Economic Development Strategy for the Greater Peoria Region, Illinois: Insights from Growth Accounting and Decision Theory

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Abstract
This paper highlights strategies for establishing and maintaining a robust economic ecosystem in the Greater Peoria region. The strategic advantage of the region is deduced from an empirical analysis of the region's national accounts and multifactor productivity statistics. A decision theory modeling of the empirical results suggests that manufacturing sector should be the focus for economic development.
Keywords: Peoria County, Illinois, Growth Accounting.

1.0. Introduction

The Greater Peoria Region (GPR), Illinois, is an economic development initiative of five counties that are located in central and north central Illinois[2]. The region is home to 403,174 residents and boasts a real GDP of $19.338bil. The bulk of the region's output comes from Peoria and Tazewell counties, they contribute 88% to the region's GDP. The other three counties: Logan, Mason, and Woodford, each accounts for less than or equal to 5% of the region's total output (Table 1).

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[2] The counties are: Logan in central Illinois and Mason, Peoria, Tazewell, and Woodford in North-Central Illinois.

Table 1: Greater Peoria Region's Real GDP in 2017

Geography	GDP ($bil)	
	Monetary Value	
Logan County	$0.851	4%
Mason County	$0.326	2
Peoria County	$11.635	60
Tazewell County	$5.506	28
Woodford County	$1.152	5
GPR	$19.338	100%

Source: Estimates of county GDPs are based on county-level earnings indicators published by the EBA.

The GPR's Comprehensive Economic Development Strategy (CEDS) is due for revision in 2020; the purpose of this exercise is to deduce strategies for establishing and maintaining a robust economic ecosystem in the region. In community economic development, strategy is viewed as the process of analyzing a region's economic resources to identify advantages which can be parlayed into superior economic performance (Athiyaman, 2019).

Two of the most important statistical tools for analysis of macroeconomics are the national accounts (GDP) and the multifactor productivity (MFP) statistics, which measure output per unit of combined inputs such as capital and technology. In the following pages we make use of these tools and decision theory models to highlight the 'strategic advantages' of the GPR.

2.0. The Region's GDP

Table 2 shows changes to the region's GDP before, around, and after the time period of the Great Recession, the 2007-2009 time period. The region's 4% growth in GDP before the Great Recession is a composite of growth rates from two county clusters, a positive-growth cluster and a negative one. Logan and Mason are part of the negative-growth grouping.

During the recession, the region's GDP registered no growth; Mason County was an outlier in that it registered a 4% growth during the widespread economic decline of 2007-2009. Since then the region has struggled to pose any growth in real GDP, for the period 2010-2017 the region registered a -1% growth.

Overall, for the entire 2001-2017 time period, the region maintained a positive, albeit small, real GDP growth rate of 1%. Peoria is the only county that contributed to this growth[3]. Logan, Mason, and Tazewell contributed little or nothing to the region's GDP growth (Table 2, Column 5).

Table 2: Annual Compound Growth Rates (ACGRs) of Real GDP

	Time Period			
County	**2001-2006**	**2007-2009**	**2010-2017**	**Overall, 2001-2017**
Peoria	3%	1%	1%	1%
Logan	-1%	0%	-1%	0%
Mason	-1%	4%	-3%	0%
Tazewell	6%	-3%	-4%	0%
Woodford	3%	1%	0%	1%
GPR	4%	0%	-1%	1%

Source: Author's computations of ACGRs, based on BEA data, Appendix 1.

2.1. Sources of GDP

The value-added components[4] of the manufacturing sector, healthcare and social assistance sectors, retail trade, and government account for about 50% of the regional GDP. In terms of goods and services classification, the region (GPR) is a service economy[5]. Table 3 lists the sectors that contribute at least 4%[6] to the regional GDP and their growth rate for the period 2001-2017.

[3] Although Woodford has a positive 1% ACGR for 2001-2017 the size of its economy makes it contribution non-salient. In other words, the size of the county should be considered along with its growth rate to infer contributions to GPR's economic growth.

[4] Value added is the numerical reminder of the computation: 'total output of the sector less intermediate purchases of the sector'.

[5] Goods producing sectors include: Natural Resources and Mining, Construction, and Manufacturing. All other sectors are classified as services.

[6] Technically, contributions above 3% to the region's GDP belong to the 3rd and the 4th quartiles of the GDP variable. In other words, the sectors listed in Table 3 are the top contributors for the regional GDP.

Table 3: Sources of GPR's GDP: NAICS Two-Digit Sectors

NAICS Codes	Sector Label	% Contribution to GDP[7]	2001-2017 Growth Rate (%)
31 to 33	Manufacturing	26	2
62	Healthcare and Social assistance	10	1
NA	Government and Government enterprise	9	0
44 to 45	Retail trade	6	0
42	Wholesale trade	5	1
52	Finance & Insurance	5	1
53	Real estate, rental and leasing	5	1
54	Professional, Scientific and Technical services	5	1
23	Construction	4	2
	Greater Peoria Region		**1**%

Source: Author's calculations based on BEA and BLS data, see Appendix 2.

A majority of the sectors in Table 3 are adding to the GPR's economic growth, but it is the manufacturing sector that makes the most contribution to the region's growth; a sub-sector analysis of manufacturing is provided in the next section. Government and retail trade sectors neither add nor reduce regional economic growth.

2.2. Manufacturing in the Region: A Sub-Sector Analysis

Categorization of manufacturing into durable and non-durable goods reveals that durable goods manufacturing is the major activity in the region, it constitutes 75% of the total manufacturing GDP. Within the "durable" category, approximately one-third of the monetary value of the category's output (GDP) comes from machinery manufacturing, primary metal manufacturing, and fabricated metal product manufacturing. Of these, only primary metal manufacturing adds to the sector's GDP; machinery manufacturing has zero contribution and fabricated metal product manufacturing is reducing the sector's economic growth (Table 4).

[7] For the year 2017.

Table 4: Manufacturing Subsectors in the GPR: Their Real[8] Size and Growth Rate[9]

NAICS	Sector / Subsector	Total GDP	ACGR
31-33	Manufacturing	$4968.2mil	**2%**
321,327-339	**Durable goods manufacturing**	$3754	**8%**
321	Wood product manufacturing	$12.98	-4%
327	Nonmetallic mineral product manufacturing	$22.11	-1%
331	Primary metal manufacturing	$294.21	2%
332	Fabricated metal product manufacturing	$257.30	-2%
333	Machinery manufacturing	$621.67	0%
334	Computer and electronic product manufacturing	$15.55	17%
335	Electrical equipment, appliance, and component manufacturing	$27.12	32%
3361-3363	Motor vehicles, bodies and trailers, and parts manufacturing	$2.61	NA
3364-3369	Other transportation equipment manufacturing	$5.49	NA
337	Furniture and related product manufacturing	$11.86	0%
339	Miscellaneous manufacturing	$39.49	4%
311-16 322-326	**Nondurable goods manufacturing**	$531.34mil	**1%**
322	Paper manufacturing	$0.08	NA
323	Printing and related support activities	$31.23	-3%
324	Petroleum and coal products manufacturing	$(0.77)	NA
325	Chemical manufacturing	$210.61	4%
326	Plastics and rubber products manufacturing	$9.22	-8%

Note: ACGRs are for the period 2001-2016; NA signifies either a zero divisor for the growth equation or a negative value in natural log conversion of GDP figures used in ACGR computations. Data used in computations are shown in Appendix 2.

3.0. Growth Accounting

In this section we attempt to address the question 'what determines the growth rate of GPR over the long run and what can policy measures do to affect it'. We begin with a simple model to explain growth.

Assume that the total real output in the GPR (*Y*) is produced using factors such as capital and labor:

[8] In inflation adjusted $mil values.
[9] A mixture of 2016 and 2017 data were used to construct the Table, see Appendix 2.

$Y_t = A.F(Kt\ Nt)$, where *K* is capital, *N* is labor, *F* (.) is the aggregate production function, and *A* is the productivity shifter (static efficiency, or technology).

The production function is assumed to have the following properties:

$F(K_t,0) = F(0,N_t) = 0$	Both factors are necessary to produce anything
$F_K(K_t,N_t) > 0$, $F_N(K_t,N_t) > 0$	For a given amount of one factor, more of the other factor results in more output
$F_{KK}(K_t,N_t) < 0$, $F_{NN}(K_t,N_t) < 0$	The amount by which an additional factor increases output (holding other factor fixed) is decreasing in the amount of that factor
$F(\eta K_t, \eta N_t) = \eta F(K_t,N_t),\ \eta > 0$	If you double both the factors then you double output

These assumptions lead to a production function of the form:

$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$ where, $0 \leq \alpha \leq 1$. (1)

Eq. 1 suggests that productivity growth can be attained by technological progress (A_t), increases in capital per worker (capital deepening), and/or increases in the number of workers. Denote the growth rate of Y_t by:

$$\frac{dY_t}{dt} = K_t^{\alpha} L_t^{1-\alpha} \frac{dA_t}{dt} + \alpha A_t K_t^{\alpha-1} L_t^{1-\alpha} \frac{dK_t}{dt} + (1-\alpha) A_t K_t^{\alpha} L_t^{-\alpha} \frac{dL_t}{dt} \quad (2)$$

It can be shown that after differentiating Y_t with respect to time *t*, Eq. 2 can be rewritten as:

$$\frac{1}{Y_t}\frac{dY_t}{dt} = \frac{1}{A_t}\frac{dA_t}{dt} + \alpha \frac{1}{K_t}\frac{dK_t}{dt} + (1-\alpha)\frac{1}{L_t}\frac{dL_t}{dt} \quad (3)$$

Since our interest is on output per worker we make use of the identity in Eq. 4 to deduce how much GDP growth over a certain period comes from growth in number of workers, growth in the stock of capital, and from improvements in static efficiency.

$$\frac{1}{Y_t}\frac{dY_t}{dt} - \frac{1}{L_t}\frac{dL_t}{dt} = \frac{1}{A_t}\frac{dA_t}{dt} + \alpha\left(\frac{1}{K_t}\frac{dK_t}{dt} - \frac{1}{L_t}\frac{dL_t}{dt}\right) \quad (4)$$

Table 5 shows the results of growth accounting for the sectors highlighted in Table 3. If we equate static efficiency with comparative advantages of the region, then retail and real estate sectors benefit from locational advantages of the GPR[10]. The healthcare sector's productivity or output is mostly driven by growth in capital infusion (technically

[10] At the subsector level, primary metal manufacturing also enjoys locational benefits (A = 2.48), see Appendix 2.

'capital deepening'). Labor inputs play a major role in the construction sector's total output.

Table 5: Growth Accounting for Salient Sectors in the GPR

Sector	% Contribution to GDP	K	L	A
Manufacturing	26	0.29	0.29	-0.38
Healthcare and Social assistance	10	3.3	1.11	-1.14
Government and Government enterprise	9	0.39	0.24	0.21
Retail trade	6	0.46	0.51	1.63
Wholesale trade	5	0.98	1.01	-1.85
Finance & Insurance	5			
Real estate, rental and leasing	5	0.73	0.06	0.73
Professional, Scientific and Technical services	5	0.29	1.31	-0.13
Construction	4	0.31	1.40	0.03

Note: K, L, and A were computed by the author using the national figures published by the BEA.

4.0. Economic Development Strategy Recommendations: A Bayesian Approach

Based on the above analyses decisions can be made about resource allocation[11] for business creation, attraction, retention, and expansion in GPR. In line with the decision theory framework (Kochenderfer, 2015), we specify "maximizing industrial sectors' contribution to GDP in the region" as the objective and assess whether we could reach a terminal decision (optimize the objective function) without seeking additional information.

The situation can be symbolized as follows:

$V_{ij} = f(A_i, S_j)$, where

A_i = the i^{th} course of action available to us (i = 1, ….., m);
S_j = j^{th} state of nature that can occur (j = 1, …., n);
V_{ij} = the value of the result of the interaction of the i^{th} course of action and the j^{th} state of nature, and
$f(.)$ = functional relationship between the criterion and the predictors.

The decision situation facing GPR is whether to target one or more manufacturing subsectors for economic development purposes. Specifically, these would be the alternatives (A_i) for the purpose of maximizing industrial sectors' contribution to GDP:

(i) NAICS 331, Primary metal manufacturing that had a $294.21mil value-added metric during 2016 and is growing at the rate of 2% per annum;
(ii) NAICS 333, Machinery manufacturing with a value-added component of $621.67 mil;
(iii) NAICS 334, Computer and electronic product manufacturing that averaged 17% growth per annum during the 2001 – 2016 time period;
(iv) NAICS 335, Electrical equipment, appliance and component manufacturing that had an ACGR of 32%, and
(v) NAICS 325, Chemical manufacturing that produced $210.61mil in value added and had an ACGR of 4% for the time period 2001-2016.

The utility or value of V_{ij} is the subsector's contribution to the region's GDP. For example, NAICS 335 contributed $27.2mil to the regional economy in 2016 and is expected to contribute $484mil in 2025. Table 6, column 3 highlights the predicted 2025 GDP contributions of these manufacturing subsectors to the GPR's economy. Recognizing that predictions are uncertain, we use Laplace criterion to assign probabilities to the GDP outcomes in Table 6 and compute the expected values of Vij.

[11] Resources are defined broadly to include both monetary and in-kind support provided for CARE initiatives by economic development agencies.

Table 6: Strategic Choice: Laplace Decision Criterion

A_i	2016 GDP ($mil)	Predicted 2025 GDP ($mil)	V_{ij}: Expected Monetary Value, GDP in 2025
NAICS 331, Primary metal manufacturing.	294.21	352.23	323.22
NAICS 333, Machinery manufacturing	621.67	621.67	310.84
NAICS 334, Computer and electronic product manufacturing	15.55	56.26	35.91
NAICS 335, Electrical equipment, appliance, and component manufacturing	27.12	484.55	255.83
NAICS 325, Chemical manufacturing	210.61	301.87	256.24

Note: Authors computations based on data from Table 4 and growth accounting numbers for the subsectors.

The risk analysis in Table 6 suggests that GPR would benefit the most, maximize its economic development efforts, by creating, attracting, retaining, and expanding businesses in the primary metal manufacturing subsector (NAICS 331).

5.0. Summary and Conclusion

The economy of the Greater Peoria region is driven mostly by businesses located in the Peoria and Tazewell counties, 88% of the region's GDP comes from these two counties. For the 2001-2017 time period, the region averaged a real GDP growth rate of 1%. Value added from manufacturing, health, retail, wholesale, and construction businesses account for about 50% of the regional GDP. Manufacturing, retail and real estate sectors benefit from locational advantages of the GPR. The healthcare sector's productivity is mostly driven by growth in capital infusion.

If we combine the above information with growth rates of industries over the 2001-2017 time period, it is evident that to maximize its economic development efforts the Greater Peoria region should encourage investments in the manufacturing sector.

6.0. References

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