3 billion |
| Total additional GSP (real \$2002)                       | \$8.7 billion |



BFTP also had a positive impact on the state treasury during the period. The additional economic activity spawned by BFTP has an impact on the fiscal situation in Pennsylvania. Between 2002 and 2006, the state received \$517 million (\$490 million after adjusting for inflation) in additional state tax receipts as a direct result of BFTP client investments during the period.

| Fiscal Impact of BFTP Program, 2002-2006    |               |
|---|---------------|
| Additional state tax receipts               | \$517 million |
| Additional state tax receipts (real \$2002) | \$490 million |

**That represents a 3½-to-1 payback to the Commonwealth on its \$140 million investment during the same period.**



## Section Six: Cumulative Economic Impact, 1989-2006

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Given the interests of stakeholders and the availability of data, to this point the analysis and discussion has related to the recent period 2002 to 2006. The methodology was essentially the same as was utilized during two prior economic impact studies (i.e., October 1999 and March 2003). To review, the first study considered the period 1989 to 1996, and the next report extended the study period by including new data and analysis relating to the period 1997 through 2001. The analysis that follows relates to the cumulative period 1989 to 2006. The analysis was conducted separately from that relating to the recent period.

Based on additional analysis, **BFTP generated 45,667 additional job-years in client firms over the period since 1989.** These are jobs in client firms that would not have existed except for BFTP investment. Commonwealth employment gains increase each year as new companies are added to the roster of BFTP clients. As they mature, successful firms that received BFTP investments in earlier years “assimilate” into the macro economy, at which time other effects influence their behavior.

| <b>Impact of BFTP on Employment in Client Firms, 1989-2006</b> |                  |
|--|------------------|
| <b>Additional job-years in client firms</b>                    | 45,667 job-years |

In addition to the 45,667 additional job-years in client firms over the period, as those direct impacts rippled through the economy, an additional 80,160 job-years were generated in other companies and organizations across Pennsylvania. **The total of 125,827 job-years that were created would not have existed in the Commonwealth without the new investments made by BFTP in client firms since 1989.**

| <b>Total Statewide Employment Impact of BFTP Program, 1989-2006</b> |                   |
|---|-------------------|
| <b>Total additional job-years in state</b>                          | 125,827 job-years |

Gross State Product (GSP) measures total economic activity in the state, and is equal to the total output produced in Pennsylvania less the cost of intermediate goods and services. As a result of the direct impacts on clients and subsequent multiplier effects due to BFTP client-related investments, BFTP boosted the Pennsylvania economy by more than \$17 billion since 1989.

| <b>Impact of BFTP Program on Gross State Product, 1989-2006</b> |              |
|---|--------------|
| <b>Total additional GSP (nominal)</b>                           | \$17 billion |

## Section Seven: Conclusion

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BFTP was established to promote technological innovation, stimulate job growth and, thus, improve economic well-being in the Commonwealth. This evaluation demonstrates that companies across Pennsylvania have benefitted from the assistance provided by BFTP. Individually, portfolio companies have developed new products, built management teams, established production capacity, identified new markets and increased sales as a direct result of BFTP investment programs. Most important, these programs have generated substantial public benefits in terms of a significant increase in employment and income in Pennsylvania, along with an expansion of the state's tax base.

An analysis of economic impacts of the program for the years from 2002 to 2006, based on a quasi-experimental design that compares the performance of BFTP clients to a control group, demonstrates that BFTP is fulfilling its mission as summarized below:

### ***Current analysis, 2002-2006:***

- BFTP boosted the Pennsylvania economy by \$9.3 billion, or \$8.7 billion after adjusting for inflation.
- BFTP had a positive impact on the state treasury during the period. The Commonwealth received \$517 million in additional state tax receipts as a direct result of BFTP investment in client firms. That represents a 3½-to-1 payback to the Commonwealth on its \$140 million investment during the period.
- On average, BFTP clients employed five more people in each year following funding than they would have in the absence of BFTP investment.
- In aggregate, BFTP generated 10,165 additional job-years in client firms. These jobs are in industries that pay annual salaries 33 percent higher than the average salary in Pennsylvania as a whole.
- Client impacts rippled through the economy, giving rise to higher employment in the state. BFTP generated an additional 22,667 job-years in Pennsylvania beyond those in client firms, for a total of 32,832 additional job-years.

### ***Cumulative impact, 1989-2006:***

- Since 1989, BFTP generated 45,667 additional job-years in client firms.
- BFTP generated 80,160 additional job-years in Pennsylvania beyond those in client firms, for a total of 125,827 additional job-years since 1989.
- BFTP boosted the state economy by more than \$17 billion since 1989.

BFTP continues to be a catalyst for technology-based entrepreneurship and technological innovation and a driver of economic growth. BFTP is among the most widely known and emulated state technology-based economic development programs in the nation. By providing capital and expertise to startups and early-stage and established companies, and promoting the development of a statewide infrastructure favorable to technology-based companies, BFTP generates immediate economic gains while also building a foundation for continued economic growth.

## Technical Appendix

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The methodology used to obtain results for the period 2002 to 2006 consists of two basic parts:

- **Part One: Econometric Analysis**—Calculating Client Impacts
- **Part Two: Economic Modeling**—Calculating Macroeconomic Impacts

The first part of the study used regression techniques to calculate the impact of the program on employment growth within client firms. The second part of the analysis uses economic modeling techniques to calculate the macroeconomic effects resulting from those client impacts, along with further expenditures of BFTP funds and the taxes imposed in the state to fund the program. Each step of the process is discussed in more detail below.

### ***A.1 Econometric Analysis—Calculating Client Impacts***

Regression analysis is a statistical procedure that explains the degree to which the variation of a dependent variable—in this case, company-level employment—can be explained by the variation of one or more independent variables such as firm size, wage rates, industry trends, general economic conditions and—most important—whether a company was a client of BFTP or not. In short, the analysis provides the answer to the question: On average, have BFTP clients increased employment more than they would have in the absence of the program? The analysis focused on changes in employment, given the nature of the program, interests of stakeholders and the availability of data.

#### **Data sources: Data used in the analysis come from two sources:**

- **Administrative databases of the four regional Ben Franklin Technology Partners.** BFTP databases were used to establish a list of client companies as well as the year and amount of funding they received. This process identified 592 distinct companies in Pennsylvania that received funding between 2002 and 2006.
- **Labor Department’s Quarterly Census of Employment and Wages.** The Quarterly Census of Employment and Wages Program (QCEW)—also commonly called the ES-202 program—summarizes employment and wage data for workers covered by state unemployment insurance. It is a cooperative endeavor of the Bureau of Labor Statistics (BLS) and the Pennsylvania Department of Labor and Industry (with similar programs cooperatively administered by BLS and each state’s employment security agency). The program serves as a near census of monthly employment and quarterly wage information by 6-digit NAICS industry. Employers provide data to the program in the process of paying unemployment insurance compensation premiums. The QCEW database was first used to gather employment, NAICS and wage data on the list of BFTP clients and the companies that applied for but were denied funding. In total, 310 client companies were identified in the QCEW database. After the client group was profiled, a subsequent list of matching criteria was established, and the QCEW database was used as a source from which a similar non-client control group was drawn.

#### **Statistical Sampling—Creating a Comparison Group**

To create a comparison or control group, each client record was individually matched based on NAICS with similar non-clients in the QCEW database with the goal of finding non-client matches for each client in the BFTP portfolio. In addition, employment in the non-client company should be approximately the same as the client’s employment level just prior to funding. From these criteria, a stratified random sample of similar clients was obtained.

**Econometric Model and Calculation:**

The basic model used in the analysis is as follows:

$$\Delta EMP_{aft} = \alpha Constant + \beta_1 BFP + \beta_2 \Delta AWG_{aft} + \beta_3 WGINTR + \beta_4 EMP_{bef} + \beta_5 \Delta EMP_{bef} + \beta_6 GDP + \beta_7 IND + \varepsilon$$

Where:

- $\Delta EMP_{aft}$  is the average annual change in employment between the year of initial funding and 2006.
- $BFP$  is a dummy variable equal to one if the company received BFTP funding, otherwise equal to zero.
- $\Delta AWG_{aft}$  is the average change in average annual salaries between the year of initial funding and 2006.
- $WGINTR$  is an interaction term between  $\Delta AWG_{aft}$  and  $BFP$ .
- $EMP_{bef}$  is the level of employment in the year before initial funding.
- $\Delta EMP_{bef}$  is the average annual change in employment between 2001 (or date founded) and the year of initial funding.
- $GDP$  is the average annual change in U.S. gross domestic product between the year of initial funding and 2006.
- $IND$  is a series of dummy variables to account for fixed industry effects.
- $\varepsilon$  is an error term.

The calculated parameters of the model are as follows:

| <b>REGRESSION RESULTS</b>  |                                  |
|--|----------------------------------|
| <b>Dependent variable:</b>   | $\Delta EMP_{aft}$               |
| <b>Independent variables:</b>  |                                  |
| <b>BFP</b>   | 4.662 <sup>***</sup><br>(0.812)  |
| $\Delta AWG_{aft}$   | 0.182 <sup>***</sup><br>(0.032)  |
| <b>WGINTR</b>  | 0.006<br>(0.013)                 |
| $EMP_{bef}$  | -0.084 <sup>***</sup><br>(0.003) |
| $\Delta EMP_{bef}$   | 0.021 <sup>***</sup><br>(0.002)  |
| <b>GDP</b>   | -0.008<br>(0.014)                |
| <b>Constant</b>  | 4.641<br>(3.621)                 |
| <b>Adjusted R-squared</b>  | 0.346                            |
| Notes: Estimates using OLS. S.E. in parentheses. *** is significant at $\leq .001$<br>Dummy variables to account for industry fixed effects also included. |                                  |

As shown, the model is significant. The terms that measure the net impact of BFTP funding are the coefficients for the dummy variable *BFP* and for interaction term *WGINTR*. The coefficient of the interaction term shows no difference in the change in average annual salaries for BFTP clients or the control group. On average, BFTP client companies employed 4.7 more people per year between 2002 and 2006. Other coefficients were significant at  $p \leq .001$ , except for GDP, which was not statistically significant.

## ***A.2 Economic Modeling—Calculating Macroeconomic Impacts***

The coefficients derived through the regression analysis explained how many more employees per year the average BFTP client has than similar non-client companies. Thus, the additional job-years created each year during the study as a direct result of the program can be calculated by multiplying the coefficient by the number of BFTP participants in that year. The resulting additional job-years created as a direct result of the program can be said to be the client impacts due to BFTP activity during 2002 to 2006.

BFTP client impacts ripple through the economy, giving rise to additional gross state product and employment in the state. BFTP funding has an economic impact by creating demand and employment that would otherwise not exist in the Commonwealth, as documented by the regression analysis. The new employment creates a larger impact on the Pennsylvania economy through economic multipliers and the “multiplier effect.” Multipliers quantify the total impact within the Commonwealth of successive rounds of spending that occur as the direct BFTP investments and new employment generate new business for other firms and residents of the state, who then make additional purchases and generate additional rounds of economic activity.

The analysis of these multiplier effects is based on estimates derived from a regional economic model designed specifically for Pennsylvania and developed by the U.S. Department of Commerce Bureau of Economic Analysis (BEA). Known as the Regional Input-Output Modeling System (RIMS II) and in development since the 1970s, the model estimates the impact of spending by a given industry on a region—in this case, Pennsylvania—by taking into account the relationships among approximately 500 industries in the region, the region’s prevailing economic structure and trading patterns in the region. Within the defined region, the RIMS II model measures the extent to which an investment in one industry affects all other industries in that region and, ultimately, the region’s economy. Systematic analysis of economic impacts must account for the inter-industry relationships within regions because these relationships largely determine how regional economies respond to project and program changes. Thus, regional input-output (I-O) multipliers, which account for inter-industry relationships within regions, are useful tools for conducting regional economic impact analysis.

RIMS II is based on an accounting framework called an I-O table. For each industry, an I-O table shows the industrial distribution of inputs purchased and outputs sold. A typical I-O table in RIMS II is derived mainly from two data sources: BEA’s national I-O table, which shows the input and output structure of nearly 500 U.S. industries, and BEA’s regional economic accounts, which are used to adjust the national I-O table to show a region’s industrial structure and trading patterns.

### ***The RIMS II model allows for calculation of three economic impacts:***

1. Economic output—the value of goods and services produced in the state (GSP)
2. Employment—the number of jobs in the state
3. Employee earnings—wage and salary income associated with the affected jobs

Since the regression analysis indicates the average change in average annual salaries is similar for BFTP clients and unfunded companies, only results for output (GSP) and employment are discussed in this report.

Using the RIMS II model to calculate the economic impacts of BFTP is a multi-step process. The additional job-years created each year during the study are combined with RIMS II direct effect multiplier data to yield the change in employment per dollar of final demand. Next, the initial change in employment and the results of the first step are used to yield the change in final demand. In the last step, the change in final demand is combined with the final-demand output multiplier to yield the impact on output—in this case, GSP. BFTP adds new employment over multiple years, so the steps must be repeated, with appropriate linkages and inflation adjustments.

RIMS II multipliers have been used in a wide variety of studies to analyze the economic impact of projects and events on state and local areas. Users can be found inside government, the private sector and academia. A number of studies have compared RIMS II multipliers and analyses based on the RIMS II model with results from other economic models and have documented the accuracy of RIMS II.

### ***A.3 Calculating Cumulative Economic Impact***

In the first step, several projections of past study results were computed using historical data combined with sensitivity analysis to account for the difference in direct impact on BFTP client firms, as documented by earlier studies. The range of results between the upper- and lower-bound “baseline” were then compared with current period analysis of new BFTP impact based on results from the RIMS II model. Finally, the projections of historic data were adjusted, and RIMS II was used to incorporate new BFTP client investments not previously captured but documented in the current period analysis.

## About the Pennsylvania Economy League and the Economy League of Greater Philadelphia

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The Pennsylvania Economy League (PEL) has been a force for positive change since its founding in 1936. PEL is widely recognized and well regarded as a nonpartisan research organization committed to sound public policy that enhances the competitiveness of the Commonwealth. From its offices in Harrisburg, Philadelphia, Pittsburgh and Wilkes-Barre, PEL's professional staff and its regional and statewide civic leadership of more than 150 board members work in partnership with governmental, business and civic groups to develop consensus and action on programs and solutions to increase the effectiveness of state and local governments and improve Pennsylvania's economic competitiveness and quality of life.

The Economy League of Greater Philadelphia (ELGP) is an affiliate of PEL, founded in 1909. ELGP is an independent, nonprofit organization dedicated to research and analysis of the region's resources and challenges with the goal of promoting sound public policy and increasing the region's prosperity. ELGP changed its name from the Pennsylvania Economy League at the beginning of 2007 to more accurately reflect the reality of Greater Philadelphia's economy.

The Economy League of Greater Philadelphia convenes stakeholders, conducts research, incubates programs and projects and provides strategic consulting advice through collaborations with individuals and organizations in the private, public and nonprofit sectors. These efforts have focused on a wide scope of issues, ranging from early childhood education to regional transportation solutions, urban sprawl to technology commercialization.

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## Currency Note

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Unless otherwise indicated, all monetary values are stated in current dollars.



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