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Executive Summary

This report assesses the impact attributable to the Psychiatric Technician Training Program at West Hills College Coalinga (WHC Coalinga). The results of this study show the program creates a positive net impact on the WHC Coalinga Service Area economy.

Over the years, students have gained new skills, making them more productive workers, by completing the Psychiatric Technician Training Program at WHC Coalinga. Today, hundreds of the program's graduates are employed in the WHC Coalinga Service Area. Graduates of the program earn on average an additional **$15,183** per year compared to their earnings if they had not completed the program. Over their lifetime, this will increase their earnings by **$576,964**.

Altogether, graduates of this program who were active in the regional workforce generated an extra **$4.1 million** in income in the WHC Coalinga Service Area in FY 2014-15. The graduates spend these extra earnings on household items and other businesses, creating more spending throughout the regional economy and resulting in the commonly referred to multiplier effects. In addition, the graduates increase the productivity of the businesses at which they are employed. These businesses demand more inputs, which causes their supply chain to purchase more inputs, and so on.

The increase in earnings of graduates currently employed in the WHC Coalinga Service Area workforce, enhanced productivity from their employers, and the resulting multiplier effects created an additional **$12.9 million** in added income, or Gross Regional Product, for the WHC Coalinga Service Area economy in FY 2014-15. This is equivalent to creating **249** new jobs. Dividing the total additional income by the number of program graduates active in the regional workforce, each Psychiatric Technician Training Program graduate adds **$23,604** to the WHC Coalinga Service Area.

1 Introduction

West Hills College Coalinga (WHC Coalinga), established in 1932, has today grown to serve 2,793 credit and 262 non-credit students. The college is led by Dr. Carole Goldsmith, President. The college's service region, for the purposes of this report, consists of Fresno and Kings Counties in California, henceforth referred to as the WHC Coalinga Service Area.

While WHC Coalinga offers a variety of programs, this study is concerned with considering the economic impacts derived from the graduates of its Psychiatric Technician Training Program. Established in 2001, this program helps students achieve their individual potential and develop the knowledge, skills, and abilities they need to pass the Board of Vocational Nursing and Psychiatric Technician state board examination, and to have a fulfilling and prosperous career as a Licensed Psychiatric Technician.

During the 2014-15 year, a total of 201 individual students participated in the Psychiatric Technician Training Program. Of those students, 69 earned a certificate of achievement, 47 earned an associate's degree, and a further 68 students continued to progress through the program in the following academic year. The breakdown of the program's students by gender was 42% male and 58% female. The breakdown by ethnicity was 22% white and 78% minority. The students' overall average age was 29 years old.[1] An estimated 80% of students remain in the WHC Coalinga Service Area after finishing their time in the program.

This report assesses the economic impact of graduates from WHC Coalinga's Psychiatric Technician Training Program on the WHC Coalinga Service Area. Here "economic impact" describes the full range of economic effects that can be directly attributed to the academic program in terms of the increased wages for graduates, the enhanced productivity of their employers, and the resulting multiplier effects stemming from greater supply chain activities of the businesses affected by the graduates' higher earning potential and employer productivity.

[1] Unduplicated headcount, gender, ethnicity, age, and settlement data provided by WHC Coalinga.

2 Introduction to Economic Impacts and Methodology

Economic impact analyses use different types of impacts to estimate the results. The impact focused on in this study assesses the change in income. This measure is similar to the commonly used gross regional product (GRP). Income may be further broken out into the **added labor income impact**, also known as earnings, which assesses the change in employee compensation; and the **added non-labor income impact**, which assesses the change in business profits. Together, added labor income and added non-labor income sum to total added income.

2.1 Economic impact measures

This analysis breaks out the impact measures into different components, each based on the economic effect that caused the impact. The following is a list of each type of effect presented in this analysis:

- The **initial effect** is the exogenous shock to the economy caused by the initial spending of money, whether to pay for salaries and wages, purchase goods or services, or cover operating expenses.
- The initial round of spending creates more spending in the economy, resulting in what is commonly known as the **multiplier effect**. The multiplier effect comprises the additional activity that occurs across all industries in the economy and may be further decomposed into the following three types of effects:
  - The **direct effect** refers to the additional economic activity that occurs as the industries affected by the initial effect spend money to purchase goods and services from their supply chain industries.
  - The **indirect effect** occurs as the supply chain of the initial industries creates even more activity in the economy through their own inter-industry spending.
  - The **induced effect** refers to the economic activity created by the household sector as the businesses affected by the initial, direct, and indirect effects raise salaries or hire more people.

The terminology used to describe the economic effects listed above differs slightly from that of other commonly used input-output models, such as IMPLAN. For example, the initial effect in this study is called the "direct effect" by IMPLAN, as shown in the table below. Further, the term "indirect effect" as used by IMPLAN refers to the combined direct and indirect effects defined in this study. To avoid confusion, readers are encouraged to interpret the results presented in the next section in the context of the terms and definitions listed above. Note that, regardless of the effects used to decompose the results, the total impact measures are analogous.

<table>
<tr><td>EMSI</td><td>Initial</td><td>Direct</td><td>Indirect</td><td>Induced</td></tr>
<tr><td>IMPLAN</td><td>Direct</td><td colspan="2">Indirect</td><td>Induced</td></tr>
</table>

Multiplier effects in this analysis are derived using EMSI's Social Accounting Matrix (SAM) input-output model that captures the interconnection of industries, government, and households in the region. The EMSI SAM contains approximately 1,100 industry sectors at the highest level of detail available in the North American Industry Classification System (NAICS) and supplies the industry-specific multipliers required to determine the impacts associated with increased activity within a given economy. For more information on the EMSI SAM model and its data sources, see Appendix 3.

More specifically, this report analyzes the total economic impact attributable to graduates of the Psychiatric Technician Training Program. In order to capture impacts at the program level, we must map the occupations students are likely to enter upon completion of the program. Classification of Instructional Program codes (CIP codes) are how the National Center for Education Statistics categorizes and tracks an enrollee's field of study. Standard Occupation Classification Codes (SOC codes) are used by the Bureau of Labor Statistics to categorize and track employment trends for jobs with similar duties, skills, and/or education. The link between CIPs and SOCs is provided by the National Center for Education Statistics and provides the basis for calculating and attributing earnings to a program. From here we use an inverse staffing pattern to determine the industries currently employing the occupations. This is done in EMSI SAM by combining data from the national Occupational Employment Statistics (OES) staffing pattern, projections from the National Industry-Occupation Employment Matrix, and EMSI's proprietary employment data.

3 Economic Impacts on the WHC Coalinga Service Area Economy

The Psychiatric Technician Training Program (CIP 51.1502) prepares individuals to take the Board of Vocational Nursing and Psychiatric Technician state board exam in order to become a Licensed Psychiatric Technician. The program combines theory with clinical experience in skills labs and hospital facilities. The program includes Nursing Skills Development, Infection Control, Safety, Patient Care, and more. Students graduate from this program with either a certificate or associate's degree.

When exploring the impact from the Psychiatric Technician Training Program's graduates, we consider the following hypothetical question:

How would economic activity from graduates of the WHC Coalinga Psychiatric Technician Training Program change in the WHC Coalinga Service Area if the graduates did not exist in FY 2014-15?

The economic impact should be interpreted according to this hypothetical question. Another way to think about the question is to realize that we measure net impacts, not gross impacts. Gross impacts represent an upper-bound estimate in terms of capturing all activity stemming from the program's graduates; however, net impacts reflect a truer measure since they demonstrate what would not have existed in the regional economy if not for the program.

In this analysis we estimate the economic impacts stemming from the added labor income of the program's graduates in combination with their employers' added non-labor income. This impact is based on the number of students who have graduated from the Psychiatric Technician Training Program at WHC Coalinga *throughout the program's history*, or since the first graduates began entering the workforce in FY 2002-03. We then use this total number to consider the impact of those graduates in the single FY 2014-15. Only those former students who achieved a certificate or associate's degree in this program are considered graduates.

While attending the program, students receive experience, education, and the knowledge, skills, and abilities that increase their productivity and allow them to command a higher wage once they enter the healthcare workforce. But the reward of increased productivity does not stop there. Talented professionals also make capital more productive (e.g., buildings, production facilities, equipment). The employers of the program's graduates enjoy the fruits of this increased productivity in the form of additional non-labor income (i.e., higher profits).

This graduate impact is the result of years of past instruction and the associated accumulation of human capital. The initial effect of graduates is comprised of two main components. The first and largest of these is the added labor income of the Psychiatric Technician Training Program graduates. The second component of the initial effect is comprised of the added non-labor income of the businesses that employ these graduates.

We begin by estimating the number of graduates the program has generated over time. This is based on the program's historical graduates over the past 13 years, from FY 2002-03 to FY 2014-15. These graduates are reported in unduplicated terms, meaning if they achieved multiple degrees over time, they are counted in the year they received their first degree. Altogether, over the program's history, the Psychiatric Technician Training Program has generated 863 graduates from WHC Coalinga.

In the next step, we estimate the portion of the program's graduates who are employed in the regional workforce. To estimate the historical employment patterns of graduates in the region, we use the following sets of data or assumptions: 1) settling-in factors to determine how long it takes the average student to settle into a career;[2] 2) death, retirement, and unemployment rates from the National Center for Health Statistics, the Social Security Administration, and the Bureau of Labor Statistics; and 3) state migration data from the U.S. Census Bureau. The result is the estimated portion of graduates from each previous year who were still actively employed in the region as of FY 2014-15. We estimate there are approximately 643 program graduates still active in the workforce.

Next, we apply a counterfactual scenario to the number of graduates. As discussed above, counterfactual outcomes in economic analysis represent what would have happened if a given event had not occurred. The event in question is the education and training provided by the Psychiatric Technician Training Program at WHC Coalinga and subsequent influx of skilled labor into the regional economy. For this counterfactual we adjust for alternative education opportunities. In the counterfactual scenario where the program at WHC Coalinga does not exist, we assume a portion of the program's graduates would have received a comparable education elsewhere in the region or would have left the region and received a comparable education and then returned to the region. Those graduates cannot be counted when calculating the total incremental added labor income from the program graduates. The adjustment for alternative education opportunities amounts to a 15% reduction of the 643 program graduates in the regional workforce. This means that an estimated 96 graduates would have received similar education and be currently active in the regional workforce, even if the Psychiatric Technician Training Program at WHC Coalinga did not exist. For more information on the alternative education adjustment, see Appendix 5.

Now, we estimate the value that each graduate receives from the program, or the skills and human capital acquired by the program's graduates. This is done by using the *incremental* added labor income stemming from the graduates' higher wages. The incremental added labor income is the difference between the wage earned by the program's graduates and the alternative wage they would have earned had they not completed the program but had their high school diploma. The wage data is gathered from EMSI's proprietary employment and wage database, which combines a variety of

[2] Settling-in factors are used to delay the onset of the benefits to students in order to allow time for them to find employment and settle into their careers. This is based on data reported by WHC Coalinga, whereby an estimated 80% of graduates are employed upon program completion.

government data sources for complete and current data. We then adjust these wages to represent the earnings of students pre- and post-training at the midpoint of their working career.

Because workforce experience leads to increased productivity and higher wages, the incremental value each graduate receives for their education varies depending on the graduates' workforce experience, with the highest value received by the graduates who have been employed the longest by FY 2014-15, and the lowest value received by those just entering the workforce. Therefore, the incremental earnings are adjusted from the midpoint to take into account where the graduates are in their working careers. More information on the theory and calculations behind the incremental value received by each graduate appears in Appendix 4. Using the incremental earnings for each year's graduates, we estimate that the average incremental value each graduate receives is equal to $15,183. This value represents the average incremental increase in wages that graduates of the program received during the analysis year.

In determining the amount of added labor income attributable to program graduates, we multiply the number of graduates in each year, net of alternative education opportunities, by the corresponding average incremental value received by each graduate for that year. We then sum the products together. This calculation yields approximately $8.3 million in labor income from increased wages received by graduates in FY 2014-15 (as shown in Table 3.1).

Table 3.1: Number of Psychiatric Technician Training Program graduates in workforce and initial labor income created in the WHC Coalinga Service Area, FY 2014-15

Gross number of graduates in workforce	643
Percent reduction for alternative education opportunities	*15%*
Net number of graduates in workforce	546
Average incremental value received by each graduate	$15,183
Initial labor income, net of alternative education opportunities	**$8,293,005**
Percent reduction for adjustment for labor import effects	*50%*
Initial labor income, net	**$4,146,503**

Source: EMSI impact model.

The other adjustment in Table 3.1 accounts for the importation of labor. Suppose the Psychiatric Technician Training Program at WHC Coalinga did not exist and in consequence there were fewer Psychiatric Technicians in the WHC Coalinga Service Area. Businesses could still satisfy some of their need for this skilled labor by recruiting from outside the region. We refer to this as the labor import effect. Lacking information on its possible magnitude, we assume 50% of the jobs that graduates fill at regional businesses could have been filled by workers recruited from outside the region if the Psychiatric Technician Training Program at WHC Coalinga did not exist. We conduct a sensitivity analysis for this assumption in Section 4. With the 50% adjustment, the net added initial labor income added to the economy comes to $4.1 million, as shown in Table 3.1.

The $4.1 million in added labor income appears under the initial effect in the labor income column of Table 3.2. To this we add an estimate for initial non-labor income. As discussed earlier in this section, businesses that employ graduates of the Psychiatric Technician Training Program at WHC

Coalinga see higher profits as a result of the increased productivity of their capital assets. To estimate this additional income, we allocate the initial increase in labor income ($4.1 million) to the six-digit NAICS industry sectors where students are most likely to be employed with a certificate or associate's degree from the Psychiatric Technician Training Program. This allocation entails a process that maps the program's graduates in the region to the detailed occupations for which those graduates have been trained, and then maps the detailed occupations to the six-digit industry sectors in the SAM model.[3] Using a crosswalk created by National Center for Education Statistics (NCES) and the Bureau of Labor Statistics (BLS), we map the breakdown of the region's completers to the approximately 700 detailed occupations in the Standard Occupational Classification (SOC) system. Finally, we apply a matrix of wages by industry and by occupation from the SAM model to map the occupational distribution of the $4.1 million in initial labor income effects to the detailed industry sectors in the SAM model.[4]

Once these allocations are complete, we apply the ratio of non-labor to labor income provided by the SAM model for each sector to our estimate of initial labor income. This computation yields an estimated $6.5 million in added non-labor income attributable to the program's graduates. Summing initial labor and non-labor income together provides the total initial effect of graduate productivity in the WHC Coalinga Service Area economy, equal to approximately $10.6 million. To estimate multiplier effects, we convert the industry-specific income figures generated through the initial effect to sales using sales-to-income ratios from the SAM model. We then run the values through the SAM's multiplier matrix.

[3] Completer data comes from the Integrated Postsecondary Education Data System (IPEDS), which organizes program completions according to the Classification of Instructional Programs (CIP) developed by the National Center for Education Statistics (NCES).

[4] For example, if the SAM model indicates that 20% of wages paid to workers in SOC 31-1011 (Home Health Aides) occur in NAICS 621610 (Home Health Care Services), then we allocate 20% of the initial labor income effect under SOC 31-1011 to NAICS 621610.

Table 3.2: Graduate impact, FY 2014-15

	Added labor income (thousands)	Added non-labor income (thousands)	Total added income (thousands)	Sales (thousands)	Jobs
Initial effect	**$4,147**	**$6,503**	**$10,649**	**$15,781**	**176**
Multiplier effect					
Direct effect	$391	$45	$436	$1,089	9
Indirect effect	$50	$6	$55	$137	1
Induced effect	$1,483	$270	$1,752	$7,229	64
Total multiplier effect	**$1,923**	**$320**	**$2,243**	**$8,456**	**74**
Total impact (initial + multiplier)	**$6,069**	**$6,823**	**$12,892**	**$24,237**	**249**

Source: EMSI impact model.

Table 3.2 shows the multiplier effects of the program's graduates. Multiplier effects occur as graduates generate an increased demand for consumer goods and services through the expenditure of their higher wages. Further, as the industries where graduates are employed increase their output, there is a corresponding increase in the demand for input from the industries in the employers' supply chain. Together, the incomes generated by the expansions in business input purchases and household spending constitute the multiplier effect of the increased productivity of the program's graduates. The final results are $6.1 million in added labor income and $6.8 million in added non-labor income, for an overall total of $12.9 million in total added income in the WHC Coalinga Service Area in FY 2014-15. This is equivalent to 249 new jobs.

From a different perspective, each graduate of the Psychiatric Technician Training Program adds, on average, $23,604 in added income to the economy annually (Table 3.3). The graduates themselves also benefit from this program, increasing their income an average of $576,964 in their lifetime.

Table 3.3: Programmatic impacts per graduate, FY 2014-15

Number of graduates in regional workforce, net alternative education opportunities	546
Annual economic impact per graduate	$23,604
Average lifetime earnings change per graduate	$576,964

Source: EMSI impact model.

4 Sensitivity Analysis

Sensitivity analysis measures the extent to which a model's outputs are affected by hypothetical changes in the background data and assumptions. This is especially important when those variables are inherently uncertain. This analysis allows us to identify a plausible range of potential results that would occur if the value of any of the variables is in fact different from what was expected. Here we test the sensitivity of the labor import effect variable.

The labor import effect variable only affects the graduate impact calculation in Table 3.2. In the model we assume a labor import effect variable of 50%, which means that we claim only 50% of the initial labor income generated by increased graduate productivity. The other 50% we assume would have been created in the region anyway – even without the Psychiatric Technician Training Program at WHC Coalinga– since the businesses that hired the program's graduates could have substituted some of these workers with equally-qualified people from outside the region had there been no WHC Coalinga program graduates to hire.

Table 4.1 presents the results of the sensitivity analysis for the labor import effect variable. As above, the assumption increases and decreases relative to the base case of $12.9 million by the increments indicated in the table. Graduate productivity impacts attributable to the Psychiatric Technician Training Program at WHC Coalinga, for example, range from a low of $6.4 million at a -50% variation to a high of $19.3 million at a +50% variation from the base case assumption. This means that if the labor import effect variable decreases, the impact that we claim as attributable to graduates decreases. The impact stemming from the graduates still remains a sizeable factor in the WHC Coalinga Service Area economy, even under the most conservative assumptions.

Table 4.1: Sensitivity analysis of labor import effect variable

% variation in assumption	-50%	-25%	-10%	Base Case	10%	25%	50%
Labor import effect variable	75%	63%	55%	50%	45%	38%	25%
Graduate impact (thousands)	$6,446	$9,669	$11,603	$12,892	$14,182	$16,115	$19,339

Appendix 1: Glossary of Terms

Alternative education	A "with" and "without" measure of the percent of students who would still be able to avail themselves of education if the program under analysis did not exist. An estimate of 10%, for example, means that 10% of students do not depend directly on the existence of the program at WHC Coalinga in order to obtain similar education.
Attrition rate	Rate at which students leave the workforce due to out-migration, unemployment, retirement, or death.
Demand	Relationship between the market price of education and the volume of education demanded (expressed in terms of enrollment). The law of the downward-sloping demand curve is related to the fact that enrollment increases only if the price (tuition and fees) is lowered, or conversely, enrollment decreases if price increases.
Economics	Study of the allocation of scarce resources among alternative and competing ends. Economics is not normative (what ought to be done), but positive (describes what is, or how people are likely to behave in response to economic changes).
Gross regional product	Measure of the final value of all goods and services produced in a region after netting out the cost of goods used in production. Gross regional product (GRP) equals the combined incomes of all factors of production; i.e., labor, land and capital. These include wages, salaries, proprietors' incomes, profits, rents, and other. Gross regional product is also sometimes called value added or added income.
Initial effect	Income generated by the initial injection of monies into the economy through the higher earnings of the program's graduates.
Input-output analysis	Relationship between a given set of demands for final goods and services and the implied amounts of manufactured inputs, raw materials, and labor that this requires. When businesses that employ the program's graduates increase their productivity and spend money for supplies in the region, they also generate earnings in all sectors of the economy, thereby increasing the demand for goods and services and jobs. Moreover, as graduates enter or rejoin the workforce with higher skills, they earn higher salaries and wages. In turn, this generates more consumption and spending in other sectors of the economy.

Earnings (labor income) Income that is received as a result of labor; i.e., wages.

Multiplier effect Additional income created in the economy as program graduates spend money in the region. It consists of the income created by the supply chain of the industries initially affected by the spending of graduates (i.e., the direct effect), income created by the supply chain of the initial supply chain (i.e., the indirect effect), and the income created by the increased spending of the household sector (i.e., the induced effect).

Non-labor income Income from high business productivity as a result of hiring skilled program graduates.

Appendix 2: Example of Sales versus Added Income

EMSI's economic impact study differs from many other studies because we prefer to report the impacts in terms of added income rather than sales (or output). Added income is synonymous with value added or GRP. Sales include all the intermediary costs associated with producing goods and services. Added income is a net measure that excludes these intermediary costs:

$$Added\ income = Sales - Intermediary\ Costs$$

For this reason, added income (or GRP) is a more meaningful measure of new economic activity than reporting sales. This is evidenced by the use of gross domestic product (GDP) – a measure of income – by economists when considering the economic growth or size of a country. The difference is GRP reflects a region and GDP a country.

To demonstrate the difference between added income and sales, let us consider an example of a baker's production of a loaf of bread. The baker buys the ingredients such as eggs, flour, and yeast for $2.00. He uses capital such as a mixer to combine the ingredients and an oven to bake the bread and convert it into a final product. Overhead costs for these steps are $1.00. Total intermediary costs are $3.00. The baker then sells the loaf of bread for $5.00.

The sales amount of the loaf of bread is $5.00. The added income from the loaf of bread is equal to the sales amount less the intermediary costs:

$$\text{Added income} = \$5.00 - \$3.00 = \$2.00$$

In our analysis, we provide context behind the added income figures by also reporting the associated number of jobs. The impacts are also reported in sales and earnings terms for reference.

Appendix 3: EMSI MR-SAM

EMSI's Multi-Regional Social Accounting Matrix (MR-SAM) represents the flow of all economic transactions in a given region. It replaces EMSI's previous input-output (IO) model, which operated with some 1,100 industries, four layers of government, a single household consumption sector, and an investment sector. The old IO model was used to simulate the ripple effects (*i.e.*, multipliers) in the regional economy as a result of industries entering or exiting the region. The SAM model performs the same tasks as the old IO model, but it also does much more. Along with the same 1,100 industries, government, household and investment sectors embedded in the old IO tool, the SAM exhibits much more functionality, a greater amount of data, and a higher level of detail on the demographic and occupational components of jobs (16 demographic cohorts and about 750 occupations are characterized).

This appendix presents a high-level overview of the MR-SAM. Additional documentation on the technical aspects of the model is available upon request.

A3.1 Data sources for the model

The EMSI MR-SAM model relies on a number of internal and external data sources, mostly compiled by the federal government. What follows is a listing and short explanation of our sources. The use of these data will be covered in more detail later in this appendix.

EMSI Data are produced from many data sources to produce detailed industry, occupation, and demographic jobs and earnings data at the local level. This information (especially sales-to-jobs ratios derived from jobs and earnings-to-sales ratios) is used to help regionalize the national matrices as well as to disaggregate them into more detailed industries than are normally available.

BEA Make and Use Tables (MUT) are the basis for input-output models in the U.S. The *make* table is a matrix that describes the amount of each commodity made by each industry in a given year. Industries are placed in the rows and commodities in the columns. The *use* table is a matrix that describes the amount of each commodity used by each industry in a given year. In the use table, commodities are placed in the rows and industries in the columns. The BEA produces two different sets of MUTs, the benchmark and the summary. The benchmark set contains about 500 sectors and is released every five years, with a five-year lag time (e.g., 2002 benchmark MUTs were released in 2007). The summary set contains about 80 sectors and is released every year, with a two-year lag (e.g., 2010 summary MUTs were released in late 2011/early 2012). The MUTs are used in the EMSI SAM model to produce an industry-by-industry matrix describing all industry purchases from all industries.

BEA Gross Domestic Product by State (GSP) describes gross domestic product from the value added (also known as added income) perspective. Value added is equal to employee compensation, gross operating surplus, and taxes on production and imports, less subsidies. Each of these components is reported for each state and an aggregate group of industries. This dataset is updated once per year, with a one-year lag. The EMSI SAM model makes use of this data as a control and pegs certain pieces of the model to values from this dataset.

BEA National Income and Product Accounts (NIPA) cover a wide variety of economic measures for the nation, including gross domestic product (GDP), sources of output, and distribution of income. This dataset is updated periodically throughout the year and can be between a month and several years old depending on the specific account. NIPA data are used in many of the EMSI MR-SAM processes as both controls and seeds.

BEA Local Area Income (LPI) encapsulates multiple tables with geographies down to the county level. The following two tables are specifically used: CA05 (Personal income and earnings by industry) and CA91 (Gross flow of earnings). CA91 is used when creating the commuting submodel and CA05 is used in several processes to help with place-of-work and place-of-residence differences, as well as to calculate personal income, transfers, dividends, interest, and rent.

BLS Consumer Expenditure Survey (CEX) reports on the buying habits of consumers along with some information as to their income, consumer unit, and demographics. EMSI utilizes this data heavily in the creation of the national demographic by income type consumption on industries.

Census of Government's (CoG) state and local government finance dataset is used specifically to aid breaking out state and local data that is reported in the MUTs. This allows EMSI to have unique production functions for each of its state and local government sectors.

Census' OnTheMap (OTM) is a collection of three datasets for the census block level for multiple years. **Origin-Destination** (OD) offers job totals associated with both home census blocks and a work census block. **Residence Area Characteristics** (RAC) offers jobs totaled by home census block. **Workplace Area Characteristics** (WAC) offers jobs totaled by work census block. All three of these are used in the commuting submodel to gain better estimates of earnings by industry that may be counted as commuting. This dataset has holes for specific years and regions. These holes are filled with Census' Journey-to-Work described later.

Census' Current Population Survey (CPS) is used as the basis for the demographic breakout data of the MR-SAM model. This set is used to estimate the ratios of demographic cohorts and their income for the three different income categories (i.e., wages, property income, and transfers).

Census' Journey-to-Work (JtW) is part of the 2000 Census and describes the amount of commuting jobs between counties. This set is used to fill in the areas where OTM does not have data.

Census' American Community Survey (ACS) **Public Use Microdata Sample** (PUMS) is the replacement for Census' long form and is used by EMSI to fill the holes in the CPS data.

Oak Ridge National Lab (ORNL) County-to-County Distance Matrix (Skim Tree) contains a matrix of distances and network impedances between each county via various modes of transportation such as highway, railroad, water, and combined highway-rail. Also included in this set are minimum impedances utilizing the best combination of paths. The ORNL distance matrix is used in EMSI's gravitational flows model that estimates the amount of trade between counties in the country.

A3.2 Overview of the MR-SAM model

EMSI's MR-SAM modeling system is a comparative static model in the same general class as RIMS II (Bureau of Economic Analysis) and IMPLAN (Minnesota Implan Group). The MR-SAM model is thus not an econometric model, the primary example of which is PolicyInsight by REMI. It relies on a matrix representation of industry-to-industry purchasing patterns originally based on national data which are regionalized with the use of local data and mathematical manipulation (i.e., non-survey methods). Models of this type estimate the ripple effects of changes in jobs, earnings, or sales in one or more industries upon other industries in a region.

The EMSI SAM model shows final equilibrium impacts – that is, the user enters a change that perturbs the economy and the model shows the changes required to establish a new equilibrium. As such, it is not a dynamic model that shows year-by-year changes over time (as REMI's does).

A3.2.1 National SAM

Following standard practice, the SAM model appears as a square matrix, with each row sum exactly equaling the corresponding column sum. Reflecting its kinship with the standard Leontief input-output framework, individual SAM elements show accounting flows between row and column sectors during a chosen base year. Read across rows, SAM entries show the flow of funds into column accounts (also known as receipts or the appropriation of funds by those column accounts). Read down columns, SAM entries show the flow of funds into row accounts (also known as expenditures or the dispersal of funds to those row accounts).

The SAM may be broken into three different aggregation layers: broad accounts, sub-accounts, and detailed accounts. The broad layer is the most aggregate and will be covered first. Broad accounts cover between one and four sub-accounts, which in turn cover many detailed accounts. This appendix will not discuss detailed accounts directly because of their number. For example, in the industry broad account, there are two sub-accounts and over 1,100 detailed accounts.

A3.2.2 Multi-regional aspect of the SAM

Multi-regional (MR) describes a non-survey model that has the ability to analyze the transactions and ripple effects (i.e., multipliers) of not just a single region, but multiple regions interacting with each other. Regions in this case are made up of a collection of counties.

EMSI's multi-regional model is built off of gravitational flows, assuming that the larger a county's economy, the more influence it will have on the surrounding counties' purchases and sales. The equation behind this model is essentially the same that Isaac Newton used to calculate the gravitational pull between planets and stars. In Newton's equation, the masses of both objects are multiplied, then divided by the distance separating them and multiplied by a constant. In EMSI's model, the masses are replaced with the supply of a sector for one county and the demand for that same sector from another county. The distance is replaced with an impedance value that takes into account the distance, type of roads, rail lines, and other modes of transportation. Once this is calculated for every county-to-county pair, a set of mathematical operations is performed to make sure all counties absorb the correct amount of supply from every county and the correct amount of demand from every county. These operations produce more than 200 million data points.

A3.3 Components of the EMSI MR-SAM model

The EMSI MR-SAM is built from a number of different components that are gathered together to display information whenever a user selects a region. What follows is a description of each of these components and how each is created. EMSI's internally created data are used to a great extent throughout the processes described below, but its creation is not described in this appendix.

A3.3.1 County earnings distribution matrix

The county earnings distribution matrices describe the earnings spent by every industry on every occupation for a year – i.e., earnings by occupation. The matrices are built utilizing EMSI's industry earnings, occupational average earnings, and staffing patterns.

Each matrix starts with a region's staffing pattern matrix which is multiplied by the industry jobs vector. This produces the number of occupational jobs in each industry for the region. Next, the occupational average hourly earnings per job are multiplied by 2,080 hours, which converts the average hourly earnings into a yearly estimate. Then the matrix of occupational jobs is multiplied by the occupational annual earnings per job, converting it into earnings values. Last, all earnings are adjusted to match the known industry totals. This is a fairly simple process, but one that is very important. These matrices describe the place-of-work earnings used by the MR-SAM.

A3.3.2 Commuting model

The commuting sub-model is an integral part of EMSI's MR-SAM model. It allows the regional and multi-regional models to know what amount of the earnings can be attributed to place-of-residence vs. place-of-work. The commuting data describe the flow of earnings from any county to any other county (including within the counties themselves). For this situation, the commuted earnings are not just a single value describing total earnings flows over a complete year, but are broken out by occupation and demographic. Breaking out the earnings allows for analysis of place-of-residence and place-of-work earnings. These data are created using BLS' OnTheMap dataset, Census' Journey-to-Work, BEA's LPI CA91 and CA05 tables, and some of EMSI's data. The process incorporates the cleanup and disaggregation of the OnTheMap data, the estimation of a closed system of county inflows and outflows of earnings, and the creation of finalized commuting data.

A3.3.3 National SAM

The national SAM as described above is made up of several different components. Many of the elements discussed are filled in with values from the national Z matrix – or industry-to-industry transaction matrix. This matrix is built from BEA data that describe which industries make and use what commodities at the national level. These data are manipulated with some industry standard equations to produce the national Z matrix. The data in the Z matrix act as the basis for the majority of the data in the national SAM. The rest of the values are filled in with data from the county earnings distribution matrices, the commuting data, and the BEA's National Income and Product Accounts.

One of the major issues that affect any SAM project is the combination of data from multiple sources that may not be consistent with one another. Matrix balancing is the broad name for the techniques used to correct this problem. EMSI uses a modification of the "diagonal similarity scaling" algorithm to balance the national SAM.

A3.3.4 Gravitational flows model

The most important piece of the EMSI MR-SAM model is the gravitational flows model that produces county-by-county regional purchasing coefficients (RPCs). RPCs estimate how much an industry purchases from other industries inside and outside of the defined region. This information is critical for calculating all IO models.

Gravity modeling starts with the creation of an impedance matrix that values the difficulty of moving a product from county to county. For each sector, an impedance matrix is created based on a set of distance impedance methods for that sector. A distance impedance method is one of the measurements reported in the Oak Ridge National Laboratory's County-to-County Distance Matrix. In this matrix, every county-to-county relationship is accounted for in six measures: great-circle distance, highway impedance, rail miles, rail impedance, water impedance, and highway-rail-highway impedance. Next, using the impedance information, the trade flows for each industry in every county are solved for. The result is an estimate of multi-regional flows from every county to every county. These flows are divided by each respective county's demand to produce multi-regional RPCs.

Appendix 4: Value Each Graduate Receives and the Mincer Function

Two key components in the analysis are 1) the value of the graduates' certificates or associate's degrees, and 2) the change in that value over the graduates working careers. Both of these components are described in detail in this appendix.

A4.1 Value each Graduate Receives

The first step is to find the median wage of graduates who receive their certificate or associate's degree in the Psychiatric Technician Training Program. In addition, we also find the wage of the graduates if they had chosen not to attend the program but had a high school diploma. The difference in career midpoint earnings between a high school diploma and an certificate from the Psychiatric Technician Training Program is $25,620 and the difference between a high school diploma and an associate's degree from the program is $29,232.

The sum of each graduate's corresponding incremental earnings yields the graduate's aggregate annual increase in income. Table A4.1 displays the result for the students' aggregate annual increase in income, a total of $2.6 million. By dividing this value by the total number of graduates, we derive an overall value of $22,590.

Table A4.1: Aggregate annual increase in income of students and value each graduate receives

Aggregate annual increase in income	$2,620,470
Total program graduates in FY 2014-15	116
Value each graduate receives	$22,590

Source: EMSI Impact model.

A4.2 Mincer Function

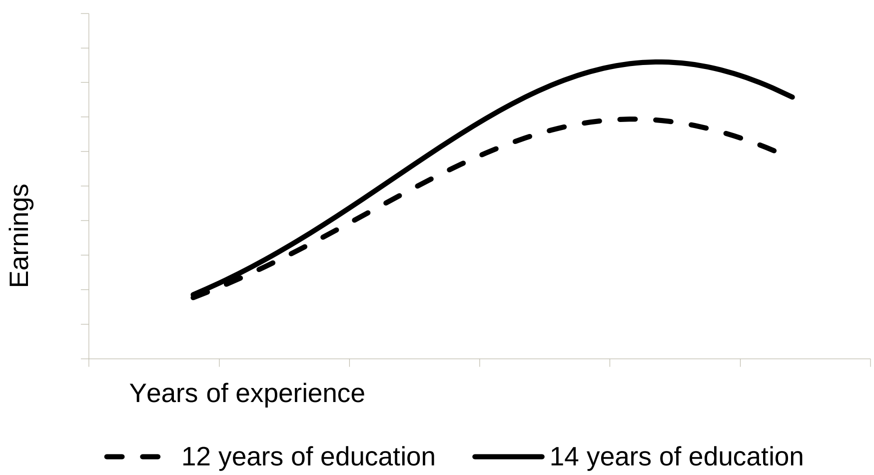
The $22,590 value each graduate receives in FY 2014-15 from their education in Table A4.1 only tells part of the story, however. Human capital theory holds that earnings levels do not remain constant; rather, they start relatively low and gradually increase as the worker gains more experience. Research also shows that the earnings increment between educated and non-educated workers grows through time. These basic patterns in earnings over time were originally identified by Jacob Mincer, who viewed the lifecycle earnings distribution as a function with the key elements being earnings, years of education, and work experience, with age serving as a proxy for experience.[5] While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Those critical of the Mincer

[5] See Mincer (1958 and 1974).

function point to several unobserved factors such as ability, socioeconomic status, and family background that also help explain higher earnings. Failure to account for these factors results in what is known as an "ability bias." Research by Card (1999 and 2001) suggests that the benefits estimated using Mincer's function are biased upwards by 10% or less. As such, we reduce the estimated benefits by 10%. We use United States based Mincer coefficients estimated by Polachek (2003).

Figure A4.1 illustrates several important points about the Mincer function. First, as demonstrated by the shape of the curves, an individual's earnings initially increase at an increasing rate, then increase at a decreasing rate, reach a maximum somewhere well after the midpoint of the working career, and then decline in later years. Second, individuals with higher levels of education reach their maximum earnings at an older age compared to individuals with lower levels of education (recall that age serves as a proxy for years of experience). And third, the benefits of education, as measured by the difference in earnings between education levels, increase with age.

Figure A4.1: Lifecycle change in earnings, 12 years versus 14 years of education



In calculating the graduate impact in Section 3, we use the slope of the curve in Mincer's earnings function to condition the $22,590 value each graduate receives to the graduate's age and work experience. The graduates just starting their career during the analysis year receive a lower value for their education; the students in the latter half or approaching the end of their careers receive a higher value for their education. The original $22,590 value each graduate receives applies only to the students precisely at the midpoint of their careers during the analysis year.

Because we only have 13 years' worth of graduates, most of the graduates are in the early part of their working career. This means that the value that they receive in FY 2014-15 for their education is lower than the midpoint value of $22,590. After adjusting for the Mincer function, or where the students are in their working careers, the average value each graduate receives is $15,183.

Appendix 5: Alternative Education Variable

In a scenario where the Psychiatric Technician Training Program at WHC Coalinga did not exist, some of its students would still be able to avail themselves of an alternative comparable education. These graduates create benefits in the region even in the absence of the program. The alternative education variable accounts for these graduates and is used to discount the benefits we attribute to the program.

Recall this analysis considers only relevant economic information regarding the program. Considering the existence of that same program at other academic institutions surrounding the region, we have to assume that a portion of the students could find alternative educations and either remain in or return to the region. For example, some students may attend psychiatric training programs at other out-of-region institutions and return to the region upon completing the program. For these students–who would have found an alternative education and produced benefits in the region regardless of the presence of the Psychiatric Technician Training Program at WHC Coalinga–we discount the benefits attributed to the program. An important distinction must be made here: the benefits from students who would find alternative educations outside the region and not return to the region are *not* discounted. Because these benefits would not occur in the region without the presence of the Psychiatric Technician Training Program at WHC Coalinga they must be included.

In the absence of the Psychiatric Technician Training Program at WHC Coalinga, we assume 15% of the program's students would find alternative education opportunities and remain in or return to the region. We account for this by decreasing the number of graduates in the region by 15%. In other words, we assume 15% of the program's graduates would have the same impact on the regional economy in the counterfactual scenario where the Psychiatric Technician Training Program at WHC Coalinga did not exist.