DOES LOCATING IN A METROPOLITAN AREA IMPROVE THE BUSINESS PERFORMANCE OF MANUFACTURING ESTABLISHMENTS?

THE LINK BETWEEN BUSINESS AND REGION

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Introduction

- Agglomeration economies arise when a business's performance is improved due to external economies of scale including labor pooling, customer supplier interactions and localized externalities and shared infrastructure, resulting in unit cost savings that accrue to individual firms when large numbers locate in one metropolitan area (Hill, 2000).

Introduction (Cont'd)

- Understanding the connection between business establishments and their regional economies is important because Ledebur & Barnes (1998) describe the economic region as the basic building block of the national economy and a building block of the three-tiered economic systems including: regional, national and global systems, where a metropolitan area is the center of a local economic region and the center of new ideas, technologies and innovation.

Objective

- The objective of this research is to fill existing gaps in the economic development and business literature by providing an analysis of the relationship between a region and objective operational practices of business establishments by testing the existence of systematic differences in these operational practices due to the region in which they are located.

Agglomeration Economies

- Glaeser et al. (2007) builds on Hoover (1948) & Marshall (1890/1916) in describing the reasons why agglomeration affects business locations. These are transport cost savings, supply-chain cost savings, and labor pooling cost savings

- Agglomeration improves a firm's performance by reducing the costs of transactions and by increasing the revenue (Appold, 1995).

- Zander (1994) suggests that location and proximity are critical in the innovation process.

Agglomeration Economies (Cont'd)

- Geographically concentrated industrial configurations have a great advantage due the exchange of tacit knowledge by face-to-face contact (Enright, 1991).

- Pavitt (1984) suggests that innovative ideas in manufacturing work frequently originate outside the firm that carries out the work.

Metropolitan Areas

- "Economic regions are centered around metropolitan areas. The fulcrum of the local economic region is the metropolitan area, not "the city" or any governmental jurisdiction. These metropolitan centers are the sources of new ideas, new technologies, and innovations that drive economic growth and development within the region and throughout the national system of economic regions" (Ledebur & Barnes, 1998).

Metropolitan Areas (Cont'd)

- A metropolitan statistical area as defined by Census 2007, contains a core urban area of 50,000 or more population, consists of one or more counties, and includes the counties that contain the core urban area, as well as any adjacent counties that have a high degree of social and economic integration with the urban core (Census, 2007).

Metro Dummy Variables

- Thirteen dummy variables are used to capture the region in Wisconsin in which the establishments are located.

- The regional dummy variables include the state's twelve metropolitan areas and the rural balance of the state.

- The twelve metropolitan areas are: Appleton, Eau Claire, Fond Du, Green Bay, Janesville, La Crosse, Madison, Milwaukee-Waukesha-West Allis, Oshkosh-Neenah, Racine, Sheboygan and Wausau. A non-metropolitan business location is signified by the thirteenth regional dummy variable.

Research Question

- The primary research question in this essay explores the influence of metropolitan area agglomeration effects on business establishment's performance.

- The research question (RQ) addressed in this essay is:

  Does locating in a metropolitan area affect the performance of small and midsized manufacturing establishments in Wisconsin?

Table I: Hypotheses Sets For The Independent Variable Metro

RH 1	H_0	The percentage improvement in productivity over the past three years does not depend on the business establishment locating in a metropolitan area.
	H_1	The percentage improvement in productivity over the past three years depends on the business establishment locating in a metropolitan area.
RH 2	H_0	The percentage of reduction in the total value of inventory throughout the supply chain for the primary product over the last three years does not depend on the business establishment locating in a metropolitan area.
	H_1	The percentage of reduction in the total value of inventory throughout the supply chain for the primary product over the last three years depends on the business establishment locating in a metropolitan area.
RH 3	H_0	The percentage of annual sales derived from new products introduced in the past three years does not depend on the business establishment locating in a metropolitan area.
	H_1	The percentage of annual sales derived from new products introduced in the past three years depends on the business establishment locating in a metropolitan area.

Table II: Definitions Of Variables & Ordinal Scales

Competitive Advantage Dependent Variables	Productivity Growth	Ordered dependent variable, defined as the percentage improvement in productivity over the past three years, and is scaled on a five level ordinal scale: level one being 0-25%, level two 26-50%, level three 51-75%, level four 76-99%, and level five >100%.
	Supply-Chain Efficiency	Ordered dependent variable, defined as the percentage of reduction in the total value of inventory throughout the supply chain for the primary product over the last three years, and is scaled on a four level ordinal scale: level one being <10%, level two 10-25%, level three 26-50%, and level four >50%.
	New Products	Ordered dependent variable, defined as the percentage of annual sales derived from new products introduced in the past three years, and is scaled on a four level ordinal scale: level one being <5%, level two 5-25%, level three 26-50%, and level four >50%.

Table III: Definitions Of Variables & Ordinal Scales (Cont'd)

Independent Variable	Metro	Independent variable, defined as the metropolitan statistical area (MSA) as defined by Census 2007, and contains a core urban area of 50,000 or more population, and consists of one or more counties and includes the counties containing the core urban area, as well as any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core.

Table IV: Definitions Of Variables & Ordinal Scales (Cont'd)

Control Variables	Organizational Culture	Participation	Independent variable, defined as the percentage of employees regularly participating in empowered work teams (i.e., make decisions without supervisor approval), and is scaled on a five level ordinal scale: level one being <25%, level two 25-50%, level three 51-75%, level four 76-90%, and level five >90%.
		Training	Independent variable, defined as the number of training hours devoted annually to each employee, and is scaled on a four level ordinal scale: level one being ≤8 hours, level two 9-20, level three 21-40, and level four >40 hours.
		Talent Management	Independent variable, defined as the percentage of employees dedicated to assessing and upgrading the organization's talent pool, and is scaled on a four level ordinal scale: level one being <1%, level two 1-5%, level three 6-10%, and level four >10%.
	log(SIZE)		Control variable, defined as the log of the number of full time employees.
	log(AGE)		Control variable, defined as the log of the number of years the organization has been in operation.
	GREEN		Control variable, defined as the percentage of workforce dedicated to reducing energy, or emissions in operations.
	NAICS		Control variable, defined as the North American Industry Classification System (NAICS).
	GLOBAL		Control variable, measured by the rate of organization's progress toward becoming a world-class global player.

Table V: Descriptive Statistics

Dependent Variable			Independent Variable		
Percentage improvement in productivity over the past three years			**Metropolitan statistical area (MSA), contains a core urban area of 50,000 or more population, and consists of one or more counties.**		
Scale	**Number of Establishments**	**Percentage of Establishments**	**MSA**	**Number of Establishments**	**Percentage of Establishments**
<25%	230	48%	Appleton	18	4%
26-50%	155	32%	Eau Claire	5	1%
51-75%	64	13%	Fond Du	9	2%
76-99%	26	5%	Green Bay	34	7%
>100%	5	1%	Janesville	15	3%
	480	100%	La Crosse	4	1%
Percentage of annual sales derived from new products introduced in the past three years			Madison	50	10%
			Milwaukee-Waukesha-West Allis	150	31%
<5%	132	27%	Oshkosh-Neenah	12	2%
5-25%	224	46%	Racine	35	7%
26-50%	93	19%	Sheboygan	13	3%
>50%	36	7%	Wausau	10	2%
			No MSA; rural	136	28%
	485	100%		491	100%
Percentage of reduction in the total value of inventory throughout the supply chain for the primary product over the last three years					
<10%	285	59%			
10-25%	138	29%			
26-50%	46	10%			
>50%	10	2%			
	479	100%			

Research Models

Model 1:

$$PRODUCTIVITYGROWTH_i = f(\alpha + \beta_1 METRO_i + \beta_2 PARTICIPATION_i + \beta_3 TRAINING_i$$
$$+\beta_4 TALENTMGMT_i + \beta_5 \log(SIZE_i) + \beta_6 log(AGE_i) + \beta_7 GREEN_i + \beta_8 GLOBAL_i + \beta_9 NAICS_i + \varepsilon_i)$$

Model 2:

$$SUPPLYCHAIN_i = f(\alpha + \beta_1 METRO_i + \beta_2 PARTICIPATION_i + \beta_3 TRAINING_i$$
$$+\beta_4 TALENTMGMT_i + \beta_5 \log(SIZE_i) + \beta_6 log(AGE_i) + \beta_7 GREEN_i + \beta_8 GLOBAL_i + \beta_9 NAICS_i + \varepsilon_i)$$

Model 3:

$$NEWPRODUCTS_i = f(\alpha + \beta_1 METRO_i + \beta_2 PARTICIPATION_i + \beta_3 TRAINING_i$$
$$+\beta_4 TALENTMGMT_i + \beta_5 \log(SIZE_i) + \beta_6 log(AGE_i) + \beta_7 GREEN_i + \beta_8 GLOBAL_i + \beta_9 NAICS_i + \varepsilon_i)$$

Where: *f( )* is used to signify the proportional odds logistic regression function

Table VI: Summary of the Proportional Odds Logistic Regressions Results

	p-value		
	Model 1	Model 2	Model 3
	Dependent Variable		
	PRODUCTIVITYGROWTH	SUPPLYCHAIN	NEWPRODUCTS
F-test for the Joint Independent Variable METRO	**0.3941**	**0.6546**	**0.0033***
df	121	120	121
AIC	1062	890	1155
Pseudo R^2	0.3023	0.1452	0.2864
Proportional Odds Test "*Pchisq*"	0.2842	0.9462	0.1233

*significant at the 0.10 confidence level **significant at the 0.05 confidence level
***significant at the 0.01 confidence level. N=492

Table VII: Estimation Results For The Model That Uses 4-Digit NAICS Fixed-Effects For Small And Mid-Sized Business Establishments

Independent Variable	Model1 Dependent Variable PRODUCTIVITYGROWTH		Model2 Dependent Variable SUPPLYCHAIN		Model3 Dependent Variable NEWPRODUCTS	
	Value (Std. Error)	EXP(Coef) (t value)	Value (Std. Error)	EXP(Coef) (t value)	Value (Std. Error)	EXP(Coef) (t value)
REGION2-Eau Claire	1.6612 (1.2143)	5.2656 (1.3681)	0.5623 (0.8591)	1.7547 (0.6545)	-0.6072 (0.9225)	0.5449 (-0.6582)
REGION3- Fond Du	-0.2785 (0.9594)	0.7569 (-0.2902)	-0.7574 (0.9609)	0.4689 (-0.7882)	0.5403 (0.8464)	1.7165 (0.6383)
REGION4-Green Bay	-0.3363 (0.5135)	0.7144 (-0.6549)	-0.7300 (0.5312)	0.4819 (-1.3743)	-0.4786 (0.5037)	0.6197 (-0.9502)
REGION5-Janesville	0.6913 (0.6130)	1.9962 (1.1276)	-0.5576 (0.6696)	0.5726 (-0.8327)	-1.3067 (0.6538)	0.2707 (-1.9986)**
REGION6-La Crosse	2.8057 (1.2291)	16.5378 (2.2827)**	-0.2570 (1.3568)	0.7734 (-0.1894)	-1.2742 (1.0769)	0.2797 (-1.1831)
REGION7-Madison	0.3628 (0.4247)	1.4373 (0.8541)	-0.3901 (0.4583)	0.6770 (-0.8512)	-0.5731 (0.4146)	0.5638 (-1.3822)
REGION8-Milwaukee	-0.1633 (0.3027)	0.8493 (-0.5395)	-0.2435 (0.3169)	0.7839 (-0.7682)	-1.2635 (0.2913)	0.2827 (-4.3366)***
REGION9-Oshkosh-Neenah	0.0165 (0.7860)	1.0166 (0.0210)	0.1424 (0.8385)	1.1531 (0.1699)	-0.4975 (0.7935)	0.6080 (-0.6269)
REGION10-Racine	0.3709 (0.5224)	1.4490 (0.7100)	0.3985 (0.5057)	1.4896 (0.7880)	0.0055 (0.4868)	1.0055 (0.0113)
REGION11-Sheboygan	0.1121 (0.6720)	1.1187 (0.1669)	-0.4108 (0.7968)	0.6631 (-0.5155)	0.3377 (0.6146)	1.4017 (0.5494)
REGION12-Wausau	0.5286 (0.8618)	1.6965 (0.6133)	1.0599 (0.8041)	2.8862 (1.3182)	0.7966 (0.8046)	2.2180 (0.9900)
REGION13-Appleton	0.7530 (0.6768)	2.1233 (1.1125)	-0.8583 (0.7221)	0.4239 (-1.1886)	-0.2752 (0.5911)	0.7595 (-0.4655)

*significant at the .10 confidence level **significant at the 0.05 confidence level ***significant at the 0.01 confidence level. N=492

Findings

- The results in Table VII show that locations in both the Milwaukee and the Janesville metropolitan areas are associated with lower proportions of establishment annual sales coming from products introduced in the past three years than for manufacturing establishments located in rural Wisconsin.

- The association for locations in the Milwaukee metropolitan area is significant at the 1% critical level & for locations in the Janesville metropolitan area at the 5% critical level

Findings (Cont'd)

- These results are surprising and they are robust throughout the models. There is a strong association for locations in Milwaukee & Janesville but it is negative.

- There is no available information to explain why, but however probable causes of this surprising result include:

    - Large manufacturing plants are relocating or closing down, for example GM in Janesville (over 2000 jobs lost)
    - Headquarters relocation (Miller Brewing), plant closures and massive layoffs (Harley- Davidson) in Milwaukee
    - House prices declining in Milwaukee at a rate higher than other metro areas
    - Steep recession period

Limitations

- This research is exploratory & the findings are tentative for a number of reasons:
  - First, only one state, Wisconsin, is included in the analysis
  - Second, the distribution of the business establishments is skewed, even though NAICS industry dummies help control for the impact of the skew on the results
  - Finally, data were collected at an early stage of a steep recession, however, despite these time limitations the results are suggestive and justify replication with other different data sets.

Conclusions

- Models restricted to SME size & 4-digit NAICS fixed effects have superior results than other models

- This study provides empirical evidence on the link between locating a business establishment in a metropolitan area & business behavior that is associated with competitive advantage

- This study shows that location of a business establishment in the La Crosse metropolitan area is associated with supply chain efficiency

Conclusions (Cont'd)

- Locating a business establishment in the Milwaukee metro area or the Janesville metro area (during this period) is associated with lower revenues being generated from new products

- The link between the region & the firm can be used for business retention & attraction purposes by economic development managers

- The link can also be used by site selection consultants for location selection decision making & by firms that seek to increase the sustainability of the competitive advantage of their businesses. However, other factors need to be considered such as whether the region is affected by a recession.