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REPORT

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# IS GROWTH IN OUTSTATE MISSOURI TIED TO GROWTH IN THE ST. LOUIS AND KANSAS CITY METRO AREAS?

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## KEY TAKEAWAY

- Changes in employment growth in the St. Louis metropolitan area appear to cause changes in the same direction to employment growth in outstate Missouri.

## INTRODUCTION

In a 2016 Show-Me Institute essay, Michael Podgursky and Nick Pretnar demonstrated the proportional importance to the state economy of Missouri's two dominant metro areas.[1] As they report, the St. Louis and Kansas City metro areas together account for well over half of Missouri's economic output (64 percent of gross state product in 2013), indicating that the aggregate performance of the state economy is largely determined by the performance of the two metro areas' economies. In this essay I take this idea a step further and examine whether there is more than simply a proportional relationship.

Specifically, I look at whether the level of growth in outstate Missouri (all areas not included in the two metro areas) can be predicted by the levels of growth in the metro areas. Because predictability would be consistent with a causal link between the economies of the metro areas and outstate Missouri, economic events in the metro areas might be of greater interest to the rest of the state than is usually thought. In terms of policy, causality would, among other things, strengthen arguments that the state as a whole (and thus state government) has an interest in local-level economic policymaking within the St. Louis and Kansas City metro areas.

The motivation for pursuing such links is the long-held view among researchers that the economic pull of cities extends beyond their metro areas into megaregions, usually centered around traditional metro areas. Recent research has extended the study of metro areas to account for interconnectedness: for example, St. Louis is connected to Wentzville, and Wentzville is connected to Columbia, so St. Louis and Columbia are interconnected.[2] Such research suggests that what happens in St. Louis and Kansas City doesn't stay in St. Louis and Kansas City. This essay provides some evidence of the importance of this interconnectedness.

## MODELING WITHIN-MISSOURI CAUSALITY

It should be noted that true causality, which is embedded in nearly all economic models and theories, is difficult if not impossible to prove empirically. Economists often test for a special type of causality—Granger causality—which occurs when changes in one data series are followed on a statistically consistent basis by changes in a second time series.[3] While not conclusive, Granger causality is a useful empirical test for the possible existence of the causal links inherent in economic theories. As an example: all else constant, if changes in Kansas City's growth are followed the next year by predictable changes in outstate Missouri's growth, then Kansas City's growth is said to "Granger-cause" outstate Missouri's growth.

The growth variable used throughout this analysis is the percentage change in household employment (the number of people employed), which is provided by the Bureau of Labor Statistics.[4] Household employment is the most suitable variable because, to my knowledge, it is the only one that meets the following criteria: enough observations over time, data at the metro and state levels, and metro-level data that can be split into in-state and out-of-state parts.[5] Using household employment data, I test for links among the St. Louis and Kansas City metro areas and outstate Missouri using annual averages for the data for 1990 through 2019. Data are available for 2020 and 2021, but pandemic years should be treated as outliers.

The empirical test for Granger-causality is relatively straightforward: the current values of each of the three endogenous variables (all annual employment growth rates: *OMO* = outstate Missouri, *STL* = St. Louis metro area, and *KC* = Kansas City metro area) are modeled as being determined by lagged values of all three variables. Each regression equation is then estimated independently. If the lags of one area's growth are statistically significant in another area's equation, then growth in the first area is said to cause growth in the second. There are, of course, exogenous factors that might affect all three endogenous variables. To control for the overall business cycle, I include in the estimation the rate of growth of the U.S. economy net of the Missouri economy, denoted as *US′*. To control for other occurrences over time that might be driving growth in the three areas, the model includes a quadratic trend. Because of the relatively short time series, the model includes only one lag for each endogenous variable.[6] The three equations constitute a vector autoregressive (VAR) model and are estimated using Ordinary Least Squares. In each, $\varepsilon_i$ is the idiosyncratic part of growth not captured by the other variables:

$$(1)\ OMO_t = \alpha_1 + \beta_1 OMO_{t-1} + \lambda_1 STL_{t-1} + \gamma_1 KC_{t-1} + \delta_1 US'_t + \eta_1 time + \kappa_1 time^2 + \varepsilon_{1t}$$

$$(2)\ STL_t = \alpha_2 + \beta_2 OMO_{t-1} + \lambda_2 STL_{t-1} + \gamma_2 KC_{t-1} + \delta_2 US'_t + \eta_2 time + \kappa_2 time^2 + \varepsilon_{2t}$$

$$(3)\ KC_t = \alpha_3 + \beta_3 OMO_{t-1} + \lambda_3 STL_{t-1} + \gamma_3 KC_{t-1} + \delta_3 US'_t + \eta_3 time + \kappa_3 time^2 + \varepsilon_{3t}$$

Table 1: **Estimation Results: Ordinary Least Squares for VAR System**

| | | Equation (1) Outstate Mo. | | Equation (2) St. Louis Metro | | Equation (3) KC Metro | |
|---|---|---|---|---|---|---|---|
| Variable (notation) | Parameter | Coeff. | t-stat. | Coeff. | t-stat. | Coeff. | t-stat. |
| Constant | $\alpha_i$ | 1.869 * | 2.14 | 0.415 | 0.41 | 1.538 | 1.24 |
| Outstate Missouri $(OMO_{t-1})$ | $\beta_i$ | 0.128 | 1.32 | −0.082 | −0.73 | −0.005 | −0.03 |
| St. Louis metro $(STL_{t-1})$ | $\lambda_i$ | 0.513 * | 2.95 | −0.242 | −1.20 | −0.406 | −1.64 |
| Kansas City metro $(KC_{t-1})$ | $\gamma_i$ | 0.168 | 0.98 | 0.140 | 0.71 | 0.285 | 1.17 |
| U.S. without Missouri $(US'_t)$ | $\delta_i$ | 0.608 * | 3.77 | 0.804 * | 4.33 | 0.497 * | 2.17 |
| Time | $\eta_i$ | −0.226 * | −2.16 | −0.112 | −0.93 | −0.173 | −1.17 |
| Time squared | $\kappa_i$ | 0.004 | 1.47 | 0.003 | 0.97 | 0.005 | 1.20 |
| $R^2$ | | 0.833 | | 0.515 | | 0.322 | |
| $\rho$ | | 0.007 | | 0.126 | | 0.063 | |
| Durbin-Watson statistic | | 1.968 | | 1.699 | | 1.857 | |

*Statistical significance at the 5 percent level is indicated by an asterisk.*

## RESULTS

The estimation results are reported in Table 1. The $R^2$s indicate the predictive power of the model while the coefficients on the two exogenous variables—time and U.S. growth—indicate the extent to which growth in the three areas is driven by time trends and the general state of the U.S. economy. As already noted, causality is indicated by the statistical significance of the estimated coefficients on the lags of the endogenous variables ($\beta_i, \lambda_i, \gamma_i$; i = 1,2,3).

As indicated by the $R^2$s, the model is much better at explaining growth in outstate Missouri than in either of the metro areas: about 83 percent of the variation in *OMO* is explained by the model, whereas the model explains only about 52 and 32 percent of the variation in *STL* and *KC*, respectively. For reference, the fitted and actual values of the three endogenous variables are shown in Figure 1.

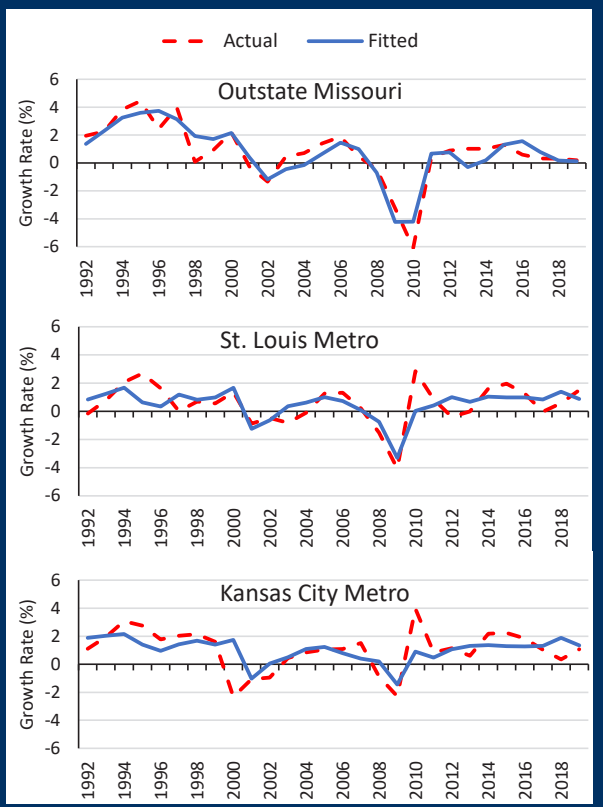
Most importantly for our purposes, because the estimate of $\lambda_1$ is statistically significant, the results suggest that growth in the St. Louis metro area caused growth in outstate Missouri. None of the other relevant coefficients are statistically significant, although $\lambda_3$, which would indicate a causal link from the St. Louis metro area to the Kansas City metro area, was not far from being statistically significant.

The estimated coefficients alone do not tell us the total effect of a change in one area on other areas, which requires using the entire system of equations (1), (2), and (3). That is, a shock to growth in (for example) the St. Louis metro area will spread through the other two areas and back, then out to the other areas and back again, and so on, dissipating over time. The complete estimate of the effects of a shock are captured by impulse responses, which show the growth effects over several time periods for all three areas. Of the impulse responses in this model, the only statistically significant effect is for that of a shock to St. Louis metro growth on outstate Missouri growth (see Figure 2).

As illustrated by Figure 2, a one-percentage-point shock to growth in the St. Louis metro area this year will mean about a 0.5-percentage-point increase in outstate Missouri's growth rate next year, followed by a couple of years of small decreases in growth.[7] The cumulative effect is that outstate Missouri's employment growth would be about 0.35 percentage points higher 2 to 3 years after the shock to the St. Louis metro economy. In terms of

Figure 1

**Fitted versus Actual Values: Employment Growth 1992–2019**

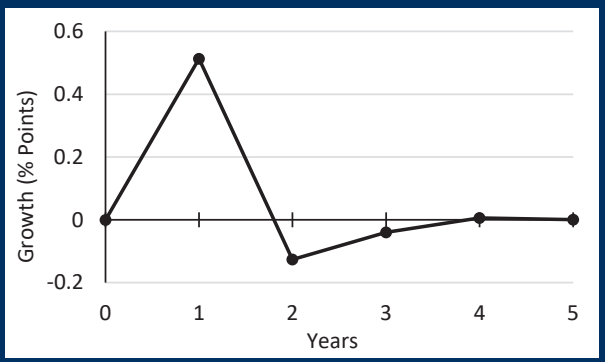



employment levels, a rule of thumb is that if the shock meant that employment had grown by 1,000 in the St. Louis metro area, then we would expect that within 2 to 3 years there would be an additional 300 people employed in outstate Missouri.[8]

The results are useful for showing the effects of a permanent increase in St. Louis metro employment growth, which has typically been about a half point lower than for the country as a whole. Imagine that policymakers in the St. Louis metro area had adjusted taxes or implemented some other policies that resulted in local employment growth that was 0.5 percentage points higher every year, starting in 2011. Figure 3 illustrates the alternative growth paths for the St. Louis metro area

Figure 2

**Responses to a One-Percentage-Point Shock to St. Louis Metro Growth**



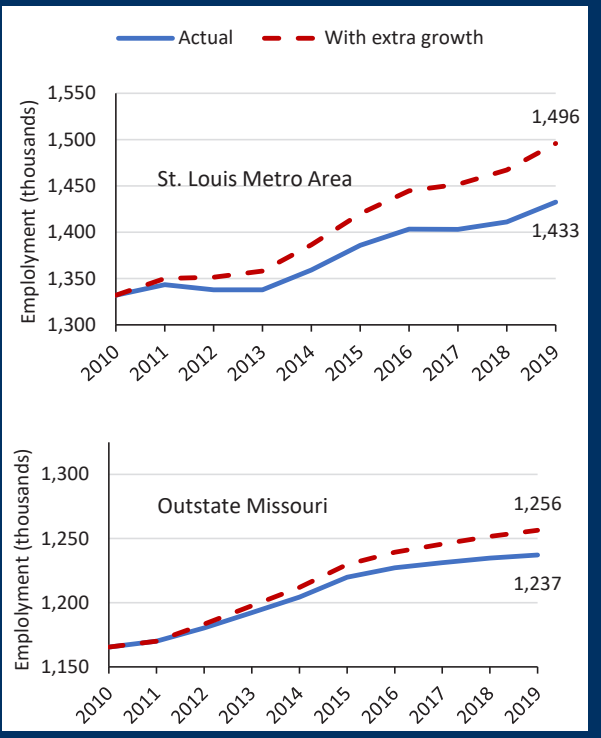

and outstate Missouri between 2011 and 2019. For the St. Louis metro area, the higher growth would have meant an extra 63,000 people employed by 2019, an increase of about 4.7 percent. For outstate Missouri, this annual jolt to St. Louis metro growth would have meant annual growth responses as shown in Figure 1. By 2019, about 19,000 more people would have been employed in outstate Missouri because of policy changes in the St. Louis metro area, an increase of about 1.6 percent. As a rule of thumb, if the St. Louis area sees extra employment growth of *X* percent over the course of a decade or so, then outstate Missouri should see growth of about *X*/3 percent.

## CONCLUSIONS

The purpose of this essay is to explore the possibility that growth in outstate Missouri is determined in part by growth in Missouri's two dominant metro areas. Using a simple three-equation VAR model, one direction of Granger-causality was found: growth in the St. Louis metro area causes higher growth in outstate Missouri. If an event leads to 1,000 more people being employed in the St. Louis metro area, we should expect that about 300 more people will be employed in outstate Missouri within three years.

Figure 3

## Changes to Employment from a Permanent Half-percent Increase in St. Louis Metro Growth




Over the period from 2011 to 2019, average annual household employment growth was 11,200 for the St. Louis metro area and 8,000 for outstate Missouri. If St. Louis metro employment instead had grown at a rate one-half a percentage point higher, perhaps because of some policy reforms, it would have averaged an annual employment increase of 18,200. According to my results, this extra growth in the St. Louis metro area would have meant employment growth of about 10,100 per year in outstate Missouri.

As mentioned earlier, true causality is difficult if not impossible to prove. I've demonstrated that employment growth in the St. Louis metro area has Granger-caused employment growth in outstate Missouri over the period from 1990 to 2019. That is, the former area's growth in one year tends to predict the latter area's growth for the following year, even after controlling for national-level growth and shared time trends. To the extent that it is possible given the data limitations, I have tried to account for factors other than causality that might explain these results, including longer lags. It remains possible, however, that there is some third, excluded factor that affects employment growth in the St. Louis metro area one year and outstate Missouri the next year. Or, there might be an alternative, statistically preferred specification of the model that I haven't considered. At this point, however, the evidence suggests that changes in St. Louis metro area employment growth cause changes in outstate Missouri employment growth.

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