The Economic Impact of the

JOHNSON COUNTY EDUCATION RESEARCH TRIANGLE

on the Kansas City Metropolitan Area

Franklin A. Lenk, PhD
Director of Research Services

Mid-America Regional Council
600 Broadway, Suite 200
Kansas City, MO 64105

August 2019

Introduction

Regions grow when their economies are able to provide goods and services to the rest of the world and are able to do so at lower cost or higher quality than other regions. The resulting exports bring new dollars into the area which then get recirculated through successive rounds of spending decisions by businesses and consumers. Though some dollars leak out of the region in each round, because no region or nation is economically self-contained, those that remain continue to produce further economic impact. In the end, the final impact on a metropolitan economy is typically two to three times larger than the initial influx of dollars from exports, which is why such export dollars are said to have a multiplier effect.

Increasingly, the ability of a region's firms to consistently produce better goods and services for less cost depends on the innovation capacity of the people they employ. Expertise in science, engineering, technology and math (STEM) is especially critical, given the increasing digitalization of the national and world economies.

Preparing residents with such capacities is the role of higher education. The overall educational attainment of Greater Kansas City's residents is about average, ranking 15th out of 31 peer metros in the percentage of adults with at least an associate degree[1]. Unfortunately, among those with bachelor's degrees, metropolitan Kansas City scores much lower on the percentage of residents with degrees in STEM fields, ranking 28th. This relatively low level of STEM expertise when STEM fields are among the most rapidly growing inhibits the region's economic competitiveness.

Additionally, institutions with strong research capabilities in STEM fields bring dollars into the region from the federal government, as well as firms around the country, to conduct that research. Strong research capacity also raises a region's profile as a location where innovation takes place, important to attracting and retaining top research talent. When that research is in medicine, the research can also lead to longer life and more years of high-quality life for both area residents and the rest of the world.

It was to create these kinds of opportunities for economic growth and prosperity that the residents of Johnson County approved the creation of the Johnson County Education Research Triangle (JCERT) and approved funding it through a one-eighth-cent sales tax in 2008. Now, 10 years later, it is time to take stock of what is being accomplished.

This impact study evaluates the economic benefits flowing from the investments made and programs created utilizing the JCERT tax. These investments include creating a new campus for Kansas State University in Olathe, constructing the Business, Education, Science and Technology

[1] The Kansas City metropolitan area's 30 peer metros are defined by KC Rising (www.kcrising.com). How Greater Kansas City compares on a wide variety of socioeconomic indicators can be found at KC Rising's metrics site, www.kcrisingmetrics.org.

building on the KU Edwards campus in south Overland Park, and expanding the University of Kansas Clinical Research Center, housed in a state-of-the-art building in Fairway.

The purpose of this study is to estimate how much larger the Kansas City metropolitan economy is as a result of these investments than it would have been without them. This is done by using a regional economic model to trace the flow of dollars into and out of the metropolitan area as a result of expenditures related to the creation and operation of JCERT. The model and its operation are described in the next section.

Methodology

Economic impact estimates were prepared by the Mid-America Regional Council using the Policy Insight™ model from Regional Economics, Inc. (the REMI model). This model is comprised of some 2,000 simultaneous equations, whose aim is to describe how the Kansas City metropolitan economy competes against rest of the U.S., industry-by-industry, for 70 sectors.

Like most economic impact models, at its heart it is an input-output model describing how each industry's products and services are produced using inputs from all the other industries. These "industrial recipes" are made specific to the Kansas City region by modeling how much of local demand is satisfied by local suppliers vs. being imported from outside the region and how much of local production is exported to the rest of the U.S. and world.

Unlike other economic impact approaches, the REMI model estimates how an economy responds over time to an economic shock or stimulus. As such, it models the long-term impact of these changes, not just the short-run immediate impact. Prices are flexible in the model, so that a stimulus, which increases demand for labor and other inputs, increases prices. These increases in costs then reduce the long-term impact compared to the short-term. This means that the model typically produces somewhat more conservative estimates than standard economic impact approaches.

The REMI model is a forecasting model. It comes with U.S. and Kansas City area historical economic data from 1991 through 2016, along with a baseline forecast of the economic growth for each out to 2060. This baseline forecast, also known as a control forecast, represents the expected state of the economy in the absence of any new policies or investments. This is then compared to a policy forecast where the investments and programs of interest are simulated by inputting their expenditures and letting the model estimate which sectors of the economy are affected and by how much. The difference in the level of economic activity between the baseline and policy forecasts provides the estimate of the economic impact of the assumed investments and programs.

The REMI model provides more than 2,000 policy variables to assist in simulating the policy alternative. The art of modeling lies largely in knowing what data to prepare, what assumptions

are reasonable in preparing that data, and which combination of policy variables to use and in what order.

Unfortunately, the REMI model cannot run a simulation in history. Instead, one must create a simulation that starts from the last year of history. To conduct the simulation, MARC replicated the year-by-year pattern of increased economic activity supplied by each institution. According to the data provided, these revenues and expenditures began in 2010[2] and ended in 2018. This data was then translated into equivalent model years that begin in 2017 end in 2025. All dollar values are entered in constant 2016 dollars (the last year of history) to eliminate the effects of inflation.

There was a desire to estimate the impact based only on the eight years of data provided and not do any forecasting. Simultaneously, there was a desire to be able to compare the results to the initial impact estimates, which were based on a 20-year timeline. Moreover, these are young programs, with some not beginning full operation until 2013, providing only five years of data to estimate impact. Perhaps most importantly, one the largest contributors to economic impact is the increased earnings of graduates. These graduates accumulate in the region over time, producing larger impacts as the number of graduates residing in the region grows.

Balancing these somewhat competing desires, MARC felt it was important to extend the simulation out an additional 10 years to match the prior impact analysis and the term of the bonds issued to finance the initial JCERT investments. Despite the fact that these programs are currently growing rapidly, to be conservative and to fit more with the desire for the impact estimates to be based on actual data and not an assumption-filled forecast, MARC simply held the data provided for 2018 constant over this additional time frame. Thus the full range of data input into the REMI model covered a period from 2010 to 2028. Again, because the model cannot re-run history, this data was translated into an equivalent 18-year model simulation period running from 2017 to 2035.

One of the most important considerations in conducting an economic impact study is to avoid double-counting dollars that would have been in the economy anyway. When the situation is simple, this is easy. If a manufacturer builds a new plant in the region, virtually all of the product is typically exported out of the region, which in turn means virtually all of the dollars that flow into an area are net new. Then, as the plant purchases parts and supplies from local dealers, and as it pays its workers who then buy goods and services in the region, that full economic footprint of activity can legitimately be counted as being caused by the new plant. The total economic footprint equals its economic impact.

The situation is different, though, if the investment is a new attraction, like an amusement park. While some of the dollars paying for the park and its operation might come from outside the

[2] There was a one-month payment of the JCERT tax in 2009, but the economic activity did not begin until 2010. When estimating the impact of the sales tax as described below, this one-month amount was added to the 2010 tax receipts and the simulation started there.

region, most would likely come from local residents who are spending money at the park that they would have otherwise spent elsewhere in the local economy. Thus, as dollars flow into the park from local residents, and equivalent amount of dollars flows out of the other places they might spend their money, such as groceries, other entertainment options or even savings.

While portions of the revenues received by the JCERT institutions act like those for a manufacturer — the research dollars flowing from outside the region to the KU Cancer Center's Clinical Research Center, for example — a large portion are dollars from local residents and businesses spent for things like tuition and events. To assume that all of these dollars contribute to net new economic activity would be to double count them since they already exist in the economy.

There are two ways to avoid double-counting local dollars. The simplest is to simply exclude them from the analysis. This was the approach of the initial JCERT economic impact analysis. The REMI model offers an alternative approach of adding in the new activity and then subtracting the local dollars from where they otherwise would have been spent. Modeling the spending as displacement of existing spending has the advantage of more accurately modelling which sectors benefit from the new activity and which might be hurt. MARC chose to employ this latter approach.

MARC carried this methodology to the JCERT sales tax itself. This sales tax, which funded the construction or substantial renovation of three buildings and continues to provide an ongoing source of funding for program development, represents a diversion of spending from that which residents would have ordinarily made. As a sales tax, it has the impact of raising prices and, based on recommendations from REMI's senior staff, this is how MARC simulated its impact. Raising the cost of retail goods reduces the income available to be spent in other parts of the economy. While we calculate the total value of the economic footprint created by the JCERT institutions for comparison with other studies, we subsequently subtract the impact of increasing the sales tax so that the final estimate is one of the net benefit to the Kansas City economy, rather than a gross impact.

Double-counting is also an issue with respect to how impact is measured. Most studies measure the dollar value of the overall economic impact in terms of output. But output is essentially equal to sales, and a sales price reflects the costs incurred during all prior stages of production. For example, the sales price of a car includes the cost of the glass, steel, rubber and electronics that go into it. These inputs are purchased by the automaker, not manufactured by it. On top of these input costs, though, the price also includes the value added by the automaker itself — the work that goes into the design, assembly and quality control that transform such inputs into a high-quality vehicle. As products move from raw material to finished good, the sales price at each stage embodies all of the prior input costs. As a measure of economic activity, output simply sums up the sales price at each stage and, as a result, counts the costs of earlier stages of production every time those products are included in later-stage products.

Because of this repeated counting, national economic accounts typically report total economic activity not as output, but as GDP (Gross Domestic Product). GDP subtracts the cost of inputs from the sales price at each stage of production, so that when activity is summed across stages, only the value added at each stage is counted. Applied locally, GDP measures the value added by the Kansas City economy only, not the value of inputs purchased from other parts of the country.

MARC chose to report the total dollar value of economic activity created by JCERT as GDP, rather than output, because it is a better measure of local economic impact and it is more consistent with the way national measures of the economy are reported. It does, however, result in substantially more conservative impact estimates than most studies. In 2016, for example, the REMI model estimates metropolitan Kansas City's GDP at $124 billion compared to its output estimate of $219 billion, which is roughly 75 percent higher.

In addition to GDP, the economic impact of JCERT in this study is also measured by employment (jobs) and total personal income. Dollar-denominated impact measures can reasonably be summed over the study period as the net present value of the stream of benefits. For purposes of this analysis, MARC assumed the discount rate for the net present value calculation of 1 percent in real terms. With inflation currently running about 2 percent, this is equivalent to a 3 percent discount rate in nominal terms. MARC's research revealed that this is the rate at which the city of Grandview, Missouri, was recently able to issue bonds. MARC assumed that Johnson County would be able to do the same.

While dollars can reasonably be summed over time, jobs cannot. A firm with 100 jobs today and 100 jobs tomorrow does not have 200 jobs. It has an average of 100 jobs over the two periods. Hence job gains from JCERT are reported as the annual average of jobs gained over the full 18-year study period.

Input Data:
MARC surveyed each of the educational institutions to receive budgetary information regarding their operations as measured by their receipts and expenditures. This included receipts from the JCERT tax itself as well as revenue from other operations that were enabled by JCERT, including tuition, grants, and any allocations from a main campus to a local satellite campus. Revenues from spinoff activities were also included if they could legitimately be attributed to the existence of JCERT. Tuition was split into that coming from local students vs. that from students who were originally from outside the Kansas City region. The principal expenditures surveyed included the wages and salaries of personnel, who were assumed to live within the Kansas City area, and the initial construction costs.

MARC also surveyed the JCERT institutions concerning the number of graduates from programs supported by JCERT funding. On average, as students earn additional degrees and certifications, income rises as a result of increased productivity to employers. Because most graduates remain in the metropolitan area year after year, each graduating class adds to the number of graduates earning at higher levels than they otherwise would have. As numbers build over time, this

growth in workforce productivity and income typically accounts for a large portion of the long-run economic impact of an educational institution.

Finally, MARC surveyed the JCERT institutions for information about the number of visitors to the region, which might include participants in programs or, in the case of KUCC, patients. Like students, these were also separated into the portion who reside within the metropolitan area and those who likely traveled from outside of the region.

The collection of survey responses was followed by extensive interviews with each educational institution to resolve issues related to missing or incomplete data as well as compatibility issues in the way each institution reported its data.

Economic Impact Estimation Process:
The steps below describe the process used to simulate K-State Olathe's economic impact. K-State Olathe had the widest variety of revenue streams, making it a good case study to illustrate the process followed for generating economic impact estimates using the REMI model. Five different categories of impact were analyzed: operations, construction, visitors, spinoff businesses and graduates:

Step 1: Operations Impact:

1. We began by inputting the employment at K-State Olathe provided to MARC into the REMI model, year by year, as an increase in Educational Services employment.

2. REMI then estimated the output produced and compensation paid to those workers based on the average productivity (output per worker) and compensation per employee in the Educational Services industry.

3. K-State Olathe is not an average educational institution, however, as the educational industry averages are weighted towards elementary and secondary schools. K-State Olathe's actual revenues (the conceptual equivalent of output) and payroll are substantially larger than REMI's initial estimates based on industry averages.

4. MARC calculated the difference between the data provided and REMI's estimates and used REMI's policy variables to input an adjustment, first to output and then to compensation, so the model's data matched the actual data. This was done without affecting the number of employees previously input.

5. The source of some of the tuition revenue was from local residents. MARC assumed that residents paid their tuition by diverting their typical consumption expenditures. This was input into the REMI model as a reduction in consumption expenditures allocated to consumption categories based on historical spending patterns.

6. The combination of steps 1-5 above were input into the REMI model, which then simulated how these revenues flow from the institution to local businesses, employees, and out into the general economy.

Step 2: Construction Impact:

7. Next, MARC estimated the impact of the building construction. Construction impacts are short-term in nature, but they produce early increases in economic activity. The building construction expenditures were input as an increase in the output of the educational structures construction sector.

8. To this was added the equipment purchases for the building. This was input as equipment investment. Combining steps 7 and 8 simulates the impact of the building construction.

Step 3: Visitor Impact:

9. Next, the impact of visitors to the institution was simulated. The number of out-of-town visitors was provided by K-State Olathe. It was assumed the remaining visitors were from in town and were all day trips. Day trip expenditures were assumed to average $10 per person per day, largely for food. Out-of-town visitors were assumed to spend $100 for a room and $20 for food and gasoline.

10. MARC assumed that 50 percent of the day trip visitor expenditures would have occurred elsewhere in the local economy regardless of the existence of JCERT programs and, in a manner equivalent to step 5 above, reduced local consumption expenditures by this amount.

11. Both day trip and overnight stay visitor expenditures were input into the model, which then simulated the flow of visitor dollars throughout the rest of the economy.

Step 4: Spinoff Business Impact:

12. Two spinoff companies were identified by K-State Olathe. The impact of their operations was simulated in a manner completely analogous to that of the institution itself. First, their employment levels were input. It was assumed that both spinoffs were part of the Professional, Scientific and Technical Services industry.

13. Based on REMI's estimates of output per employee and compensation per employee, its initial estimate of total output and total compensation were calculated. This was then compared to the data on actual revenue and actual payroll provided by the firms and K-State Olathe.

14. Because these are startups, their actual sales volume was less than what REMI estimated based on industry averages. Similarly, actual compensation was also less than the industry average. MARC used REMI's policy variables to adjust output and compensation to match the input data provided, and the model was rerun to simulate the impact based on these corrected values.

Step 5: Graduate Impact

15. On average, additional educational attainment leads to higher compensation. Each graduating class is modelled as a cohort. As the number of graduating classes increases,

so do the number of graduates in the region earning higher incomes as a result of their academic success. Each new cohort then adds to the accumulated total earnings increase from previous cohorts.

16. Key assumptions are as follows:

    a. Average earnings differential by degree is from the 2017 American Community Survey (ACS), 1-year data, and adjusted to 2016 dollars for consistency with other inputs:

Median Earnings by Educational Attainment, 2016 Dollars	Median annual earnings	Increment from prior attainment level
Less than high school graduate	$25,328	
High school graduate (includes equivalency)	$31,153	$5,825
Some college or associate degree	$36,552	$5,399
Bachelor's degree	$52,500	$15,948
Graduate or professional degree	$62,858	$10,358

    b. Regional annual out-migration rate of those with a bachelor's degree and above is 4.5 percent, according to Public Use Microdata Sample (PUMS) of the 2016 ACS, as accessed via IPUMS USA.

    c. The increment from the prior attainment level is assumed to be received immediately upon graduation and kept constant throughout the simulation period. While the actual time pattern of earnings increases likely starts lower and ends higher, the above figures should average out over a long enough time period, such as the 18-year period of the study.

    d. The number of graduates each year of the study period was capped at the 2018 levels.

17. Because of the technical nature of the programs being offered as part of JCERT, it was assumed the graduates were employed in the Professional, Scientific and Technical Services industry. The cumulative increase in graduate compensation was input into the model in this industry.

18. Further, it is assumed that firms in the industry were able to increase the compensation of graduates because their productivity increased, resulting in increased sales or output. Therefore, REMI's policy variables were also used to simultaneously increase the output of this industry. Compensation and output were increased without increasing employment because it was assumed that graduates were already employed in the

industry and the increased education helped them advance, rather than obtain a first job.

Step 6: Sales Tax Impact

19. The combination of the above steps produces what might be called the "economic footprint" of JCERT. This footprint estimates how much economic activity in the Kansas City metropolitan area is affected by the investments and programs implemented because of JCERT. However, the cost of achieving those benefits — the one-eighth-cent sales tax levied in Johnson County — has not yet been subtracted out. The negative impact of raising the sales tax must be included in order to calculate the net economic benefit to the region.

20. A sales tax is implemented as an increase in prices in the REMI model, which reduces real, inflation-adjusted incomes. This, in turn, reduces expenditures elsewhere in the economy.

This methodology was developed by MARC in consultation with REMI's senior staff. The methodology and resulting economic impact estimates were further reviewed by Doug Davidson, County Economic Research Institute (CERI) and Peter Eaton, Department of Economics, University of Missouri-Kansas City (UMKC), emeritus. The feedback received allowed MARC to produce what we believe are high-quality estimates using well-reasoned and justifiable methods. However, the figures below remain estimates, and any errors remain the responsibility of MARC. Spreadsheets documenting the results are available upon request.

Summary of Impact Estimates

After inputting the provided data into the REMI model, the economic impact of each step was calculated in for each institution. These results are provided below:

KSU Olathe Economic Impact Estimate

Impact measure	Jobs	GDP	Personal Income
metric	average annual	net present value, millions of 2016 dollars	net present value, millions of 2016 dollars
Operations	83	$215.4	$121.3
Construction	21	$31.8	$28.3
Visitors	5	$5.6	$4.4
Spinoff Businesses	20	$20.9	$27.2
Graduates' Income & Productivity	15	$48.7	$39.2
Economic Footprint	144	$322.3	$220.3
Less Sales Tax Impact	(78)	($139.8)	($199.9)
Total Economic Impact	66	$182.5	$20.4

KU Edwards Economic Impact Estimate

Impact measure	Jobs	GDP	Personal Income
metric	average annual	net present value, millions of 2016 dollars	net present value, millions of 2016 dollars
Operations	58	$126.2	$80.2
Construction	18	$27.7	$24.7
Visitors	9	$9.7	$7.8
Spinoff Businesses	0	$0.0	$0.0
Graduates' Income & Productivity	107	$340.7	$275.0
Economic Footprint	192	$504.3	$387.6
Less Sales Tax Impact	(78)	($139.8)	($199.9)
Total Economic Impact	115	$364.6	$187.7

KU Clinical Research Center Economic Impact Estimate

Impact measure	Jobs	GDP	Personal Income
metric	average annual	net present value, millions of 2016 dollars	net present value, millions of 2016 dollars
Operations	190	$435.5	$225.7
Construction	15	$22.7	$19.8
Visitors	2	$2.4	$1.9
Spinoff Businesses	$0.0	$0.0	$0.0
Graduates' Income & Productivity	$0.0	$0.0	$0.0
Economic Footprint	206	$460.5	$247.3
Less Sales Tax Impact	(78)	($139.8)	($199.9)
Total Economic Impact	128	$320.8	$47.4

Total JCERT Economic Impact

Impact measure	Jobs	GDP	Personal Income
metric	average annual	net present value, millions of 2016 dollars	net present value, millions of 2016 dollars
Operations	331	$777.0	$427.2
Construction	54	$82.2	$72.7
Visitors	16	$17.7	$14.1
Spinoff Businesses	$19.9	$20.9	$27.2
Graduates' Income & Productivity	$122.2	$389.4	$314.1
Economic Footprint	543	$1,287.2	$855.3
Less Sales Tax Impact	(234)	($419.4)	($599.7)
Total Economic Impact	309	$867.8	$255.5

Overall, the passage, formation and implementation of JCERT is estimated to create a little more than 300 permanent jobs in the Kansas City area economy. Over the 18-year study period, and assuming a 3 percent discount rate, the present value of the estimated increase in the region's GDP created by JCERT is expected to be nearly $900 million, while the increase in personal income is expected to total more than $250 million (both are measured in constant 2016 dollars). Importantly, these are net impact figures that have already accounted for the fact that area residents voted to tax themselves to finance the initial capital investment required by the JCERT institutions and a portion of each institution's ongoing operational expenditures.

Conclusion and Future Research

As impressive as the above figures are, they are likely conservative estimates of the impact going forward. As stated earlier, MARC made no forecast of program growth in the above estimates, keeping the size of JCERT-funded programs constant in terms of revenues, employment and graduates at the 2018 levels provided by the institutions. Yet, in many ways, the programs funded by JCERT are still young and in their early growth phases. The potential for collaboration among the JCERT institutions, just now beginning to be explored, can only add to their growth prospects. As programs grow, so do the number of JCERT graduates, which produces an ever-rising number of residents earning higher incomes and so an increasing economic impact on the Kansas City area over time.

Growing programs also yield more research dollars, especially for the KU Clinical Research Center. In addition to ignoring any impact from the growth of these dollars, the current study also did not take into account the economic impact of any health benefits derived from the clinical trials conducted. Many of the participants in clinical trials are local and, by receiving cutting edge care, some portion of them can expect to see improved health outcomes and even

lives extended. To the degree that improvements in health raise the productivity of the area workforce or increase the length of their productive lives, this also improves the region's income-producing potential, just as it does when workers gain higher levels of education.

It must also be noted that the current estimates are likely a conservative estimate of the impact on Johnson County itself. The REMI model as currently constituted provides estimates of impact on the entire Kansas City metropolitan economy. It is a single-area model. In such a model, when students or program participants who live in the region spend money at JCERT institutions, this expenditure is shown as being diverted from spending that would have otherwise occurred elsewhere *within the same area*. The net impact of that spending is thus mostly washed out.

Yet, from the perspective of Johnson County alone, expenditures from metro residents who live outside the County are still net additions to the County's economy. A one-area model cannot capture this effect. For an extra fee, it is possible to obtain from REMI a license to a two-area model that would break out Johnson County from the rest of the region and trace the flow of dollars between them. MARC has successfully employed a multi-area REMI model in the past to estimate the impact on both the city of Kansas City, Missouri, and the region of the Kansas City Royals and the Kansas City Chiefs, of expanding Bartle Hall, of creating Science City, as well as other projects. In MARC's view, obtaining a multi-area model would provide the most reliable estimates of the economic impact of JCERT on Johnson County itself. However, the additional license fee is an impediment, so this is work still to be done.

Finally, the amount by which an increase in educational attainment increases earnings potential is based on the current difference in average earnings by type of degree. A more precise method would look at the age at which students graduate and from which program, and then estimate the life cycle of expected earnings given their age and the occupations the graduate is likely to work in after completing a degree or certificate. Adopting a life cycle approach complicates the analysis considerably, requires significantly more information from the institutions on their graduates, and would not necessarily lead to larger or smaller estimates than those provided here. It would, however, provide a check on the validity of the simpler method adopted for this report and so also remains research to be done.