Is Growth In Outstate Missouri Tied To Growth In The Saint Louis And Kansas City Metro Areas?

By Howard J. Wall

The Hammond Institute
CENTER FOR ECONOMICS AND THE ENVIRONMENT
AT LINDENWOOD

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EXECUTIVE SUMMARY

Because the Saint Louis and Kansas City metro areas together account for well over half of Missouri's economy, the overall performance of the state is largely determined by the two metro areas. In this study, I see whether the metro areaas are important to the state beyond their relative sizes. That is, I test whether employment growth in the rest of Missouri tends to follow (or be caused by) employment growth in the metro areas.

According to my results, growth in outstate Missouri tends to be caused by growth in the Saint Louis metro area. More precisely, if an event leads to 1,000 more people being employed in Saint Louis, there should be about 270 more people employed in outstate Missouri in the following year. Put another way, if for a given year Saint Louis employment grew at the same rate as the average U.S. metro area, it would see an employment increase of 19,000 instead of its usual average of 4,500. The extra employment in St. Louis should generate additional employment of about 4,200 for outstate Missouri.

The policy implications of the results reported in this study strengthen arguments that the state as a whole (and thus state government) should have a heightened interest in local-level economic policymaking, especially in the Saint Louis metro area.

1. INTRODUCTION

In a recent 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 Saint 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 area's 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 Saint 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, Saint Louis is connected to Wentzville, and Wentzville is connected to Columbia, so Saint Louis and Columbia are interconnected.[2] According to this research, what happens in Saint Louis and Kansas City doesn't stay in Saint Louis and Kansas City. This essay provides some evidence of the importance of this interconnectedness.

2. 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. 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.[4] Using household employment data, I test for links among the Saint Louis and Kansas City metro areas and outstate Missouri using annual averages for the data, which are available for 1990 through 2014.

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* = Saint 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 a single lag for each endogenous variable.[5] The three equations, which together constitute a vector autoregressive (VAR) model, are estimated using Ordinary Least Squares:

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

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

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

In each, ε_t is the idiosyncratic part of growth that is not captured by the included variables.

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	α_i	2.935**	3.45	1.123	0.92	2.739**	2.30
Outstate Missouri (OMO_{t-1})	β_i	-0.002	-0.01	-0.154	-0.84	-0.025	-0.16
St. Louis metro (STL_{t-1})	λ_i	0.566**	3.14	-0.021	-0.13	-0.286*	-2.05
Kansas City metro (KC_{t-1})	γ_i	-0.083	-0.39	-0.075	-0.34	0.071	0.43
US without Missouri (US'_t)	δ_i	0.736**	2.75	0.731**	3.25	0.479*	1.90
Time	η_i	-0.422**	-3.61	-0.203	-1.28	-0.413**	-2.40
Time squared	κ_i	0.012**	2.78	0.006	1.23	0.015**	2.42
R^2		0.768		0.374		0.374	
R^2 exogenous variables only		0.643		0.354		0.290	
ρ		-0.174		0.146		0.033	
Durbin-Watson statistic		2.302		1.646		1.878	

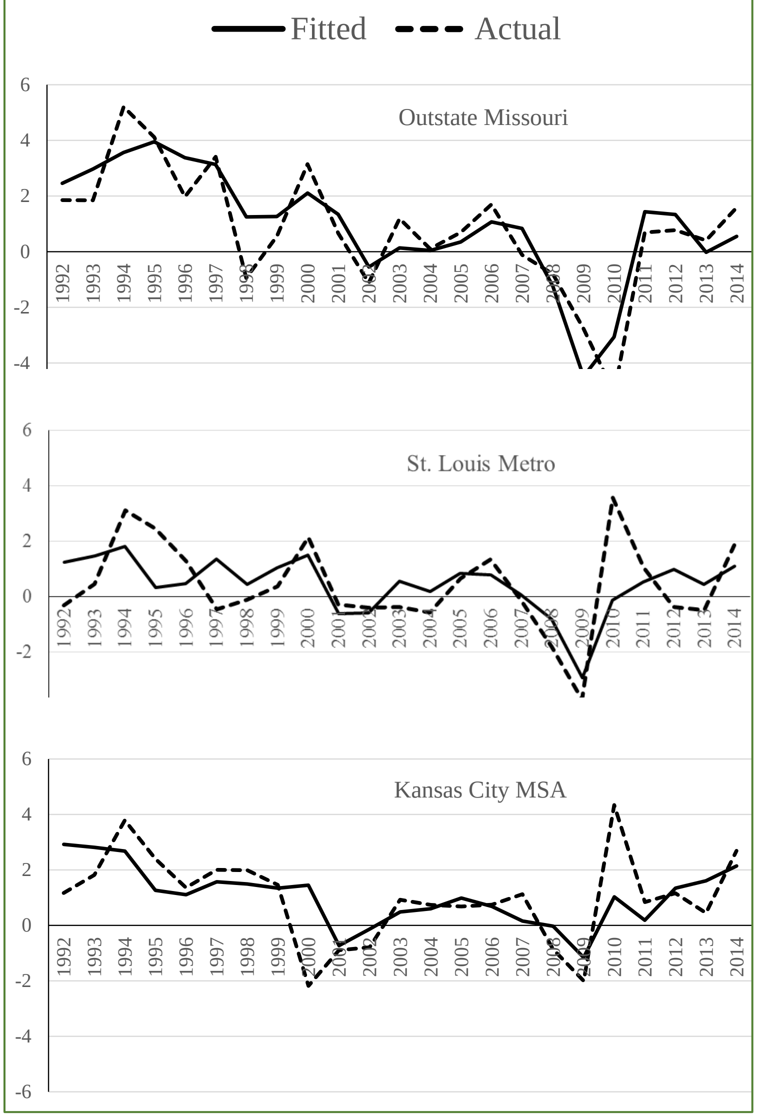
Standard errors are corrected for autocorrelation and heteroskedasticity. Statistical significance at the 5 percent and 10 percent levels are indicated by a double or single asterisk, respectively.

3. RESULTS

The estimation results are reported in Table 1. The R^2s 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 (β_i, λ_i, γ_i; i=1,2,3).

As indicated by the R^2s, the model is much better at explaining growth in outstate Missouri than in either of the metro areas: About 77 percent of the variation in OMO is explained by the model, whereas the model explains only about 37 percent of the variation in STL and KC. For reference, the fitted and actual values of the three endogenous variables are shown in Figure 1.

Figure 1. Fitted versus Actual Values: Employment Growth 1992-2015

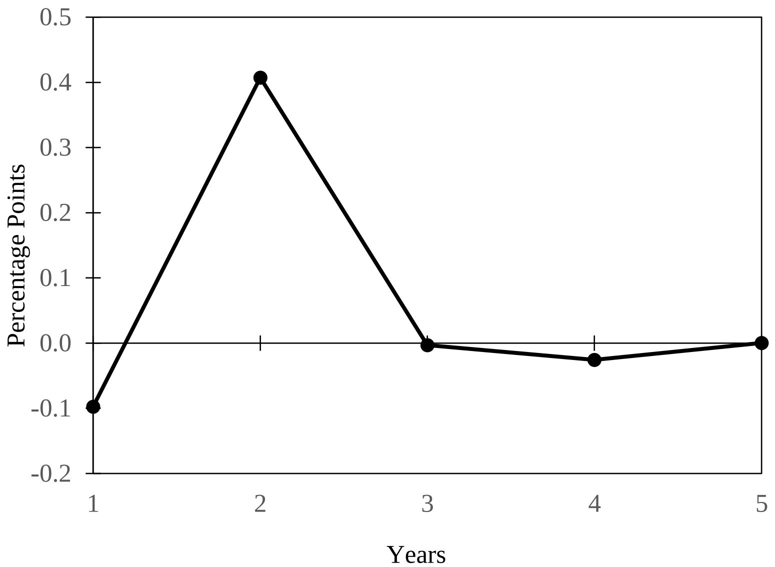


Note that most of the explanatory power of the model comes from trends and the state of the U.S. economy: If the lags of the endogenous variables are excluded, the remaining model explains 64 percent, 34 percent, and 29 percent of the variation in OMO, STL, and KC, respectively. Most importantly for our purposes, because the estimates of λ_1 and λ_2 are statistically significant, the results suggest that growth in the Saint Louis metro area caused growth in the Kansas City metro area and in outstate Missouri. None of the other seven relevant coefficients is close to 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 Saint 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 Saint Louis metro growth on outstate Missouri growth (See Figure 2).

As illustrated by Figure 2, a one-percentage-point shock to growth in the Saint Louis metro area today will mean a small decrease in outstate Missouri growth today and a much larger increase next year, followed by small gyrations for a couple more years.[6] For simplicity, consider only the first two years and apply the rule

Figure 2. Response of Outstate Missouri Growth to a One-Percentage Point Shock to St. Louis Metro Growth



of thumb that a one-standard-deviation shock had the cumulative effect of raising outstate Missouri's employment growth rate by 0.3 percentage points. In terms of employment levels, this rule implies that if employment had grown by 1,000 more people in the Saint Louis metro in 2013, an additional 270 people would have been employed in outstate Missouri in 2014.

4. CONCLUSIONS

The purpose of this essay was 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, two directions of Granger-causality were found: Growth in the Saint Louis metro area causes higher growth in outstate Missouri and lower growth in the Kansas City metro area. Only the former of these effects was found to be statistically significant when the entire possible response is calculated. More precisely, if an event leads to there being 1000 more people employed in the Saint Louis metro area in a given year, there also should be about 270 more people employed in outstate Missouri in the following year.

For context, consider that over the sample period of 1990 to 2014, average annual employment growth was 4,500 for the Saint Louis metro area and 8,900 for outstate Missouri. If, for a given year, Saint Louis employment instead grew at the U.S. metro area average of 1.8 percent, it would see an employment increase of 19,900. According to my results, this extra-average growth of 15,400 would generate additional employment of about 4,200 in the subsequent year for outstate Missouri.
As mentioned earlier, true causality is difficult if not impossible to prove. I've demonstrated that employment growth in the Saint Louis metro area has Granger-caused employment growth in outstate Missouri over the period from 1990 to 2014. 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 Saint 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 Saint Louis metro area employment growth cause changes in outstate Missouri employment growth.

Howard Wall is professor of economics; director of the Hammond Institute for Free Enterprise; and senior research fellow in the Center for Economics and the Environment at Lindenwood University.

NOTES

[1] Podgursky, Michael, and Nick Pretnar. "Weak Economic Growth in Missouri's Largest Cities is Holding Down Statewide Growth Rates." Show-Me Institute Essay, April 2016. See also Haslag, Joseph and Nick Pretnar. "Where is Missouri Growing?" Show-Me Institute Essay, May 2015, which describes the differences in growth rates across Missouri's metro areas. ("Metro area" refer to a Metropolitan Statistical Area (MSA) as defined by the Office of Management and Budget. The complete listing of MSAs and their component counties is available here.

[2] Nelson, Garrett Dash, and Alasdair Rae. "An Economic Geography of the United States: From Commutes to Megaregions." PLOS ONE 11(11), November 2016.

[3] Granger causality is named after Nobel-prize winning economist Clive Granger, who developed his test of causality in a paper published in 1969.

[4] Data on income or gross product are not available for enough years or for the appropriate level of disaggregation, while non-farm payroll employment are not disaggregated within metro areas. Jobs data from the Quarterly Census of Employment and Wages can be disaggregated within metro areas, but it is available for too few years.

[5] Longer lag lengths were not preferred statistically, possibly due to the shortness of the data series. Note, however, that the qualitative results are unchanged when the model uses two lags instead of one, or when US' is lagged.

[6] Note that only the effect for next year (year 2) is statistically different from zero.