OFFICE OF ECONOMIC
& DEMOGRAPHIC RESEARCH

Economic Evaluation of CareerSource Florida's Training Programs

Evaluating the Return on Investment for the Quick Response Training and Incumbent Worker Training Programs

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Contents

EXECUTIVE SUMMARY

Background and Purpose

Legislation enacted in 2013 directs the Office of Economic and Demographic Research (EDR) and the Office of Program Policy Analysis and Government Accountability (OPPAGA) to analyze and evaluate 21 state economic development incentive programs on a recurring three-year schedule.[1] EDR is required to evaluate the economic benefits of each program, using project data from the most recent three-year period, and to provide an explanation of the model used in its analysis and the model's key assumptions. Economic Benefit is defined as "the direct, indirect, and induced gains in state revenues as a percentage of the state's investment" – which includes "state grants, tax exemptions, tax refunds, tax credits, and other state incentives."[2] EDR's evaluation also requires identification of jobs created, the increase or decrease in personal income, and the impact on state Gross Domestic Product (GDP) for each program. Typically, EDR calculates a return on investment in addition to reporting the impact on the key economic variables.

In this report, the following programs are under review:

- Quick Response Training Program – QRT; and
- Incumbent Worker Training Program – IWT.

The review period covers Fiscal Years 2014-15, 2015-16, and 2016-17.

EDR calculates the state's Return-on-Investment (ROI) as state revenues generated by a program, minus state investment in that program, all divided by the state's investment. Since the IWT grant program is entirely federally funded, there is no state investment from which to calculate a return on investment. For this analysis, the economic impact from the expenditure of the federal dollars is reported instead.

Overall Results and Conclusions

CareerSource Florida, Inc. (CSF) offers two training grant programs to qualified for-profit businesses. The QRT program provides match funding for customized, skills-based training while the IWT grants are used for training related to a significant upgrade in skills for existing full-time employees. These programs are designed to meet workforce needs of existing, expanding, and new businesses and to promote economic development in Florida. Individual trainees also benefit, as training may result in new (or retained) employment, acquisition of transferable skills, and increased earnings. The literature indicates that even absent the state or federal subsidy, businesses gain from the provided training above and beyond the increased wage costs caused by the greater skillset.

This analysis shows that the state's ROI for the QRT program is small, approximately 0.19, or a $0.19 return for every $1.00 invested. While this is slightly better than the ROI of 0.09 from the previous review of the program (2015), the program still does not break even. However, there is some evidence that the ROI would continue to increase over a period of time that is greater than the three-year window. No ROI can be calculated for the IWT program as it is fully federally funded; however, its economic impacts are generally smaller than the QRT program's because the total of IWT grant

[1] Section 288.0001, F.S.
[2] Section 288.005(1), F.S.

payments made in the review period was approximately ten times smaller than the total for QRT. The level of federal funding has dropped since the last report.

While the return associated with the QRT training program is relatively low, two points are worth noting. First, this analysis captures a single three-year period. Returns that would take decades to develop are not captured. In this regard, the long-term benefits to employees may have this feature. Second, a return on investment is a measure of financial returns and does not address issues of overall effectiveness or societal benefit. It is beneficial to the state to have a more productive and educated populous, even if the financial returns are initially minimal. Furthermore, the availability of these programs signals to the business community that the state is actively engaged in devising strategies and providing resources to meet their workforce training needs, and the EDR results indicate that the private sector is made overall better off by these grant programs. Collectively, these programs enhance the state's business climate and support state and local economic development efforts.[3]

Finally, a separate analysis was performed regarding the characteristics that make a productivity-focused training program more effective. Both the literature review and the results from a QRT and IWT data analysis suggest that the characteristics below would likely contribute to such a training program's effectiveness:

- provides grants for on-the-job training;
- has a focus towards workers with a low level of
    - education,
    - pre-training wage, and
    - age (however, not youths);
- returns a low level of grant per trainee; and
- targets industries in line with the explanations provided later in this report.

[3] Appendix One addresses a number of related issues including the general value of employee training programs.

OVERVIEW OF TRAINING PROGRAMS

CareerSource Florida
CareerSource Florida, Inc., is "a business-led statewide workforce investment board that provides policy oversight and designs strategies to address critical statewide workforce needs."[4] Organized under a public-private partnership, CSF is charged to:

> "…design and implement strategies that help Floridians enter, remain in, and advance in the workplace, so that they may become more highly skilled and successful, which benefits these Floridians, Florida businesses, and the entire state, and fosters the development of the state's business climate."[5]

The Quick Response Training and Incumbent Worker Training grant programs are two of CSF's strategies to address the workforce-skill needs of existing, expanding, and new businesses in Florida.

Quick Response Training
Section 288.046, Florida Statutes, provides the Legislative Intent for QRT:

> "The Legislature recognizes the importance of providing a skilled workforce for attracting new industries and retaining and expanding existing businesses and industries in this state. It is the intent of the Legislature that a program exist to meet the short-term, immediate, workforce-skill needs of such businesses and industries. It is further the intent of the Legislature that funds […] be expended on businesses and industries that support the state's economic development goals, particularly high value-added businesses or businesses that locate in and provide jobs in the state's distressed urban and rural areas, and that instruction […] lead to permanent, quality employment opportunities."

Further, Section 288.047(2), Florida Statutes, requires that CSF ensure that QRT funded instruction:

> "promotes economic development by providing specialized training to new workers or retraining for current employees to meet changing skill requirements caused by new technology or new product lines and to prevent potential layoffs."

Quick Response Training (QRT) is a state-funded grant program that provides funding for customized training to new or expanding businesses in Florida's targeted industries. The total amount appropriated to the QRT program in FY 2014-15, FY 2015-16, and FY 2016-17 was $12.1 million, $12.1 million, and $12 million, respectively.[6] In total ($36.2 million), this is a 51% increase in funding over the prior review period.

The description of the QRT program below reflects the program guidelines from FY 2014-15 to FY 2016-17.

In order to qualify for funding, a business must meet the following criteria:

[4] http://careersourceflorida.com/about-careersource-florida/ Last accessed 8/27/15. For an overview of Florida's Workforce system, see EDR's Economic Evaluation of CareerSource Florida's Training Programs (2015), pages 5-10.
[5] Section 445.004(2), F.S.
[6] Appropriated amount by fiscal year may not match the amounts expended by fiscal year.

- It must be a "for profit" business;
- It must create permanent, full-time jobs for Florida workers.[7] The jobs must meet the following criteria:
    - They must require training of 12 months or less, not available at the local level; [8]
    - They must be in one of the qualified targeted industries; and
    - On average, they must pay an annual wage of at least 125% of the local or state private sector wages (whichever is lower),[9] unless the business is located in a distressed community or Brownfield area.
- It must produce an exportable (beyond regional markets) good or service; and
- It must demonstrate "financial viability."

Priority will be given to a business that meets following criteria:

- It applied for the grant relatively early;
- It would create jobs located in distressed communities or Brownfield areas;
- The training has a great potential for an economic impact; or
- It commits cash or in-kind contributions to its training program.

If a business's application is successful, then CareerSource Florida will determine an approved per-trainee reimbursement amount based upon the business's industry, wages, location, and reimbursable training expenses. These expenses typically include instructors' wages, curriculum development, textbooks, online training, and domestic travel for trainers or trainees. They may not include trainees' wages.

The business pays for the training, and it is reimbursed upon submission of the required documentation. The documentation must be submitted within 60 days after the end of the training period. The actual reimbursement amount is calculated based on the number of new hires or retained employees that have completed training and the approved amount per trainee.

Incumbent Worker Training

Section 445.003(3)(a)3., Florida Statutes, establishes the IWT Program and provides "grant funding for continuing education and training of incumbent employees at existing Florida businesses."

Incumbent Worker Training (IWT) is a federally funded grant program that provides funding for 12-month training of incumbent workers at existing Florida businesses. The amount appropriated to the IWT program in each of the 2014-15, 2015-16, and 2016-17 fiscal years was $3 million. The maximum

[7] Section 288.047(2), F.S., stipulates the QRT funds "may not be expended in connection with the relocation of a business from one community to another unless CareerSource Florida determines that, in the absence of such relocation, the business will move outside this state or that the business has a compelling economic rationale for the relocation which creates additional jobs."

[8] In FY 2014-15 and FY 2015-16, for businesses creating 25 or fewer jobs, the contract length was up to 12 months, and for businesses creating 26 or more jobs, the contract length was up to 24 months. In FY 2016-17, the contract length was up to 12 months for all businesses.

[9] In FY 2014-15 and FY 2015-16, the requirement was that they must pay an annual wage of at least 115% of the local or state private sector wages. In FY 2016-17, the value was increased to 125%.

funding that can be awarded to any one business was $50,000 in FY 2014-15 and $30,000 in FY 2015-16 and FY 2016-17.

The description of the IWT program below reflects the program guidelines from FY 2014-15 to FY 2016-17.

In order to qualify for funding, a business must meet the following criteria:

- It must be a "for profit" business;
- It must have been in operation for at least one year prior to its application date;
- It must have at least one full-time employee;
- It must not have received the grant in the previous or current program year;[10] and
- It must demonstrate "financial viability."

Priority will be given to a business that meets the following criteria:

- It has fewer than 50 employees;[11]
- It is in one of the qualified targeted industries;
- The training would significantly improve employee skills;
- The training would be for individuals with barriers to employment;[12]
- The training would avoid layoffs.

A business can have up to 50% of its training costs reimbursed. That value is increased to 75% for a business that meets the following criteria:

- It has fewer than 50 employees;[13] and
- It is in a rural area, distressed area, Brownfield area, or HUB zone.

If a business's application is successful, then it will be notified of the approved grant amount and the date that training can commence. Training costs that are reimbursable include tuition costs, instructors' wages, textbooks, and curriculum development. They may not include trainees' wages, capital improvements, or costs incurred before the start of the contract.

Approved budget items are reimbursed upon presentation of documentation of the training and evidence that the training expenses (incurred within the 12-month training period) have been paid. The percent of funds reimbursed will always be equal to or less than the percent of total trainees that have been trained to date.

[10] In FY 2015-16, this criteria was that the business must not have received the grant in the previous 2 program years or the current program year.
[11] This criteria for priority was not in effect in FY 2014-15 or in FY 2015-16.
[12] This criteria for priority was not in effect in FY 2014-15 or in FY 2015-16.
[13] In FY 2014-15 and FY 2015-16, this criteria was that businesses have fewer than 25 employees. In FY 2016-17, the value was increased to 50 employees.

ECONOMIC EVALUATION OF THE STATE AND FEDERAL INVESTMENT IN THE QRT AND IWT GRANT PROGRAMS

Purpose

EDR is tasked with evaluating the economic benefits of the QRT and IWT programs. Economic Benefit is defined as "the direct, indirect, and induced gains in state revenues as a percentage of the state's investment" – which includes "state grants, tax exemptions, tax refunds, tax credits, and other state incentives."[14] In this report, the term Return-on-Investment (ROI) is synonymous with economic benefit, and is used in lieu of the statutory term. This measure does not address issues of overall effectiveness or societal benefit; instead, it focuses on tangible financial gains or losses to state revenues, and is ultimately conditioned by the state's tax policy.

EDR used the Statewide Model to estimate the ROI for the QRT grant program and the economic activity generated by the federally funded IWT grant program. The Statewide Model is a dynamic computable general equilibrium (CGE) model that simulates Florida's economy and government finances.[15] The Statewide Model is enhanced and adjusted each year to reliably and accurately model Florida's economy. These enhancements include updating the base year the model uses as well as adjustments to how the model estimates tax collections and distributions.

Among other things, it captures the indirect and induced economic activity resulting from the direct project effects. This is accomplished by using large amounts of data specific to the Florida economy and fiscal structure. Mathematical equations[16] are used to account for the relationships (linkages and interactions) between the various economic agents, as well as likely responses by businesses and households to changes in the economy.[17] The model also has the ability to estimate the impact of economic changes on state revenue collections and state expenditures in order to maintain a balanced budget by fiscal year.

When using the Statewide Model to evaluate economic programs, the model is "shocked"[18] using static analysis to develop the initial or direct effects attributable to the projects funded by the incentives. In this analysis, direct effects are essentially the changes experienced by the businesses receiving the grants. The combined annual direct effects ("shocks") took the form of:

- For the QRT program, removal of the grant payments from the state budget, with a corresponding award to businesses as subsidies to production.

[14] Section 288.0001, F.S.

[15] The statewide economic model was developed using GEMPACK software with the assistance of the Centre of Policy Studies (CoPS) at Victoria University (Melbourne, Australia).

[16] These equations represent the behavioral responses to economic stimuli – to changes in economic variables.

[17] The business reactions simulate the supply-side responses to the new activity (e.g., changes in investment and the demand for labor).

[18] In economics, a shock typically refers to an unexpected or unpredictable event that affects the economy, either positive or negative. In this regard, a shock refers to some action that affects the current equilibrium or baseline path of the economy. It can be something that affects demand, such as a shift in the export demand equation; or, it could be something that affects the price of a commodity or factor of production, such as a change in tax rates. In the current analyses, a shock is introduced to remove the impact of the incentive on the economy.

- For the IWT program, receipt of the federal funds from outside the state, essentially a "helicopter drop" that expands the economy through business subsidies to production.
- Increased outputs based on trainee wage appreciation attributed to the project.

The model is then used to estimate the additional—indirect and induced—economic effects generated by the projects, as well as the supply-side responses to the new activity, where the supply-side responses are changes in investment and the demand for labor arising from the new activity. Indirect effects are the changes in employment, income, and output by local supplier industries that provide goods and services to support the direct economic activity. Induced effects are the changes in spending by households whose income is affected by the direct and indirect activity.

All of these effects can be measured by changes (relative to the baseline) in the following outcomes:

- State government revenues and expenditures
- Jobs
- Personal income
- Florida Gross Domestic Product
- Gross output
- Household consumption
- Investment
- Population

EDR's calculation of the Return-on-Investment uses the model's estimate of net state revenues and expenditures. Other required measures for this report include the number of jobs created, the increase or decrease in personal income, and the impact on gross domestic product, all of which are included in the model results.

Explanation of Return-on-Investment
The ROI is developed by summing state revenues generated by a program less state expenditures invested in the program, and dividing that calculation by the state's investment. It is most often used when a project is to be evaluated strictly on a monetary basis, and externalities and social costs and benefits—to the extent they exist—are excluded from the evaluation. The basic formula is:

$$\frac{\text{(Increase in State Revenue – State Investment)}}{\text{State Investment}}$$

Since EDR's Statewide Model is used to develop these computations and to model the induced and indirect effects, EDR is able to simultaneously generate State Revenue and State Investment from the model so all feedback effects mirror reality. The result (a net number) is used in the final ROI calculation.

As used by EDR for this analysis, the returns can be categorized as follows:

- **Greater Than One (>1.0)**…the program more than breaks even; the return to the state produces more revenues than the total cost of the investment.

- **Equal To One (=1.0)**…the program breaks even; the return to the state in additional revenues equals the total cost of the investment.
- **Less Than One, But Positive (+, <1)**…the program does not break even; however, the state generates enough revenues to recover a portion of its cost of the investment.
- **Less Than Zero (-, <0)**…the program does not recover any portion of the investment cost, and state revenues are less than they would have been in the absence of the program, typically because taxable activity is shifted to non-taxable activity.

The numerical ROI can be interpreted as return in tax revenues for each dollar spent by the state. For example, a ROI of 2.5 means that $2.50 in tax revenues is received back from each dollar spent by the state.

The basic formula for ROI is always calculated in the same manner, but the inputs used in the calculation can differ depending on the needs of the investor. Florida law requires the return to be measured from the state's perspective as the investor, in the form of state tax revenues. In this regard, the ROI is ultimately shaped by the state's tax code.

Description of the Data

CareerSource Florida, Inc. (CSF) and the Florida Education and Training Placement Information Program (FETPIP) provided EDR with datasets detailing the grant contracts and the trainees' labor histories, respectively.

The Florida Department of Education describes FETPIP as:

> "… a data collection and consumer reporting system … to provide follow-up data on former students and program participants who have graduated, exited or completed a public education or training program within the State of Florida … All elements of Florida's workforce development system [are required] to use information provided through FETPIP … This information is part of the performance accountability processes for all parts of the K-20 system and serves as an indicator of student achievement and program needs."[19]

FETPIP links individual identifiable data (social security numbers) from several different administrative databases to track earnings, continuing education, and related outcomes.

In the CSF dataset, each observation contains the following information:

- the contract identification number;
- the name of the business;
- the business's FEIN;
- the business's primary NAICS code;
- whether the grant was a QRT or IWT grant;
- the date the grant was awarded;
- the date training started;
- the date training was completed;
- the amount of grant funds spent; and

[19] http://www.fldoe.org/accountability/fl-edu-training-placement-info-program last accessed November 27, 2018.

- the amount of money that the business estimated (at the time of application) that it would spend on the proposed training.

In the FETPIP dataset, each observation contains the following information:

- the trainee's identification number;
- his birth year (however, this information is often missing);
- his employer's name, FEIN, and NAICS code;
- the year and quarter;
- his wages earned;
- "Program"; and
- "Fiscal Year."

The final two variables require an explanation. If a trainee was trained as part of a QRT grant contract that was awarded in FY 2011-12 and also trained as part of an IWT grant contract that was awarded in FY 2014-15, then his "Program" and "Fiscal Year" should read "QRT, IWT" and "FY 2011-12, FY 2014-15" respectively.[20]

Shocks to the Statewide Model: Calculating CSF Grant Payments

Below is a description of the method for using the CSF dataset to calculate the grant payment shocks used in the statewide model for the QRT simulation. The method for IWT is almost identical but with obvious changes.

The method is as follows:

1. Filter the CSF dataset to only include those contracts with some QRT funded training within the three-year review period.
2. For each contract, for each fiscal year within the three-year review period, find the fraction of the training that took place within that fiscal year and multiply that fraction by the grant funds spent on that contract.
3. Within each of the fiscal years, sum the values from the previous step. The resulting values are the total grant funds spent on training in each of the fiscal years in the three-year review period.

Table 1 displays the results of the method. It also displays what the results of the method would be if, for each contract, the number of trainees is used instead of grant funds spent.

[20] These two variables, however, very often contain values that are inconsistent with the CSF dataset despite the fact that the information in these variables are sent to FETPIP by CSF. In particular, trainees often have too many programs and fiscal years in their "Program" and "Fiscal Year" variables, which makes it difficult to determine which trainees were trained multiple times and which ones simply appear to have been trained multiple times due to poor recordkeeping.

Table 1. Estimated Employees Trained and QRT and IWT Grant Payments

	FY 14-15	FY 15-16	FY 16-17	Total
Total Trained (QRT)	8,371	8,880	6,751	24,002
Total Trained (IWT)	3,871	2,892	1,665	8,429
State Payments (QRT)	$10,411,321	$13,858,308	$13,088,010	$37,357,640
Federal Payments (IWT)	$1,401,881	$1,243,762	$903,909	$3,549,552

Shock to the Statewide Model: Calculating Productivity Growth

Below is a brief description of the method for using the datasets to calculate the productivity shocks used in the statewide model for the QRT simulation. A more detailed description of the method is in Appendix Two. The method for IWT is almost identical but with obvious changes.

The method is as follows:

1. Filter the CSF dataset to only include those contracts with some QRT-funded training within the three-year review period.
2. Assign each contract an "f-grant" equal to the fraction that the grant funds were of the total spending on the training. Also, assign each contract an "f-window" equal to the fraction of the training that was after the start of the three year review period.
3. Attempt to match each trainee with the first QRT contract that he was trained under.[21] Drop unmatched trainees.
4. Assign each trainee the training start date, f-grant, and f-window of the contract to which he was matched.
5. Find each trainee's median pre-training quarterly wage growth rate (MPQWGR).[22]
6. For each trainee, find a set of similar trainees (i.e. trainee with the same mode two-digit NAICS code, a similar age, and a similar pre-training average wage). **Note**: Another important way that the trainees are similar is that they are all the type of person who qualifies for QRT funded training.
7. Assign to each trainee a "CQWGR" equal to the average MPQWGR among the trainees in his set of similar trainees. CQWGR stands for "counterfactual quarterly wage growth rate."
8. For each trainee, for each quarter that he has non-zero wages after his training has started, find the difference between his sum of wages earned and what his sum of wages would have been if his pre-training average quarterly wage had grown at the rate of his CQWGR. The difference is his wage growth that quarter due to training.
9. Multiply each trainee's wage growth each quarter by his f-grant and his f-window to obtain his wage growth that quarter due to grant payments made within the three-year review period.[23]

[21] The decision to match each trainee only with the first QRT contract that he was trained under is due to the limitations of the data mentioned in the previous footnote.

[22] Anywhere in the method that a value for a "pre-training" variable is calculated for a trainee, the data for the year prior to his training start quarter is excluded, if possible. The purpose is to avoid the Ashenfelter dip. See Ashenfelter (1978), Heckman, Lalonde, and Smith (1999), Heckman and Smith (1999), Kambourov, Manovskii, and Plesca (2010), Andersson et al. (2016), and Barnow and Smith (2015).

[23] For a discussion of proportional attribution, see EDR's Economic Evaluation for Select State Economic Development Incentive Programs (2017), pages 44-46.

10. Translate NAICS codes in the FETPIP dataset to CGE codes (i.e. the industry codes used in the statewide model) and find each trainee's mode industry for each fiscal year within the review period.
11. For each trainee, for each quarter, allocate his wage growth due to grant payments made within the three-year review period to his mode industry in the fiscal year containing that quarter.
12. When the wage shocks are put into the model, the percentage change in an industry's overall wages in a fiscal year is set equal to the percentage change in its overall productivity that fiscal year. However, the consensus from the literature review is that the percentage increase in a worker's wage, due to training, is roughly half of the percentage increase in his productivity due to training.[24] Therefore, the last step before inputting the wage shocks into the model is to multiply them by two.

Table 2 displays the results of the method at the end of step nine, except that each trainee's wage growth is multiplied by his f-window but not his f-grant. Recall that f-grant is a variable that each trainee inherits from the contract that he was trained under and it is equal to the fraction that the grant funds were of the total spending on the training.

Table 2. Total Wage Growth of QRT and IWT Trainees Attributable to QRT and IWT Training Within the Three-Year Review Period

	FY 14-15	FY 15-16	FY 16-17	Total
Wage Growth (QRT)	$22,249,875	$69,023,110	$122,830,537	$214,103,522
Wage Growth (IWT)	$13,144,490	$12,636,365	$23,556,081	$49,336,936

Table 3 displays the results of the method at the end of step nine. Notice that, in Table 2, each trainee's wage growth was not multiplied by his f-grant whereas in Table 3 it was. Therefore, Table 2 captures wage growth attributable to the training whereas Table 3 captures wage growth attributable to the grant payments themselves.

Table 3. Wage Growth of QRT and IWT Trainees Attributable to Grant Payments Within the Three-Year Review Period

	FY 14-15	FY 15-16	FY 16-17	Total
Wage Growth (QRT)	$3,268,564	$14,676,301	$24,460,758	$42,405,623
Wage Growth (IWT)	$2,041,072	$1,169,235	$3,604,314	$6,814,621

Key Assumptions

The following key assumptions are used in the Statewide Model to determine the economic benefits of the QRT and IWT programs. Some of the assumptions are used to resolve ambiguities in the literature, while others conform to the protocols and procedures adopted for the Statewide Model.

[24] See Barron et al. (1989), Dearden et al. (2005), Ballot et al. (2006), Colombo and Stanca (2008), and Konings and Vanormelingen (2010).

- Funding of the IWT program is strictly federal, thus there is no state investment for a return to be evaluated upon.
- The effect of each grant was to increase the total spending on each business's proposed training by the amount of the grant.
- The effect of increasing the total spending on a business's proposed training by X% was to increase, each quarter, the total wage growth due to the proposed training by X%.
- The size and purpose of the grants are not conducive to capital investment. As such, any concurrent capital investments of businesses receiving QRT or IWT grants are not considered to be attributable to the state or federal investment.
- Other state and local economic incentives are not attributed any of the training or wage growth that occurs as a result of the QRT and IWT programs.
- Training completion occurs and grant payments are made at a uniform rate over the timeframe of the training.
- Absent the training, an individual who was trained through QRT or IWT would have experienced wage growth equal to his counterfactual quarterly wage growth rate.
- The percentage increase in a worker's wage, due to training, is exactly half of the percentage increase in his productivity due to training.

Results

With the direct benefit and direct cost to the state determined, the state's Return-on-Investment from the QRT program and the economic activity generated by the IWT program are evaluated using EDR's Statewide Economic Model. It is calculated that, for every dollar spent by the state of Florida on QRT in Fiscal Years 2014-15, 2015-16, and 2016-17, $0.19 of tax revenue was generated, or an ROI of 0.19. Additional economic impacts of the wage growth generated due to the state's investment in QRT over the three-year period are shown in Table 4. A guide to interpreting these indicators can be found in Appendix Three.

Table 4. Economic Impact of the Quick Response Training Program

		14-15	15-16	16-17	Total
State Payments in the Window	Nominal $ (M)	10.4	13.9	13.1	**37.4**
Total Net State Revenues	Nominal $ (M)	1.9	2.7	2.6	**7.2**
Return-on-Investment by Year		0.19	0.2	0.2	
Return-on-Investment for the 3 year period					**0.19**

		14-15	15-16	16-17	Total		Average per Year
Personal Income	Nominal $ (M)	22.2	29.6	26.6	**78.4**		**26.1**
Real Disposable Personal Income	Fixed 2010-11 $ (M)	18.1	24.3	21.4	**63.9**		**21.3**
Real Gross Domestic Product	Fixed 2010-11 $ (M)	28.2	43.6	45.2	**117.0**		**39.0**
Consumption by Households and Government	Fixed 2010-11 $ (M)	15.6	21.1	18.9	**55.6**		**18.5**
Real Output	Fixed 2010-11 $ (M)	45.7	70.9	72.9	**189.5**		**63.2**

		14-15	15-16	16-17	Minimum	Maximum	Average per Year
Total Employment	Jobs	109	115	115	109	115	**113**
Population	Persons	38	102	166	38	166	**102**

The ROI for QRT over the three-year review period is 0.19. The ROI from EDR's previous review of the program was 0.09. The increase from 0.09 to 0.19 (approximately double) is what one would expect when (a) the total state payments increased from $17.4m to $37.4m (approximately double), and (b) the total impact on real output increased from $51.4m to $189.5 (approximately quadruple). However, the sum of wage shocks only increased by a factor of 2.42. One partial explanation for the relatively large increase in the total impact on real output could be that the wage shocks were more evenly distributed over industries, which allows the economy to grow more quickly given household preferences and each industry's pre-review period capital stock. For example, the wholesale industry, which had the greatest wage shocks in both the previous report and this one, had 41% of the sum of wage shocks in the previous report but only 28% in this one. Another partial explanation could be that the industries with increased shares of the wage shocks have higher output-wage ratios than those with decreased shares of the wage shocks. For example, the paper industry's share increased by fifteen percentage points, and its 2014-15 output-wage ratio is roughly twice that of the wholesale industry.

For the IWT program, no ROI can be calculated since the funding is entirely federal. Economic impacts of the wage growth generated due to the federal investment in IWT over the three-year period are shown in Table 5. Again, a guide to interpreting these indicators can be found in Appendix Three.

Table 5. Economic Impact of the Incumbent Worker Training Program

		14-15	15-16	16-17	Total
State Payments in the Window	Nominal $ (M)	0.0	0.0	0.0	**0.0**
Total Net State Revenues	Nominal $ (M)	0.2	0.4	0.3	**0.9**
Return-on-Investment by Year		N/A	N/A	N/A	
Return-on-Investment for the 3 year period					**N/A**

		14-15	15-16	16-17	Total		Average per Year
Personal Income	Nominal $ (M)	3.6	5.0	2.6	**11.3**		**3.8**
Real Disposable Personal Income	Fixed 2010-11 $ (M)	2.8	4.3	2.2	**9.3**		**3.1**
Real Gross Domestic Product	Fixed 2010-11 $ (M)	3.7	7.1	4.8	**15.7**		**5.2**
Consumption by Households and Government	Fixed 2010-11 $ (M)	2.4	3.6	1.8	**7.8**		**2.6**
Real Output	Fixed 2010-11 $ (M)	5.9	13.0	9.9	**28.8**		**9.6**

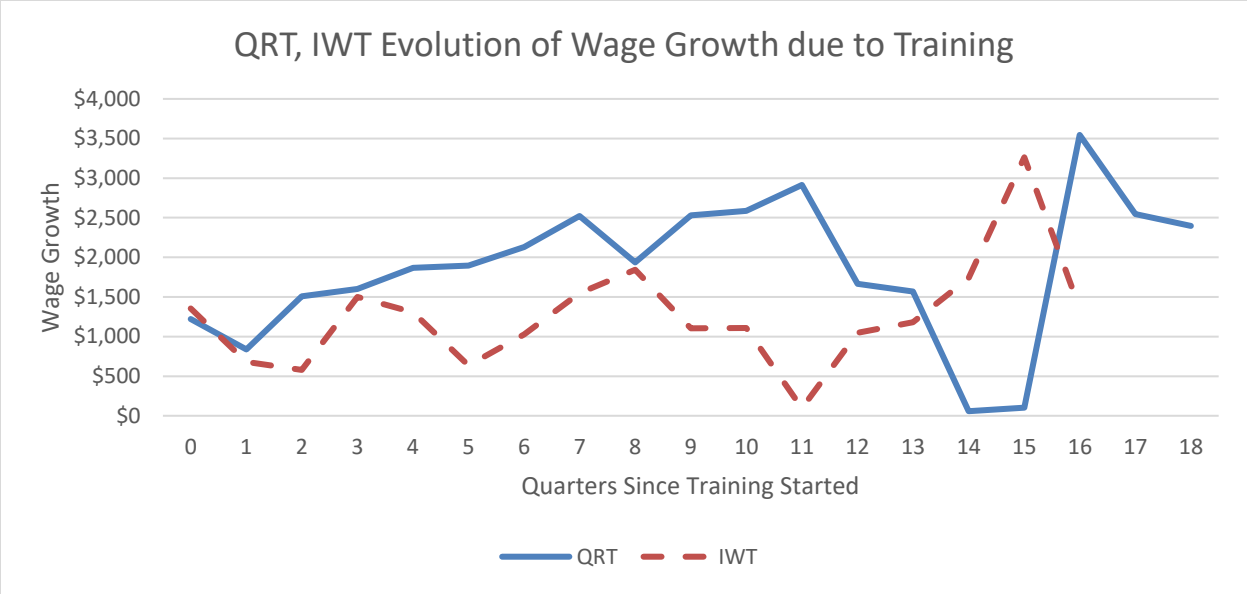
		14-15	15-16	16-17	Minimum	Maximum	Average per Year
Total Employment	Jobs	1	(1)	(10)	(10)	1	**(3)**
Population	Persons	32	32	64	32	64	**43**

The main differences between the IWT results in the previous report and the results in this one are that the total grant payments in the three-year review period fell to 37% of its previous review period level and the total wage shocks fell to 68% of its previous review period level. Therefore, all the economic impacts are now smaller.

The results presented here are dependent upon the assumptions listed earlier. These assumptions are sound and consistent with the literature; however, arguments could be made to be more or less exclusive.

Evolution of Wage Growth Over Time

The results in this section are based on the same set of trainees that the ROI results were based on except that, to obtain a clearer picture of the evolution of wage growth due to training, all trainees who received training (QRT or IWT) more than once were excluded. To construct the evolution of wage growth results, first take the average wage growth over all QRT trainees in their training start quarter, then take the average wage growth over all QRT trainees in the quarter after their training start quarter, and so on. Then do the same for IWT trainees.



For the QRT data, the Excel Linear Trendline has an intercept and a slope of $1,562 and $34, respectively. For the IWT data, they are $856 and $50, respectively. On average, the difference between a worker's actual wage and his counterfactual wage tends to grow slightly over time.

There is no consensus in the literature on whether the effect of training on wages tends to increase or decrease over time.[25] See Appendix One for details.

Under the assumption that the grant-driven wage growth neither increases nor decreases beyond the end of FY 2016-17, the ROI over FY 2014-15 to FY 2023-24 of the state payments made within the FY 2014-15 to FY 2016-17 window is 0.57. To be clear, in this simulation, the benefits to state revenue due to increased labor productivity continue until FY 2023-24, whereas the costs of the state payments end in FY 2016-17.

Observations Regarding the Effectiveness of QRT and IWT

The results in this section are derived from data on QRT and IWT contracts and trainees. Grant-driven wage growth per grant dollar is the measure of effectiveness used in this section. It is a measure of a trainee's wage growth per grant dollar allocated to him that takes into account that the grant only covered a portion of his training costs and therefore only a portion of his wage growth is grant-driven.

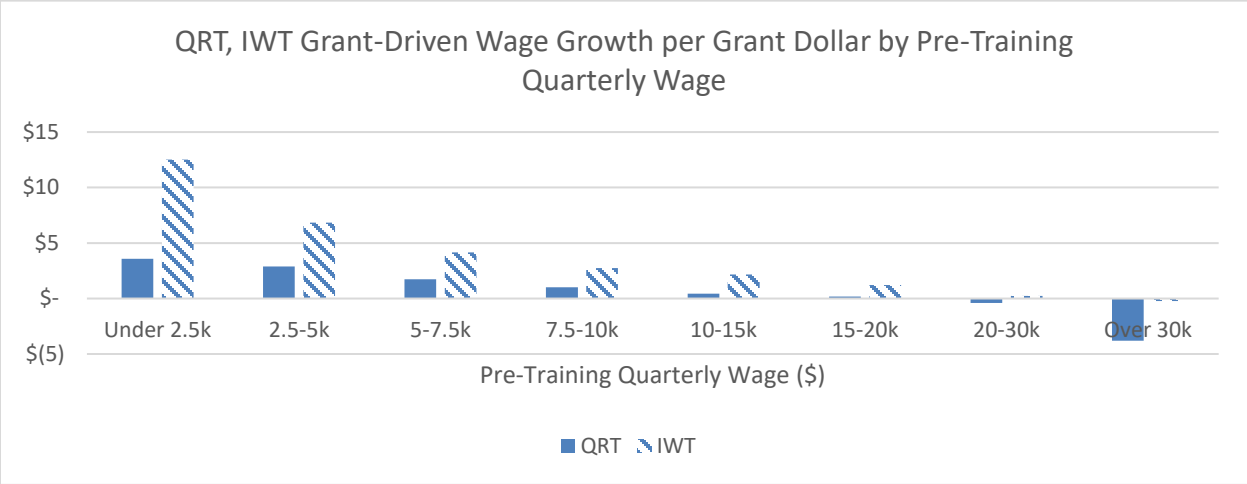
The table below presents some raw values and basic estimates (by EDR) for all grant contracts for which there was some training between the start of FY 2014-15 and of the end of FY 2015-16.

[25] See Lillard and Tan (1986), Tan et al (1991), Mincer (1994), Hollenbeck and Huang (2006), Arulampalam et al. (1995), Blundell et al (1996), and Holzer et al. (1993) for evidence of depreciation. See Lengermann (1996), Card, Kluve, and Weber (2009), Heinrich et al. (2013), and Andersson et al. (2016) for evidence of appreciation.

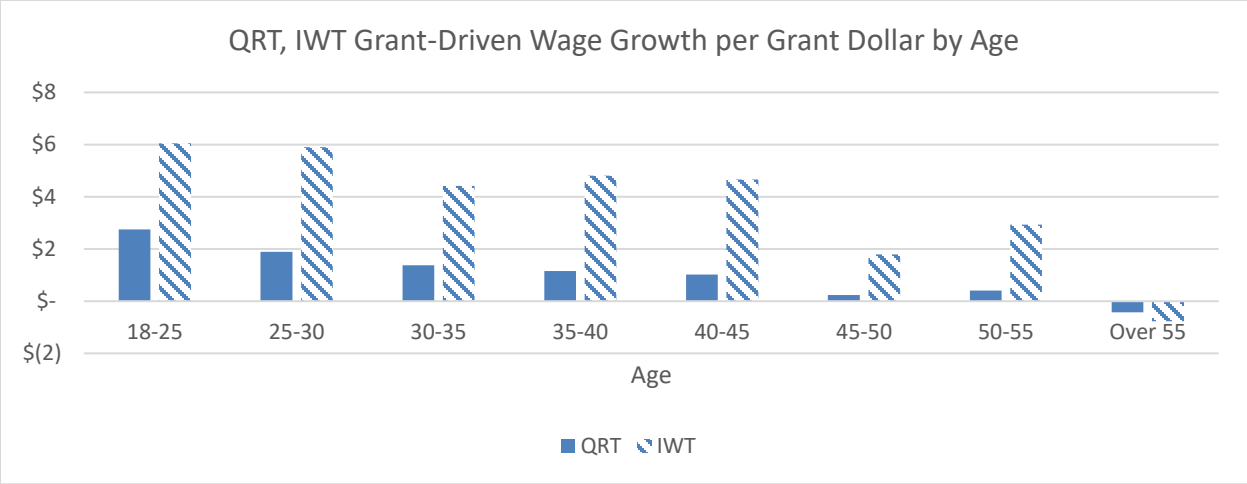
Table 6. Summary Statistics for QRT and IWT Programs

	QRT	IWT
Number of Contracts	136	301
Grant Funds Spent	$37,245,035	$4,150,382
Number of Trainees (from CareerSource Florida)	27,525	11,886
Number of Trainees (for wage growth estimates)[26]	16,496	7,907
Estimated Wage Growth (before the end of FY2016-17)	$214,397,494	$116,643,417
Estimated Grant-Driven Wage Growth (before the end of FY2016-17)	$46,773,032	$15,427,595

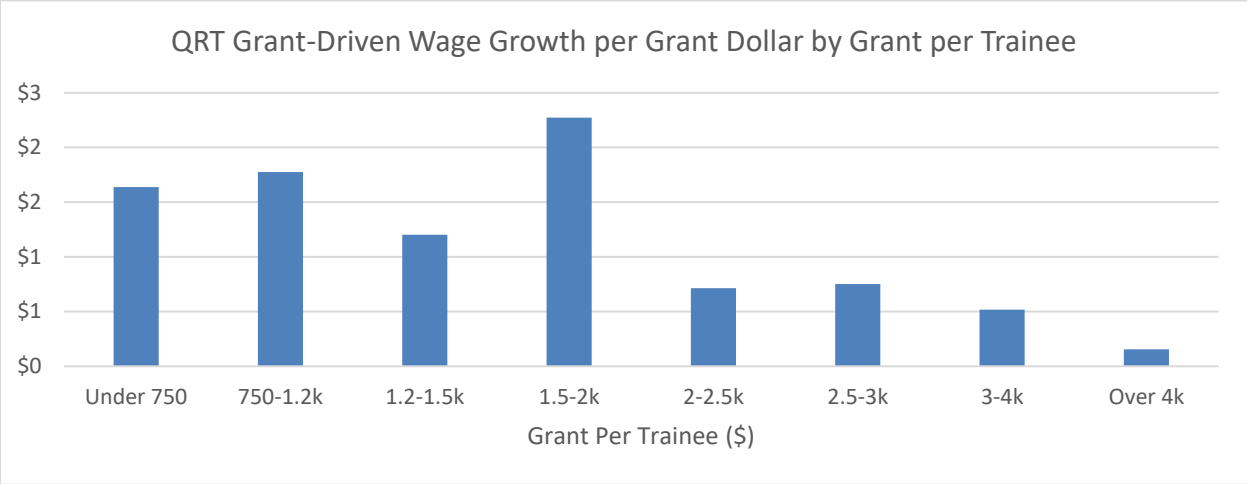
In the five graphs below, trainees are assigned to groups based on their pre-training quarterly wage, age, grant per trainee, or two-digit NAICS code. The interpretation of the leftmost bar on the first graph is that, for each $1 of QRT funds that was allocated to a trainee whose pre-training quarterly wage was under $2,500, there was $3.69 of grant-driven wage growth. The takeaway from the first four graphs is that, for both QRT and IWT, the effectiveness of grant funds decreases as pre-training wage, age, or grant per trainee increase.

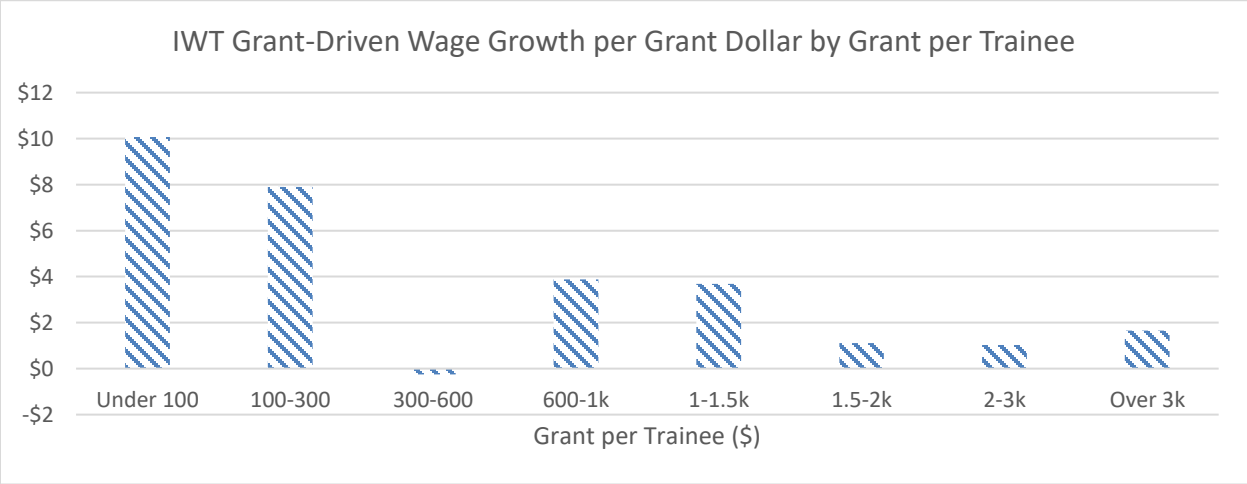


[26] These are the trainees (within Florida Education and Training Placement Information Program (FETPIP) data) that were matched with the businesses (within CSF data) that were likely to have trained them. The matching process uses the FEINs of trainees' employers and FEINs of businesses that received grants. Due to limitations of the data, each trainee is only matched with the first business that trained him under a QRT grant and the first business that trained him under an IWT grant. Approximately 88% of trainees, within FETPIP data, who first received QRT funded training in FY2014-15 or FY2015-16 were successfully matched.



For the next variable (grant per trainee), the QRT and IWT results are displayed on two separate graphs.



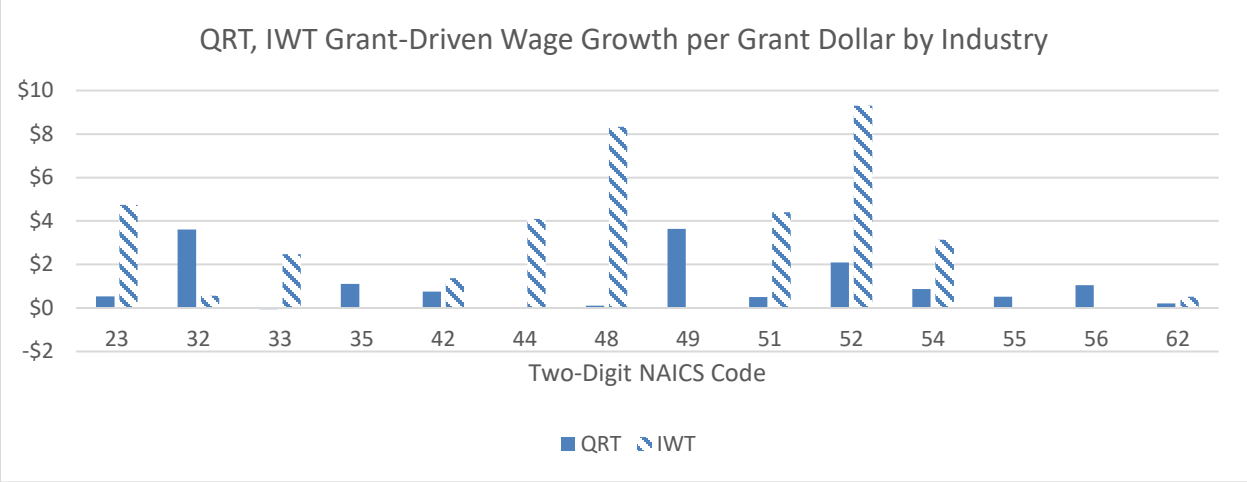


There is a clear inverse relationship between grant-driven wage growth per grant dollar and the pre-training wage, age, and grant per trainee variables. [27]

The age result here is somewhat in contrast with the results in the literature review that youths experience smaller program effects. However, the results in the literature review were only comparisons of very young workers to other workers. Dostie and Leger (2014) find that "the wage impact of training also declines with age. More specifically, we show that a worker aged 25 to 34 who participates in firm-sponsored classroom (FSC) training earns 1.2 percent more than a young worker who does not participate in FSC training. These wage impacts decline to 0.7 percent for workers aged 55 to 64." They also write "we are not aware of any studies presenting differential wage impacts of training by age."

The relationship between the effectiveness of training and pre-training wage was not addressed in the literature review, but the result here is consistent with the result that there is an inverse relationship between the effectiveness of training and education level. Further, Bartel (1995) finds that the effect of the type of training provided to workers with low salaries relative to others in their position (ie. remedial training) on wage growth rates is five times greater than the effect of the type of training provided to workers with relatively high salaries (ie. stars).

The grant per trainee result here is consistent with the related results in the literature review.



Regarding the QRT program, industries 32 (Manufacturing II), 49 (Transportation and Warehousing II), and 52 (Finance and Insurance) appear to perform well. With the two robustness checks (see footnote 27), industry 32's average value falls to 0.42 but industry 49 and industry 52 continue to perform well. Industry 33 (Manufacturing III) performs the worst but received by far the most QRT grant funds. Regarding the IWT program, industries 23 (Construction), 31 (Manufacturing I), 44 (Retail), 48 (Transportation and Warehousing I), 51 (Information), 52 (Finance and Insurance), and 54 (Professional,

[27] The relationships are just as clear under the two robustness checks. The first check is to extend the time period over which each trainee's total wage growth is measured from two to three years. The second check is to replace each trainee's counterfactual quarterly wage growth rate from one based on their pre-training wage, age, and industry to 1%.

Scientific, and Technical Services) appear to perform well and continue to do so in the two robustness checks.[28]

The final test provides a check of whether or not grant-driven wage growth per grant dollar's relationship with one variable is driven by its relationship with one or more other variables.[29] For example, perhaps it only has an inverse relationship with age because it has an inverse relationship with pre-training wage and young people tend to have low wages. Or perhaps its low QRT value for a particular industry is only because that industry tends to train older, higher-income workers. In this test, each relationship is measured while controlling for the others.

The results are that, for both QRT and IWT, the inverse relationships with pre-training quarterly wage, age, and grant per trainee are maintained, but the ranking of industries does change. For QRT, the most notable differences are that industries 49 and 52 fall from first and third to third and sixth whereas industries 23 and 33 rise from eighth and thirteenth to second and fourth. For IWT, the most notable differences are that industries 48 and 51 fall from third and fifth to seventh and eleventh whereas industry 33 rises from eighth to first.

An industry's rise (fall) indicates that part of its low (high) ranking in the graph can be attributed to the fact that its trainees tend to have relatively high (low) values for pre-training quarterly wage, age, or grant per trainee.

Observations Regarding Other States

This section presents the features of the workforce training grant programs of California, New York, Texas, Pennsylvania, Massachusetts, Washington, and Louisiana that relate to the effectiveness observations above.

California, Texas, and Pennsylvania impose a minimum wage for trainees ($14.50/hour for new hires and $17.50/hour for retrainees in CA, wages must be greater than those for the same or similar occupations in the area in TX, and 150% of the federal minimum wage in PA).[30] New York imposes a maximum wage for trainees ($35/hour).

All states except Louisiana impose a maximum grant amount per contract ($900,000 in CA, $400,000 in NY, $500,000 in TX, $75,000 in PA, $250,000 in MA, and 10% of the annual appropriation in WA).[31] California imposes a maximum grant amount that a contractor can receive per four contracts ($2,500,000). California, Pennsylvania, and Louisiana impose a maximum grant amount per trainee ($25

[28] For the graph of effectiveness by industry, industry 31 (Manufacturing I) has been removed to make the graph easier to read: it does not have a QRT value and its IWT value is approximately 19.6.

[29] Specifically, I run two OLS regressions (one for QRT, one for IWT) in which the dependent variable is grant-driven wage growth per grant dollar and the independent variables are pre-training quarterly wage, age, grant per trainee, and a dummy variable for each of the industries that appear in the relevant industry graph.

[30] QRT has a minimum average-wage requirement (the average is over all workers trained under the contract) but no minimum wage requirement. A business receiving a QRT contract could achieve the minimum average wage by training many low-wage workers and a few very high-wage workers. Some evidence that it may in fact be happening is that, for trainees who first received QRT funded training within FY2013-14 to FY2015-16, 65% of them had quarterly earnings less than the average quarterly earnings of the group.

[31] In the 2017-18 Guidelines, QRT and IWT have a maximum grant amount per contract of $500,000 and $200,000, which is a newly imposed type of constraint for QRT but not for IWT.

per hour of training in CA, $450 in PA, and $3,000 in LA but only for their small business training program).

Policy Considerations

Because of the close relationship between wage growth due to training and productivity growth due to training,[32] the wage growth results in the literature review and from the QRT and IWT data analysis are informative about what program characteristics make a productivity-focused training program more effective. In particular, the characteristics below would likely contribute to such a training program's effectiveness:

- provides grants for on-the-job training;
- has a focus towards workers with a low level of
    - education,
    - pre-training wage, and
    - age (however, not youths);
- returns a low level of grant per trainee; and
- targets industries in line with the explanations above.

Comments

While the return associated with the QRT training program is relatively low, it is worth reiterating that a Return-on-Investment does not address issues of overall effectiveness or societal benefit. It is beneficial to the state to have a more productive and educated populous, even if the financial returns are initially minimal. Additionally, returns to the employees may take decades to develop and may not be captured in a three-year period. Furthermore, the availability of these programs signals to the business community that the state is actively engaged in devising strategies and providing resources to meet their workforce training needs. Collectively, these programs enhance the state's business climate and support state and local economic development efforts.

[32] The consensus in the training literature is that the effect of training on a worker's wage growth is approximately half of its effect on his productivity growth. See Barron et al. (1989), Dearden et al. (2005), Ballot et al. (2006), Colombo and Stanca (2008), and Konings and Vanormelingen (2010).

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APPENDIX ONE: LITERATURE REVIEW

Introduction

This literature review provides support for the method used to do the analysis in the body of the report and also addresses topics that pertain to the general value of employee training (beyond the scope of the return on investment). In the first category, it addresses the effect of training on wages relative to its effect on productivities, the Ashenfelter dip, and whether wage growth due to training tends to increase or decrease over time.[33] In the second category, it addresses what types of training are the most effective, the net benefit to the firm and the state from worker training, and spillover effects from training.

Do state grants increase worker training or are they just windfalls for companies that were planning to do training anyway?

Basic economic theory dictates that, when the cost of taking some action decreases, economic agents will do more of it. In this case, the state grant decreases the cost of training, so we should expect that firms will do more of it.

Holzer et al. (1993) use data on Michigan firms that had applied, sometime between 1986 and 1990, for a state grant for training worth on average $16,000. They find that, in the year they receive it, training more than triples for firms receiving grants.

It is less theoretically clear what the effect of receiving a one-time state grant is on a firm's level of training in future years. It could be that having undertaken more training in one year causes future training to be of higher quality or cheaper (learning by doing). On the other hand, having done some training may also cause training to be less necessary or valuable (decreasing marginal returns). Holzer et al. (1993) find that "training appears to be reduced the year after the grant is received by an amount almost equal to the original increase."

What is the effect of training on wages? What is the effect of training on productivity?

There are very many papers that provide estimates of the effect of training on wages. A few papers estimate both the effect on productivity and on wages, which allows for a comparison of the magnitudes. Dearden et al. (2005) find that raising the percentage of workers in an industry who report having done training within the last four weeks by one percentage point, increases the productivity of that industry by about 0.6% and wages by about 0.3%. Colombo and Stanca (2008) find that, when training intensity increases by one percentage point, productivity increases by about 0.07%. They also find, across different estimation techniques, that the effect of training on wages is roughly half of its effect on productivity. Ballot et al. (2006) find that a 1% increase in a firm's "stock of training" leads to a 0.173% (0.073%) increase in productivity and a 0.131% (0.061%) increase in wages in France (Sweden).

[33] Heckman, Lalonde, and Smith (1999) write that "Ashenfelter (1978) observed that prior to enrollment in a training program, participants experience a decline in their earning. Later research demonstrates that Ashenfelter's dip is a common feature of the pre-program earning of participants in government training programs." Heckman and Smith (1999) and Andersson et al. (2013) find that the Ashenfelter dip begins over a year before training does. Kambourov, Manovskii, and Plesca (2010) use data collected at annual interviews and avoid the Ashenfelter dip by defining the "pre-training wage" as the wage two interviews (rather than one) prior to the interview in which the worker reported starting training. Barnow and Smith (2015) also comment that "longer lags of labor market outcomes (ie. before the 'dip')" often are utilized to capture non-transitory characteristics of the worker.

They also estimate that the increase in wages is mainly due to the fact that the worker's outside option has increased, thereby improving his bargaining position. Konings and Vanormelingen (2010) find that, in a data set where training is on average 40 hours, the productivity premium for a trained employee is around 23% while the wage premium is only 12%.

How does the effect on wages evolve over time?

What evidence is there that it depreciates?

Lillard and Tan (1986) find that the average trained worker experiences no increase in earnings the year he receives training, a 16.9% increase in the following year, and then that number drops by 1.3 percentage points with each subsequent year. The effect, therefore, reaches zero sometime during the thirteenth year after training. Similarly, Tan et al. (1991) find the average trained worker experiences a small, insignificant increase in earnings the year he receives company training, an 18.6% increase in the following year, and then that number drops by 1.1 percentage points with each subsequent year. The effect, therefore, reaches zero sometime during the seventeenth year after training. Mincer (1993) estimates an exponential depreciation rate close to 4% (so, for example, the effect of training five years after training is (1-0.04)^5= 0.815 times what the immediate effect was). Mincer suspects that his estimate of the depreciation rate is lower than Lillard and Tan's (1986) because the data set that he uses has a "broader coverage of all males, compared to younger males in NLS" (which is the data set that Lillard and Tan (1986) and Tan et al. (1991) use), and younger males switch jobs more, thereby losing relevant skills faster.

Hollenbeck and Huang (2006) estimate a dollar increase in wages, for various training programs, at three quarters after completion and at twelve quarters after completion. For the Workforce Investment Act (WIA) Adult program, the short-term wage increase was $614 and the long-term was $403. For the Community and Technical Colleges (CTC) Job Prep program, the numbers were $1101 and $917. For Private Career Schools, the numbers were $397 and $312. For Vocational Rehabilitation, the numbers were $761 and $626. For all other adult programs, the difference between the short and long-term effect was less than $65.

Arulampalam et al. (1995) find that the model of depreciation that fits their data the best is not one in which skills start depreciating immediately. Instead, under their preferred model, they find that young men who have experienced at least one training event over the period 1981-91 have an increase of about 11% in the expected wages over this period, and that this effect is estimated to decrease by about 0.44 percentage points per month starting five years after completion of the training event. The effect, therefore, reaches zero 30 years after training.

Blundell et al (1996) find that training between 1981 and 89 increases wages in 1991 by about 18% less than does training between 1989 and 91.

Holzer et al. (1993) found that firms who received a grant of on average $16,000 experienced improvements in their scrap rates estimated to be worth $40,000 in the year that they received the grant. However, the effect of training on the scrap rate is substantially smaller in the following year.

What evidence is there that it appreciates?

Lengermann (1996) finds that company training, longer than four weeks in duration, increases wages by about 4% by year one (after completion), 5% by year three, 6% by year six, and 8% by year nine.

Card, Kluve, and Weber (2009) conduct a meta-study of about 200 "program impact" analyses. Not all analyses in their meta-study use worker wage growth as the measure of program impact, so the results are not quite directly applicable to the present question but are informative nonetheless. They find that program impacts are much more likely to transition upwards over time (from significantly negative to insignificant or to significantly positive, or from insignificant to significantly positive) than downwards. Specifically, they are more likely to transition upward between one year after completion and two years after completion and also between two years after competition and three years after competition.

Heinrich et al. (2013) estimate that, for WIA Adults, the effect on male (female) wages increases steadily from around $200 (-$200) one quarter after entry into the program to around $1300 ($1000) sixteen quarters after entry. For WIA Dislocated, the male and female numbers are around -$400 one quarter after entry and around $100 sixteen quarters after entry.

Andersson et al. (2013) analyze the same two programs and find that, for WIA Adult, wages increase steadily in state A (state B) from around $-600 (-$700) one quarter after registration to around $300 ($445) twelve quarters after. For WIA Dislocated, the numbers are -$940 (-$1260) and -$130 ($370).

What causes the effect of training to evolve?

The rationale for why the effect would depreciate is that the skills that one employer provides may be not as observable or productive at future employers or may simply become obsolete over time. The rationale for why the effect would appreciate is that the worker may continue to learn how to utilize his new skills for a period of time or he may move to a new career path that involves more skill accumulation and raises.

The hypothesis that the literature most clearly addresses is what happens when the worker switches employers. Booth and Bryan (2002) find that training from the previous employer has roughly twice the effect on wages as training from the current employer. Loewenstein and Spletzer (1998) find that "completed spells of general training paid for by previous employers have a larger wage effect than completed spells of general training paid for by the current employer." Lengermann (1996) finds that "company training was associated with significant wage growth effects irrespective of whether workers changed jobs, although wage growth was higher when the training occurred at a previous employer." Gerfin (2004) finds that the effect of training on wages is much bigger for job changers than for job stayers but only if the job changers quit, not if they are laid-off. Blundell et al (1999) find that the effect of on-the-job (off-the-job) employer-provided training on wages is greater if the training was at your previous (current) job.

Loewenstein and Spletzer (1998) hypothesize that, when an employer pays to train a worker, it recaptures some of the costs by increasing his wage less than another employer would.

What type of training is the most effective and for what type of workers?

Results Common to Several Studies

Greenberg, Michalopoulos, and Robins (2003) (henceforth GMR) analyze government-funded training programs for "disadvantaged" individuals and find that on-the-job training increases earnings more than classroom training. Lillard and Tan (1986), Tan et al (1991), Lengermann (1996), and Bishop (1996) find similar results outside of government-sponsored programs.

Lengermann (1996) finds that the effect of company training, lasting longer than four weeks, on wage growth is by far the lowest (in the short, medium, and long term) for workers with a college degree or

more. Hollenbeck and Huang (2006, 2008) and Hollenbeck (2009) present analyses of various state training programs in Washington, Virginia, and Indiana. They all have favorable results for the training programs aimed at those with less than an associate degree. The first finds that Community and Technical College Job-Prep, which "provides training for individuals to enter a variety of technical occupations that usually don't require a baccalaureate degree," has the second greatest (out of the eleven programs analyzed) estimated net benefit to the public (i.e. taxpayers). The second finds that the Post-Secondary Career and Technical Education (CTE) program, which provides occupational instruction or courses leading to an associate degree, has the greatest (out of the ten programs analyzed) effect on the participant's quarterly earning level four quarters after completion, which is almost three times greater than the total cost per participant. The third finds that the Post-Secondary (sub-baccalaureate) program has the greatest (out of the five programs analyzed) lifetime benefit-cost ratio for the participant, the government, and society.

Results from Meta-Analyses

A meta-analysis synthesizes results from many studies that all analyze a similar issue. Though there are several recent meta-analyses on active labor market programs, only GMR's (2003) meta-analysis focuses on the effects on earnings.

GMR (2003) find that on-the-job training increases earnings more than any of the other training programs considered in their analysis (four for men and six for women). Kluve (2010) and Card, Kluve, and Weber (2010, 2017) find that programs that focus on direct employment in the public sector perform relatively poorly.

GMR (2003) find that "effects tend to be […] negligible for youths," (youth are defined only as not adults) and similarly Kluve (2010) finds that "programs targeting youths are significantly less likely to be effective."

GMR (2003) find that, for youths, an extra $1000 in program costs per participant leads to an extra $108 in yearly earnings. For men and women, the values are -$4 and $25 respectively, and statistically it was less clear that there was any relationship at all between cost per participant and annual earning.

Is training a good investment for the worker, the firm, or the state?

What is the rate of return for workers and for firms?

In order to calculate a rate of return, the economist needs an estimate about of the costs of training as well as an estimate or assumption of the effects of training over time.

Mincer (1993) assumes that the costs to the worker of undertaking training are equal to his wage rate times the length of the training—effectively, assuming that the worker does not get paid during training. He uses his estimate, cited above, of a 4% depreciation rate, and finds an average annual rate of return to the worker of 23%. Assuming that the employers face the exact same cost of training as workers do, he finds an average annual rate of return to firms of 6.5%. Using a depreciation rate of 12% (which is more in line with Lillard and Tan's (1986) estimate) and a different data set, those numbers become 26% and 22.8%.

Bartel (1995) assumes that productivity gains are twice as large as the wage gains (which is in line with the literature cited above) and that skills depreciate at the rate of 10% per year. She has data on the actual direct costs of training and on trainee wages. She finds that the firm earns average annual rates of

return on one day of training of 34.6% for employee development training and 36.6% for technical training.

Frazis and Lowenstein (2005) assume that the worker receives zero wages during training and also pays some direct costs of training equal to 66% of his lost wages. They estimate an average annual rate of return to the worker of 40-50% for one full-time week of training.

Almeida and Carneiro (2009) estimate the average annual return to training to be 8.6% for firms but estimate the marginal rate of return to be -0.3%.

Given the magnitudes of the rates of return found in the first three papers cited in this section, the question arises of why firms do not undertake more training. The fourth paper provides a partial answer: just because training is profitable on average does not imply that it is profitable at the margin. However, the fourth paper also has a much lower estimate of the average rate of return.

What is the rate of return or the net-benefit for the state?

Hollenbeck (2012) calculates the rate of return for a Washington state provided training program. He estimates the effect of training on wages and the probability of unemployment, and then uses a simple tax system to calculate how much the state revenues increase and outlays decrease. He found a −24.32% annual rate of return for the first 2.5 years and a 0.85%–2.49% annual rate of return over the lifetime of the workers.

Glazerman and McConnell (2001) do a thorough cost-benefit analysis of the Job Corps training program for disadvantaged youth but do not calculate a rate of return. The costs and benefits include changes in the trainees' productivity, their draws on social services, crime by them and towards them, taxes, and direct training costs. The authors estimate that, if the dollar value of the earnings effect does not decay over the participant's working lifetime, then the net benefit to the participant is about $20,000 and the net benefit to the rest of society is only about -$3,000, despite the fact that the direct training costs to the rest of society are around $16,500.

Andersson et al. (2013) do a cost-benefit analysis. They use estimates from other studies of the training costs. They present various net social benefits estimates using various assumptions regarding the depreciation rate of the effect on earnings, the discount rate, and the welfare cost of taxation. Under the estimate of training costs of $2,500 ($7,500) and the middling assumptions of no depreciation until five years after enrollment followed by sudden complete depreciation, a discount rate of 0.05, and a welfare cost of taxation of 0.25, the net-benefit of the WIA Adult program is $1,652 ($402) in state A and $74 (-$1,176) in state B. For the WIA Dislocated program the numbers are -$3,855 (-$5,105) in state A and -$4,909 (-$6,159) in state B.

Finally, there is another body of literature that attempts to quantify how a country's level of human capital contributes to its economic growth, and though they find a positive effect,[34] it is not very informative about the extent to which state training grants pay for themselves.

[34] For example, Benhabib and Spiegal (1994) find that they can predict countries' GDP per capita growth rates relatively well with a model in which each country's growth depends both its stock of human capital and the gap between its level of human capital and the world leader. Also, a country's level of human capital tends to have a positive effect on its level of physical capital.

Are there spillover effects from training? Is there under-investment in training?

Who Pays for Firm-Provided Training?

Spillover effects of training are effects on economic agents other than those initiating the training (here, who initiates the training is proxied for by who pays for training). In order to know the extent of spillovers from firm provided training, therefore, we need to know who pays for it. Of course, nominally firms pay for whatever training they provide (apart from state grants), but it is theoretically possible that workers pay for part of the training costs by accepting reduced wages while in training. The empirical evidence, however, does not support that theory.[35]

What are the Spillover Effects?

The largest spillover effect is that the trained workers benefit from higher wages. Several estimates cited above were that the wage gains were roughly half of the productivity gains, which means that the spillover benefits are already large relative to the total benefits.

Another large spillover effect is that the workers' future employers will be more productive. Bishop (1996) estimates that training received from a previous employer increased worker initial productivity by 9.5% of the wage and reduced training requirements by 17%.

From an ROI perspective, the most direct benefit to the state government is higher tax revenue from both the workers and the firms. Of course, the presence of more productive workers likely has a positive impact on economic growth and innovation, but these effects are difficult to quantify. A final benefit to the state government could be in reduced wage inequality if the workers who tend to receive company training are those with low wages. It turns out that the three worker characteristics most correlated with receiving training are (a) having formal education, (b) being young, and (c) works in an industry that is experiencing rapid technological change.[36]

Should the Government Intervene?

It is a common idea in economic theory that one of the government's main roles is to intervene when the market outcome is inefficient. Firms may underinvest in training, relative to what's socially efficient, because they will not take into account the spillover effects (benefits to other economic agents) when deciding how much training to provide. The government could, therefore, offer a training grant to increase investment in training, bringing it closer to the socially efficient level.

Further, some of the estimates cited above of firms' average rate of return from training were very high, which is suggestive that firms are underinvesting even if we ignore all spillover effects in the cost-benefit analysis. It could be that firms underinvest due to liquidity constraints or even some psychological bias, but it could also be that the economists' estimates of rate of return are inaccurately high and would be substantially lower if they had all the information that the firms have.

It is important to keep in mind that investments in training have diminishing returns both in terms of productivity and employee wages. A firm that provides very little training would only teach the most valuable skills to its workers who will benefit the most from it. As a firm provides more training, however, it teaches less valuable skills to workers who benefit less. Bishop (1991) finds that the marginal gross rate of return of formal on-the-job training is estimated to drop from 11% at 100 hours of training (for a new-hire in his first three months) to -3% at 300 hours. Feinstein et al. (2004) find that firms

[35] Barron et al. (1993), Booth and Bryan (2002), Bassanini et al. (2005), Ballot et al. (2006)

[36] Lillard and Tan (1986), Tan et al. (1991), Bassanini et al. (2005), Leuven and Oosterbeek (1999)

appear to “cherry pick” workers, identifying those most likely to gain from training. They find that workers who received training (lasting more than 3 days at some point in 1991-2000) experienced 12% higher wage growth over the period. However, those workers who did not receive training would not have gained higher wages from the training had they done so. Of course, these are like average effects in some ways—there are trained workers who have less than 12% higher wage growth and untrained workers who would have increased wage growth from training.

APPENDIX TWO: DESCRIPTION OF METHOD FOR CALCULATING PRODUCTIVITY SHOCKS

Below is the method for using the datasets to calculate the productivity shocks used in the statewide model for the QRT simulation. The method for IWT is almost identical but with obvious changes.

The method is as follows:

1. Divide the CSF dataset into subsets so that every contract in a subset has its "Award Date of Grant" in the same fiscal year. Filter each subset to only the QRT contracts and the "Date Training Completed" is after the start of the three-year review period.[37] Find the earliest value of "Award Date of Grant" and call the fiscal year that it falls in "FY0" (this variable is only used in step 2).
2. The FETPIP dataset arrives with trainees already divided into subsets so that every trainee in a subset has the earliest fiscal year listed in his "FiscalYear" in the same fiscal year. Filter each subset to only the trainees in which his "Program" value contains "QRT" and the associated "FiscalYear" value is FY0 or after. Filter each subset to only the trainees with an average quarterly wage between $150 and $100,000. Move trainees from one subset to another so that, in each subset, every trainee's earliest fiscal year (associated with a QRT contract in FY0 or after) is in the same fiscal year.
3. The purpose of this step is to match each trainee with a contract. For each trainee, create the variables "Match" and "Mode Match". For each subset of the trainee dataset, do as follows:
    a. Take each observation and check whether there is a match between its FEIN and any of the FEINs in the CSF dataset with an associated "Award Date of Grant" in the fiscal year two years before (if possible), one year before (if possible) or equal to the fiscal year associated with that subset of trainees.[38,39] If there is, then record the contract's unique identifier as that observation's "Match".
    b. For each trainee, find his mode "Match" over all his observations, and record that unique identifier as his "Mode Match" (for all his observations).
    c. Check the name history of businesses and for parent or subsidiary connections so that manual corrections of FEINs can be made and the number of trainees with a "Mode Match" can be increased.
    d. Remove the trainees who don't have a "Mode Match" from the dataset. For the subsets associated with fiscal years in the three-year review period, this step decreases the number of trainees by about ten percent. This step is necessary, because without a "Mode Match" it is impossible to assign the trainee accurate values of "training start quarter," "f-grant," or "f-window" (these are defined below).

[37] All businesses in the dataset have a "Date Training Started" before the end of the three-year review period, so there is no need to apply a filter in order to ensure that condition holds.

[38] Due to inconsistencies between the two datasets, the objective is only to match each trainee with the first QRT contract that he was trained under.

[39] When there are multiple contracts with the same FEIN, match the trainees with the one awarded in the fiscal year that is closest to the fiscal year associated with that subset of trainees.

4. The purpose of this step is to decrease the incidence, in the FETPIP dataset, of the NAICS code "999999", which is not a real NAICS code Therefore, consider only the observations for which the NAICS code is "999999".
    a. For observations with a "Match", if an employer name appears sufficiently many times, then lookup its NAICS code from the CSF dataset.
    b. For observations without a "Match", if an employer name appears sufficiently many times, then lookup its NAICS code on the internet.
5. For each observation in the FETPIP dataset, translate each observation's NAICS code into CGE industry codes (these are the industry codes used in the statewide model). There will be some NAICS codes for which the translation is unsuccessful.[40] Translate those ones to a new CGE industry code "99 NaRI", which stands for "Not a Real Industry". It is only a placeholder and is dealt with it later.
6. For each contract, create a new variable called "f-grant" and calculate f-grant = grant/(grant + match) where grant is the dollar amount of the QRT grant and match is the dollar amount of the business's contribution. Also create a new variable called "f-window" and, for each contract, set it equal to the fraction of the training that is after the start of the three-year review period.
7. For each trainee, create the new variables "mode industry FY1", "mode industry FY2", "mode industry FY3", "training start quarter", "f-grant", and "f-window". For each trainee, set his mode industry FY1, FY2, and FY3 equal to his mode industry in the first, second, and third fiscal year in the three-year review period, respectively. Set his training start quarter, f-grant, and f-window equal to those of his "Mode Match".[41]
8. For each trainee, find his median quarterly wage growth rate over the following period of time: his training start quarter minus three years to his training start quarter minus one year and one quarter.[42] Create a set of "stable trainees" who are the trainees with a median quarterly wage growth rate between -10% and 10%. These bounds are still very extreme for median quarterly wage growth rates.
9. For each trainee, assemble a set of similar stable trainees. Each stable trainee in this set must (a) have the same mode two-digit NAICS code as him, (b) have a pre-training average quarterly wage that is different from his (if his is in the data), by less than 10% of his,[43] and

[40] For each observation, do a translation based on the six-digit code. If that fails, do a translation based on the first five digits, and so on down to three digits. If that fails, then call the translation unsuccessful and translate its NAICS code to the CGE code "99 NaRI".

[41] His training start quarter is actually set to the quarter after the one that contains the "training start date" of his "Mode Match."

[42] Heckman, Lalonde, and Smith (1999) write that "Ashenfelter (1978) observed that prior to enrollment in a training program, participants experience a decline in their earning. Later research demonstrates that Ashenfelter's dip is a common feature of the pre-program earning of participants in government training programs." Heckman and Smith (1999) and Andersson et al. (2013) find that the Ashenfelter dip begins over a year before training does. Kambourov, Manovskii, and Plesca (2010) use data collected at annual interviews and avoid the Ashenfelter dip by defining the "pre-training wage" as the wage two interviews (rather than one) prior to the interview in which the worker reported starting training. Barnow and Smith (2015) also comment that "longer lags of labor market outcomes (ie. before the 'dip')" often are utilized to capture non-transitory characteristics of the worker.

[43] The pre-training average quarterly wage is calculated over the same period of time that the pre-training median quarterly wage growth rate was.

(c) have an age at the start of training that is different from his (if his is in the data) by less than 10% of his.[44,45]

10. For each trainee, create a new variable called "CQWGR", which stands for counterfactual quarterly wage growth rate. Set his CQWGR equal to the average of the median quarterly wage growth rates of the stable trainees in his set of similar stable trainees.
11. For each trainee, do as follows:
    a. Find his average quarterly wage over the following period of time: his training start quarter minus two years to his training start quarter minus one year and one quarter. Henceforth, this is referred to as his "pre-training quarterly wage".[46]
    b. For each quarter within the three-year review period and equal to or after his training start quarter, find the sum of his wages and (if they were non-zero) subtract from that his counterfactual quarterly wage for that quarter (his counterfactual quarterly wage for that quarter is equal to what his quarterly wage would be if his pre-training quarterly wage grew at his CQWGR). In that quarter, this value is his wage growth due to his training.
    c. Example 1: Suppose a trainee's training start quarter was 2015Q2, his pre-training quarterly wage was \$100,[47] his 2015Q2 quarterly wage was \$120, and his CQWGR was 1%. His wage growth due to training in 2015Q2 would be \$120-\$100*(1.01^6)= \$13.85.
    d. Example 2: Suppose a trainee's training start quarter was 2016Q3, his pre-training quarterly wage was \$110,[48] his 2017Q2 quarterly wage was \$130, and his CQWGR was 2%. His wage growth due to training in 2017Q2 would be \$130-\$110*(1.02^9)= -\$1.46.
12. For each fiscal year within the three-year review period, multiply his wage growth due to his training by his f-grant and multiply that by his f-window. This value is his wage growth that is allocated to his mode industry FY1, FY2, or FY3 due to the state grants not before the three-year review period. Denote this value by $v_{t,i,fy}$ where t indicates that it is for trainee t, i indicates that it is for industry i, and fy indicates that it is for fiscal year fy.
13. For each industry i and fiscal year fy, sum the $v_{t,i,fy}$ over all trainees to obtain $V_{i,fy}$. This value is the total wage growth in that industry, in that fiscal year, due to state grants not before the three-year review period.
14. There is the issue that "99 NaRI" is not a real industry, so for each fy, $V_{NaRI,fy}$ must be reallocated among the real industries. Each real industry's $V_{i,fy}$ is updated as follows: $New\_V_{i,fy} = V_{i,fy} + V_{NaRI,fy}*(V_{i,fy}/(\Sigma_k V_{k,fy}))$. The $New\_V_{i,fy}$ are the wage shocks to each industry.

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[44] If a trainee's birth year is available, then his age at the start of training is estimated by the difference between his birth year and the calendar year in which his training started.

[45] For trainees with no similar stable trainees, make the restrictions to be a similar stable trainee weaker. Specifically, remove the age and pre-training average wage restrictions.

[46] However, if a trainee's pre-training quarterly wage does not exist due to lack of data, then find his average quarterly wage over the following period of time instead: his training start quarter minus one year to his training start quarter minus one quarter.

[47] This would be his average quarterly wage from 2013Q2 to 2014Q1 inclusive. Notice that the number of quarters between the midpoint of 2013Q2 to 2014Q1 (i.e. the start of 2013Q4) to the start of 2015Q2 is six, which appears later in the calculation.

[48] This would be his average quarterly wage from 2014Q3 to 2015Q2 inclusive. Notice that the number of quarters between the midpoint of 2014Q3 to 2015Q2 (i.e. the start of 2015Q1) to the start of 2017Q2 is nine, which appears later in the calculation.

15. When the wage shocks are put into the model, the percentage change in an industry's overall wages in a fiscal year is set equal to the percentage change in its overall productivity that fiscal year. However, the consensus from the literature review is that the percentage increase in a worker's wage, due to training, is roughly half of the percentage increase in his productivity due to training. Therefore, the last step before inputting the wage shocks into the model is to multiply them by two.

APPENDIX THREE: INTERPRETING IMPACTS

Key terms used in Tables 4 and 5 are described below:

State Payments – Represents the state's expenditure on the program in the fiscal year.

Total Net State Revenues – Represents the change in state tax collections from all sources.

Personal Income (Nominal $(M)) – Income received by persons from all sources. It includes income received from participation in production as well as from government and business transfer payments. It is the sum of compensation of employees (received), supplements to wages and salaries, proprietors' income with inventory valuation adjustment (IVA) and capital consumption adjustment (CCAdj), rental income of persons with CCAdj, personal income receipts on assets, and personal current transfer receipts, less contributions for government social insurance.

Real Disposable Personal Income (Fixed 2009 $(M)) – Total after-tax income received by persons; it is the income available to persons for spending or saving.

Real Gross Domestic Product (Fixed 2009 $(M)) – A measurement of the state's output; it is the sum of value added from all industries in the state. GDP by state is the state counterpart to the Nation's gross domestic product.

Consumption by Households and Government (Fixed 2009 $(M)) –The goods and services purchased by persons plus expenditures by governments consisting of compensation of general government employees, consumption of fixed capital (CFC), and intermediate purchases of goods and services less sales to other sectors and own-account production of structures and software. It excludes current transactions of government enterprises, interest paid or received by government, and subsidies.

Real Output (Fixed 2009 $(M)) – Consists of sales, or receipts, and other operating income, plus commodity taxes and changes in inventories.

Total Employment (Jobs) – This comprises estimates of the number of jobs, full time plus part time, by place of work. Full time and part time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included, but unpaid family workers and volunteers are not included.

Population (Persons) – Reflects first of year estimates of people, includes survivors from the previous year, births, special populations, and three types of migrants (economic, international, and retired).