Firm Size Profiles and Regional Volatility: Is There a Connection?

Dr. J. Barry Gilmore, Management, Memphis State University

Dr. Robert Dean, Economics, Memphis State University

Dr. Peter Wright, Management, Memphis State University

Abstract

In recent years increasing attention has been focused on the role smaller firms play in the economy. This paper examines the relationship between a region's manufacturing firm size distribution and regional economic volatility. The study findings suggest there is a relationship between the size profile of a region's manufacturing firms and that region's sensitivity to changes in the nation economy. It was also found that fewer and fewer firms of a given size were required before a region became economically sensitive to national economic cycles.

Introduction

Until the early 1970's, very little was known about the relationship between individual firms and the aggregate economy. This situation was particularly true in the case of small firms which, although great in number, were generally believed to have much less impact on the economy than large firms. This size bias toward the impact of the larger firm can also be seen at the regional and local level where economic development efforts have often been directed toward attracting firms that would hire large numbers of employees at "high" wage rates. In Tennessee, for example, the recent location of the General Motors Saturn plant near Nashville and the relocation of International Paper Company to Memphis are two excellent examples of this approach to economic development. Another illustration of this approach is that the large firm is often able to obtain local tax subsidies not available to smaller firms.

Efforts by David Birch, Catherine Armington et al., to evaluate the contributions of individual firms to the job generating process have helped us to better understand how the process actually works (Birch 1979, Birch 1982, Birch 1984). In 1979 David Birch published his pioneering research on the job generating process in the U.S. which challenged the prevailing notion of big business dominance. Utilizing the Dunn and Bradstreets market identifier file, which contains over 5.6 million establishments, Birch studied the change in business establishments over the periods 1969, 1972, 1974, and 1976. His principal finding was that 66% of all new jobs created during the 1969-76 time span were created by firms with fewer than 10 employees. Moreover, this phenomenon

cut across different regions of the U.S., with no major region having less than 50% of its jobs created by small firms. Birch also concluded that job creation was quite sensitive to the business cycle, especially in the contraction phase of the cycle.

Recent studies by Birch (1987) have added a third important finding. These studies have shown that the American economy is breaking into smaller pieces. Increasingly, smaller businesses are providing goods and services that fewer, but larger businesses used to provide. These three findings increase the importance of understanding how smaller sized businesses impact the regional economy in which they are located.

The intent of this paper is to focus more closely on the business cycle and job creation by investigating the impact that firm size distribution in a region has on the region's business cycle sensitivity to national business cycles. For example, do small firms have a greater or lesser impact on a region's sensitivity to the national business cycle? Is there a critical mass (i.e. a certain number of establishments) before a region becomes very sensitive to changes in the national economy? Before examining these questions a brief review of previous macro and micro work in this area is appropriate.

Economic Sensitivity - The Macro Perspective

Since the late 1920's, regional economists have concentrated a great deal of effort on studying the business cycle. A number of different macro approaches

have attempted to deal with the variances between a regional economy and the national economy.

Export-based theory was used by McLaughlin (1930), Vining (1940) and Williams (1950) to explain the regional business cycle. The export-based argument was that expansion and contraction in the local economy was mainly determined by fluctuation in the growth of exports. Metzler (1950) developed the Vining model into a broader set of interregional trade models accommodating feedback effects and multiplier-accelerator. Metzler's work, in turn, was expanded by Airov (1963) and Jutila (1973). They argued that differences in regional cycles were mainly due to regional differences in income elasticities of demand.

Differences in regional cycles and the conformance of regional patterns to national patterns of growth were also thought to be dependent upon a region's industrial composition. Neff and Weifenbach (1949), Williams (1950), Borts (1960), Thirwall (1966), Richardson (1969), Cho and McDougal (1978) have shown in one way or another that concentration of employment and production in the manufacturing sector influences the nature and duration of different phases in the regional cycle.

Industrial diversification, the counterpart of concentration, has also been considered a key factor in explaining the volatility of regional business fluctuations. Studies by Kidner (1946), Gabarino (1954), and Rodgers (1957) suggest that the amplitude of regional business fluctuations declines with industrial diversification. On the other hand, they found that as a region's industrial mix becomes more like the national mix its business cycle tends to conform to the national cycle.

Engerman (1962) suggested another factor which affected cyclical volatility was industrial growth itself. Engerman argued that growth tended to mitigate the dilatory effects the cyclically sensitive components of a region's industrial sector by providing new sources of income and job opportunities in the downturn phase of the cycle.

In a regional sense the most comprehensive study of the differences in regional business cycles was carried out by Bort (1962) in his study of the manufacturing sector. He assumed that manufacturing was more cyclically sensitive than other sectors, such as the service and retail sectors. Bort found that differences in regional business cycles vis-a-vis the national economy had diminished over time.

Each of these attempts to explain the regional sensitivity vis-a-vis the national economy took a macro approach. In these studies, however, little research attention was given to the role of smaller firms in regional sensitivity

to changes in the national economy.

Smaller Businesses and Economic Volatility - The Micro Perspective

Failure rates of small firms are well documented and would lead one to conclude that small firms would be very unstable and thus contribute to a region's sensitivity to changes in the national economy. As noted earlier, however, small manufacturing firms create a disproportionate number of new jobs than their share of employment in the economy and they continue to create jobs even during a recession (Jacobson 1985, Birch 1984, Birch 1987). Even so, when the small firm begins to grow toward mid-size (100-499 employees), some writers have suggested that because of the organizational changes required by this growth, these mid-size firms increase their geographic home areas' sensitivity to national economic cycles. Thus, these changes and how they might cause the smaller firm to be more sensitive to the economy in which it operates are examined below.

That an organization goes through different phases, even organizational upheavals, as it grows has been well documented in the literature by writers in a number of fields (Greiner, 1972, Quinn and Cameron 1983, McNichols, 1983, Mintzberg, 1984). This literature suggests that as an organization grows the problems it faces will change (Vozikis 1984, Blanholtz 1986). With growth the owner/entrepreneur is required to operate in an increasingly professional management mode. The owner/entrepreneur must, because of the required rise of the organization's bureaucratic structure, increasingly manage supervisors rather than operative employees (McNichols, 1983). Churchill and Lewis (1983) found that the entrepreneur must then decide whether to disengage himself from the business or make a commitment to remain in the business and manage its growth. They also found that either of these decisions could cause significant organizational challenges to the firm and the owner/entrepreneur.

Unfortunately, an entrepreneur's personal management techniques rarely evolve into the task requirements of a professional manager (Chandler 1977). Flanholtz (1986) found that entrepreneurial firms that are successful and grow rapidly can expect to experience ". . . certain problems related to the fact that they haven't had time to develop effective management systems." As a firm grows, its performance would be expected to suffer as firm size begins to overwhelm the entrepreneur's personal management techniques. Yet, a professional management organization has not been started or if started it hasn't developed sufficiently to effectively manage. The firm then enters a very critical point in its existence. As size increases, the operation efficiencies of the firm decrease (with the rise of the bureaucracy) before the firm is large enough to gain the market power efficien-

cies possessed by the large firm see Exhibit 1 (Neumann, 1979).

Exhibit 1

Management Efficiency vs Firm's Market Power

Thus, at the micro level these writers suggest that organizational performance suffers with growth because of internal inefficiencies. During this growth stage, the firm would then be more dependent on its external environment for the level of its performance. The firm may continue to perform well when its competitive environment is "easy" (during economic growth) and not perform very well in a tough, competitive environment (during a recession). This would suggest that firms as they grow may go through a mid-size range which would place them into a valley of volatility where performance is closely tied to firm size and the level of the business cycle. (1) In this situation, one could suggest that this size firm would contribute to a region being more economic volatility. Do mid-sized firms in fact go through this kind of financial volatility? There is some research to suggest this in fact is the case.

One measure of the "quality of performance" in the mid-size firm would be the dollars of assets controlled by the mid-size firms and the trend of that control. Using Internal Revenue Service data, Kuhn (1982) looked first at active corporations and then narrowed his analysis to look at manufacturing corporations. Kuhn found that the relative power of firms controlling less than \$250 million in assets declined rather dramatically between 1955-75. By dividing the companies into asset size groups, he found that the steepest decline had come in his smallest asset size group of \$10-25 million in assets (the smallest group to be tallied). This size category parallels the 100-499 employee mid-sized firms classification in this study. (2)

While controlling slightly more than 8% of total corporate assets of all firms in 1955, the \$10-25 million firms saw their influence decline to 4.4% by 1975. Kuhn

then computed Return on Equity (ROE) and Return on Equity (ROA) by firm asset size for manufacturing corporations. He found a steep drop in both ROE (18.5% to 13.59%) and ROA (7.2% to 5.8%) when comparing companies with less than \$5 million in assets to those with \$10-25 million in assets. (3)

This data suggest that as a manufacturing firm's size increases from small to mid-size to large, their financial performance, on these two measures, declines and then rises again as size increases. However, when Kuhn (1982) looked at the relationship between after tax profit as a percentage of sales and asset size for these same manufacturing firms, he found an increasingly positive relationship as company asset size increased.

Even though Hall and Weiss (1967) in their study of the Fortune 500 also found a positive relationship between size and profit, this was contradicted by other studies (Samuels and Smyth 1968). By using "multiple regression" of size and profitability to filter out other factors (e.g. market share, concentration and factors and entry barriers), the resulting "partial regression" coefficients of profitability and size indicated a negative relationship between profitability and size in both studies (Shepard, 1979 and Neumann *et al.* 1979). In attempting to explain these contradictions, Neumann *et al.* states:

... we suggest that higher rate of return of the big firm can be explained by market power. Obviously, the adverse impact of diseconomies of firm size has been overcompensated by the effects of market power enjoyed by larger firms.

Neumann's explanation would then give a plausible explanation to the conflicting findings. Small firms, usually entrepreneurially managed, will be more efficiently managed (as measured by ROA and ROE) and have a low degree of bureaucracy to support. Those same firms when they grow to mid-size would have low market power and thus low Return on Sales (Kuhn 1982, Schere 1980) which would cause them to be very sensitive to the economic cycle. The reverse is true for the large firm. Mid-sized firms find themselves with neither of these advantages; thus, it would seem that the mid-sized firms performance may be much more subject to its external economic environment than the smaller firm.

Firm Size and Employment

As noted earlier, David Birch in 1979 published his pioneering research on the job generating process in the U.S. He challenged the prevailing notion that large firms provided the primary stimulus to economic growth and were also the principal source of job creation. Birch has recently updated this earlier study and published his findings in a new book entitled *JOB CREATION IN AMERICA* (1987). Because of the relevance of this

study to our research, his empirical findings are summarized below in Tables 1 & 2.

Table 1 gives the shares of the job pool held by firms of different size. Notice that even though the size of the job pool has increased a little over 1,000,000 jobs in the four years between 1981-85, the job shares for the different employment size categories has remained roughly the same. The largest single share of the job pool in the years 1981 and 1985 was maintained by very small firms (25.3 %, 25.2 %) while medium size firms had the smallest share (17.1 %, 16.7 %). The very large firms contributed roughly one-fifth of all jobs. This stability in share over time, however, actually masked a great deal of volatility in job creation during start ups and expansions as shown in table 2. Notice that in both the start-up of new firms and the expansion of existing firms, the very small firms have had the worst record. Indeed, according to this latest data gathered by Birch, 88% of all jobs created by expansions and start-ups (net of contractions and closings) came from the very small firms. There was a large net decline for mid-sized firms and a small net decline for large firms. This is consistent with the earlier research by Kuhn and others. Clearly, there is considerable volatility in job creation and contraction by firm size. Thus, one must ask, does this volatility impact the firms home geographic regions when compared to the national economy?

Methodology

This study will focus on the impact that the distribution of firms by size has on a region's sensitivity to national

Table 1
Share of Jobs By Size of Firm
1981-1985

Size Class			Share of Jobs 1981	Share of Jobs 1985
Very Small	1- 19	employees	25.3%	25.2%
Small	20- 99	employees	19.2%	19.8%
Medium	100-499	employees	17.1%	16.7%
Large	500-4999	employees	18.3%	18.3%
Very Large	5000 plus		20.1%	19.8%
Size of Job Pool			12,127,400	13,237,200

Source: Birch, David; Job Creation in America (New Y.Y., The Free Press, 1987) p. 12.

Table 2
Net Job Creation By Size of Enterprise
1981-1985

Size Class		(000) Net Expansions	Net Startups	Overall Net	% Of Net
Very Small	(1- 19)	1809.7	753.8	2563.4	88.1%
Small	(20-99)	603.5	176.8	780.3	26.8
Medium	(100-499)	33.8	-603.4	-569.6	-19.6
Large	(500-4999)	58.9	- 61.0	-2.0	-.1
Very Large	(5000 +)	<u>-297.7</u> 2208.2	<u>435.4</u> 701.6	137.7	4.7

Source: Birch, David; Job Creation in America (New York, N.Y., The Free Press, 1987) p. 16.

economic cycles. Three questions will be examined:

1. Is there a "critical mass" (i.e. a certain number of establishment of a given size) before a region becomes very sensitive to variations in the national economy?
2. If there is a "critical mass" before a region becomes sensitive to the national economic cycles, has there been significant shift in the size of this mass between 1972 and 1982?
3. Do small and/or medium sized firms have a greater or lesser impact on the economic sensitivity of their home region?

In order to examine these questions, the Census of Manufacturing for 1972 and 1982 was used as a data base. Employment, was used to eliminate the problem associated with calculating financial performance measures (e.g. profits). The manufacturing sector was used because it is usually considered the most sensitive to fluctuations in the national economy. Each state was used as a region and its sensitivity was measured against the national economy in a regression model. The result of this regression model was an index of cyclical sensitivity called **AGAIN**. (4)

AGAIN compares the change in manufacturing employment in a region to changes in the national economy. An index number > 1 means that a region's change in employment is greater than the change in the national economic's employment percentage wise.

Findings

The data (Exhibits 2-4) suggests that there are three stages that regions go through as the number of firms of a given size increase. In Stage I, the region, with few firms of that size grouping, is insensitive to the national economic cycle. In Stage II, the region experiences rising sensitivity as the number of firms of that size grouping increases. Finally, as the number of firms of a given size continue to increase, a region becomes highly sensitive to the national economic cycle (**AGAIN** > 1). For purposes of this study, the Sensitivity Threshold is defined as moving from Stage I to Stage II.

Exhibit 2 suggest that in 1972 and 1982 a region had to have approximately 2500 very small firms before it reached its Sensitivity Threshold. When a region has between 3500-3800 firms, the sensitivity (**AGAIN** is still < 1) to the national economy is rising. A region with more than 8000 very small firms is more volatile (**AGAIN** > 1) than the national economy.

A region's Sensitivity Threshold comes when it has 1200-1500 small firms (Exhibit 3). Sensitivity rises until approximately 3500-3700 small firms at which time the

region's **AGAIN** index rises sharply. This suggest that the region then becomes highly sensitive to the national cycle.

The Sensitivity Threshold of a region is reached at approximately 600 mid-sized firms as shown in Exhibit 4. At approximately 1500 mid-sized firms, a region becomes highly sensitive to fluctuations in the national economic cycle.

Exhibits 2-4 strongly suggests that as a region begins to approach a "critical mass" of manufacturing firms of a given size, the sensitivity of that region rises dramatically. This suggestion raises a number of intriguing questions. Is there a manufacturing firm size profile for a region which would cause the region to have less sensitivity to the national economic cycle? Because the firm size/regional sensitivity issue has been examined from a macro perspective, are there micro issues which could distort or cloud the findings (e.g., the industry in which the manufacturing firm is operating)?

An examination of the second question in this study now becomes appropriate. Was there a downward shift, between 1972-1982, in the number of firms needed for rising sensitivity in a region? There has been a downward shift in threshold levels of all sized firms between 1972-1982 (Exhibit 5). A T-Test for differences in firm size regression coefficients shows significance (.95 level) for all three firm sizes (Exhibit 6). In other words, it took fewer firms in a region in 1982 (verses 1972) before that region became sensitive to the national cycle.

The data examined to this point suggests that there is a "critical mass" number of very small, small, and mid-sized firms. Beyond this threshold number of firms, a region becomes increasingly sensitive to swings in the national cycle. It has further been found that there has been a statistically significant downward shift, between 1972-1982, in the number of manufacturing firms for a region required to reach this "critical mass." Now we turn to the third question: do smaller or larger firms have more impact on a region's sensitivity? In order to examine this question, three different approaches were used.

As noted earlier, Birch's findings suggested that regions with increasing numbers of small firms will have greater sensitivity to the business cycle especially during contractions in the economy. To test this hypothesis, three different types of models were used: 1. Simple Ordinary Least Squares (OLS) Models (Expressed in Logs); 2. Two Stage Least Squares (TSLS) Models (Expressed in Logs); 3. A Multiplicative Model (Expressed in Logs).

All three types of models were tested on the years 1972 and 1982. The U.S. Census of Manufacturers was

EXHIBIT 2
Regional Sensitivity to National Economic Cycles by the Number of
Very Small Firms (1-19 Employees) in a Region

EXHIBIT 3
Regional Sensitivity to National Economic Cycles by the Number
of Small Firms (20-99 Employees) in a Region

EXHIBIT 4
Regional Sensitivity to National Economic Cycles by the Number
of Mid-Sized Firms (100-499 Employees) in a Region

Table 3
T TEST FOR
DIFFERENCES IN
FIRM SIZE REGRESSION COEFFICIENTS
1972 - 1982

<u>FIRM SIZE</u>	<u>1972-1982</u>
LARGE VS LARGE	2.60*
MEDIUM VS. MEDIUM	1.80*
SMALL VS. SMALL	1.67*
VERY SMALL VS. VERY SMALL	1.72*

* Significant at 95% CONFIDENT LEVEL
 FOR A ONE TAIL TEST

** Based on data from Exhibit 7

EXHIBIT 5

THRESHOLD LEVELS OF
ESTABLISHMENTS BY FIRM SIZE
1972 AND 1982

Exhibit 6

T TEST FOR
DIFFERENCES IN
FIRM SIZE REGRESSION COEFFICIENTS
1972 - 1982

<u>FIRM</u>	<u>SIZE</u>	<u>1972-1982</u>
LARGE VS. LARGE		2.60*
MEDIUM VS. MEDIUM		1.80*
SMALL VS. SMALL		1.67*
VERY SMALL VS. VERY SMALL		1.72*

* Significant at 95% CONFIDENT LEVEL
 FOR A ONE TAIL TEST

** Based on data from Exhibit 7

again the basic source of data for establishments by size. In the multiplication model experiment, a cross sectional pooled time series approach was used to determine the effect of time.

The simple OLS regression results for the size of establishment variables are shown in Exhibit 7. The B coefficients tend to confirm Birch's findings that very small firms have a greater impact on cyclical sensitivity than do very large firms. Indeed there is a nice progression in parameter values as one moves from large to very small establishments. This pattern holds for both 1972 and 1982 although the difference between the elasticity coefficients for very large and medium firms is not very great. It is interesting to note that the "size of establishment" variables explained a great deal of the variation in cyclical sensitivity between regions. Moreover, the R's remain fairly stable over time. Next, a T-Test was run between different sized firms for a given period of time (Exhibit 8). These tests were all found significant at the .95 level except for large vs. medium firms in 1972.

In the TSLS models, it was hypothesized that establishment size also depends on cyclicality. To eliminate the covariation in the error term and the endogenous variables, the fitted value LOG L was obtained by regressing LOG L on the instrumental variables LOG and DIV. The second stage is to regress LOG C on LOG L; the results of which are shown in Exhibit 7. In this case, the elasticity coefficients are all larger than the simple OLS counterparts. Interestingly enough, the pattern in the B coefficients has not changed. In fact, the difference in elasticity between very small and very large firms has actually widened.

Exhibit 9 indicates that the partials for the size of establishment variables are considerably different from those generated by the simple OLS and TSLS runs. Part of the explanation for the difference is that L Log and L Div both have a strong influence on regional cyclicality and that influence was not accounted for in the simple OLS models. Perhaps more importantly, the size of establishment variables is highly correlated with one another which is most evident in the sign change for the L/M and L/VS partials. Also, notice how the elasticity coefficients change greatly between the two time periods indicating considerable parameter instability. According to these results, small and large firms have the strongest impact on regional cyclical sensitivity. This pattern is not consistent with the simple OLS or TSLS runs. Finally, the time dummy's slope coefficient was not significantly different from zero. This indicated no major shift through time in the impact of size of establishments on regional cyclicality. Once again, this is not consistent with the simple OLS and TSLS findings.

Do very small establishments have a greater impact on the regional cycle than large establishments? Two of the three experiments suggest that they do; however, no definitive answer is forthcoming until the t-tests are completed. The multiplicative model is flawed because of multi-collinearity between the independent variables. Efforts to reduce multi-collinearity by transforming the

Table 4
OLS Regression Results Log of Log Gain on Firm Size

Two Stage Least Squares Regression Log Gain on Firm Size*																	
Firm Size	B ¹ Coefficient	1972				1982				1972				1982			
		SeB	T	R ²	B	SeB	T	R ²	B	S ₁ B	T	R ²	B	SeB	T	R ²	
Large	.90	(.039)	23	.92	1.03	(.046)		.92	.94	(.050)	19	.92	1.04	(.057)	18	.92	
Medium	.97	(.038)	25	.93	1.06	(.053)	20	.90	1.01	(.050)	20	.93	1.12	(.069)	16	.90	
Small	1.05	(.046)	22	.92	1.15	(.062)	19	.89	1.24	(.081)	15	.89	1.37	(.102)	13	.85	
VSmall	1.15	(.066)	17	.87	1.28	(.089)	14	.82	1.46	(.126)	12	.80	1.71	(.177)	10	.72	
Large/ medium	.93	(.036)	26	.94	1.06	(.050)	21	.91									
Small/ VSmall	1.13	(.060)	19	.89	1.25	(.081)	16	.84									

1 = Coefficients represent elasticities of cyclical sensitivity.

2 = Instrumental variables are Log and Div.

Exhibit 7
OLS Regression Results Log of Log Gain on Firm Size

									Two Stage Least Squares Regression Log Gain on Firm Size *								
		1972				1982				1972				1982			
Firm Size	B ¹ Coefficient	SeB	T	R ²	B	SeB	T	R ²	B	S ₁ B	T	R ²	B	SeB	T	R ²	
Large	.90	(.039)	23	.92	1.03	(.046)		.92	.94	(.050)	19	.92	1.04	(.057)	18	.92	
Medium	.97	(.038)	25	.93	1.06	(.053)	20	.90	1.01	(.050)	20	.93	1.12	(.069)	16	.90	
Small	1.05	(.046)	22	.92	1.15	(.062)	19	.89	1.24	(.081)	15	.89	1.37	(.102)	13	.85	
VSmall	1.15	(.066)	17	.87	1.28	(.089)	14	.82	1.46	(.126)	12	.80	1.71	(.177)	10	.72	
Large/ medium	.93	(.036)	26	.94	1.06	(.050)	21	.91									
Small/ VSmall	1.13	(.060)	19	.89	1.25	(.081)	16	.84									

1 = Coefficients represent elasticities of cyclical sensitivity.

2 = Instrumental variables are Log and Div.

variables into standard deviation units will hopefully improve the reliability of this particular model.

References

- 1 Mid-sized firms are defined in this study as having between 100-499 employees.
- 2 SBA data indicates that in the 100-499 employee group the asset size range would be approximately \$4 million to \$19 million in asset size. Small Business Administration (1983)
- 3 Probable bias causes the small firm group (<\$5 million in assets) to understate their income because smaller company owner-managers tendency to pay themselves salaries and benefits above the market. (Stekler 1963, Stigler 1963). Thus, the difference in performance is probably even more pronounced. Schere (1980) found that ROE increased as asset size increased from \$10 million to \$1 billion. Unfortunately, no firms under \$10 million in assets were included to eliminate the just-mentioned owner compensation biases.

Table 5

<u>T TEST FOR</u>		
<u>FIRM SIZE REGRESSION COEFFICIENTS</u>		
<u>FIRM SIZE</u>	<u>1972</u>	<u>1982</u>
LARGE VS. MEDIUM	2.34**	.50
MEDIUM VS. SMALL	2.00*	1.85*
SMALL VS. VERY SMALL	1.67*	1.88*
*SIGNIFICANT AT 95% CONFIDENCE LEVEL		
ONE TAIL TEST		

Exhibit 8

<u>T TEST FOR</u>		
<u>FIRM SIZE REGRESSION COEFFICIENTS</u>		
<u>1972 AND 1982</u>		
<u>FIRM SIZE</u>	<u>1972</u>	<u>1982</u>
	<u>T VALUE</u>	<u>T VALUE</u>
LARGE VS. MEDIUM	2.34*	.50
MEDIUM VS. SMALL	2.00*	1.85*
SMALL VS. VERY SMALL	1.67*	1.88*
* SIGNIFICANT AT 95% CONFIDENCE LEVEL		
ONE TAIL TEST		

- 4 For a complete discussion of the AGAIN model see Appendix 1. The AGAIN index was then plotted for 1972 and 1982 for firms on three different sizes. The firm sizes plotted were: 1. Very Small Firms (< 20 employees), 2. Small Firms, (20-99 employees) and 3. Mid-Sized Firms (100-499 employees). These graphs then allowed examinations of the first research question.

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Table 6
Multiplicative Model in Log Linear Form

	1972			1982			1972/1982 Pooled Series		
	B	SeB	T	B	SeB	T	B	SeB	T
LDIV	-.05	.03	-1.6	.04	.06	.71	-.03	.03	-.81
LLOQ	.92	.18	5.1	.26	.24	1.04	.57	.17	3.32
LL	.24	.14	1.7	.84	.26	3.14	.21	.11	1.94
LM	-.37	.23	-1.6	-.64	.35	-1.79	-0.13	.18	-.69
LS	.92	.26	3.5	.82	.49	1.67	1.01	.28	3.64
LVS	.07	.26	.27	-.01	.39	-.03	-.18	.24	-.73
Dummy	--	--	--	--	--	--	-.09	.07	-1.25
R ²			.97			.94			.94

Exhibit 9

Multiplicative Model in Log Linear Form

	1972			1982			1972/1982 Pooled Series		
	B	SeB	T	B	SeB	T	B	SeB	T
LDIV	-.05	.03	-1.6	.04	.06	.71	-.03	.03	-.81
LLOQ	.92	.18	5.1	.26	.24	1.04	.57	.17	3.32
LL	.24	.14	1.7	.84	.26	3.14	.21	.11	1.94
LM	-.37	.23	-1.6	-.64	.35	-1.79	-0.13	.18	-.69
LS	.92	.26	3.5	.82	.49	1.67	1.01	.28	3.64
LVS	.07	.26	.27	-.01	.39	-.03	-.18	.24	-.73
Dummy	--	--	--	--	--	--	-.09	.07	-1.25
R ²			.97			.94			.94

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Appendix I: The AGAIN Model

To test the hypothesis that the size distribution of firms within a region influences the sensitivity of the region to the national business cycle, a regression model is established as follows:

$$Y = a + b_1 x_1 + b_2 x_2 + \dots + b_{16} x_{16}$$

where:

Y Log Gain Statistic, measure of cyclical sensitivity for a given region.

X₁ Manufacturing Employment Concentration Index, measure of the relative concentration of manufacturing in a given region.

X₂ Growth Index, measure of five year rate of growth in the region.

X₃ Growth Index, measure of five year rate of growth in the region.

X₄ Research and Development, measure of R & D spending in the region

X₅ Retail/Wholesale Gain Statistic, measure of the impact of changes in Retail/Wholesale employment on

manufacturing employment.

X_6 Finance Gain Statistic, measure of the impact of changes in Finance employment on manufacturing employment

X_7 Service Gain Statistic, measure of the impact of changes in Service employment on manufacturing.

X_8 Capital Expenditure per Employee, measured of annual spending on capital equipment in manufacturing.

X_9 HSD effect, measure of major changes in employment growth in region.

X_{10} Number of establishments with < 20 employees.

X_{11} Number of establishments with 20-99 employees.

X_{12} Number of establishment with 100-499 employees.

X_{13} Percentage of establishment with < 20 employees.

X_{14} Percentage of establishment with 20-99 employees.

X_{15} Percentage of establishment with 100-499 employees.

X_{16} Total number of establishments.

The relationship between the dependent variables, regional cyclical sensitivity and the independent variables is described below. The first independent variable (X_1) is called the location quotient and is a concentration index indicating the concentration of manufacturing employment at the state level in relation to the national level.

manufacturing employment @ state level; total employment @ state level; X_1 manufacturing employment @ national level; total employment @ national level

If X is greater than one, the state has a higher concentration than the national average. One would anticipate that, since manufacturing is highly cyclical, Y and X_1 should have a direct relationship.

The second independent variable (X_2) is called the diversification index. The diversification index measures employment in all industries, other than manufacturing, in relation to total employment. X_2 is calculated from cumulative frequency distributions of industrial employment. If X_2 is close to one, it represents a highly diversified economy that should be less susceptible to cyclical fluctuations. If this is true, Y and X_2 should have an inverse relationship.

The third independent variable (X_3) is called the growth index. The growth index represents the average growth rate over multiple two year periods.

$$X_3 = \frac{E_t - E_{t-1}}{E_{t-1}}$$

$$E_t - 1$$

A high, steady average growth rate should tend to offset counter cyclical activity, while a lower, unsteady rate

should increase cyclicality. If this is the case, Y and X_3 should have an inverse relationship.

The fourth independent variable (X_4) is a measurement of the level of spending on research and development. It would be natural to assume that higher levels of R & D spending increase efficiency, productivity, expansion and growth and, consequently, reduce regional sensitivity to cyclical fluctuations. If this is true, the relationship between Y and X_4 should be inverse.

The fifth, sixth and seventh independent variables (X_5 , X_6 , and X_7) are wholesale gain statistic, finance, insurance and real estate gain statistic and the service gain statistic, respectively. These variables represent the ratio of manufacturing activity to wholesale, F.I.R. and service activity, respectively. Decrease in manufacturing are often offset by increases in one of these industries. When this is true, and one or more of these gain statistics are low, the cyclical sensitivity should be reduced. This means that Y should have a direct relationship to X_5 , X_6 , and X_7 .

The eighth independent variable (X_8) is capital expenditures per worker. This is a productivity measure with counter cyclical effects. Consequently, Y and X_8 should have an inverse relationship.

The ninth independent variable (X_9) is a dummy variable called the threshold effect.

The tenth, eleventh and twelfth independent variables (X_{10} , X_{11} , and X_{12}) are the number of establishments with less than twenty, twenty to ninety-nine and 100-499 employees respectfully. These indicate the effect of small and mid size firms on cyclical fluctuations. As was mentioned earlier, the greater the number of small and mid size firms the more sensitive the economy should be to these fluctuations. This result would come because the small and mid size firm is more volatile and subject to swings in the economy. If this is true, then Y should have a direct relationship to X_{10} , X_{11} , and X_{12} .

The thirteenth, fourteenth and fifteenth independent variables (X_{13} , X_{14} , X_{15}) represent the percentage of establishments with less than twenty, twenty to ninety-nine and 100-499 employees respectively. These should provide an indication of the effect of small and mid size business on cyclical fluctuations. As with X_{10} , X_{11} , and X_{12} , X_{13} , X_{14} , X_{15} should have a direct relationship to Y .

The independent variable (X_{16}) is the total number of establishments. As total establishments increase, sensitivity to cyclical fluctuations should increase. Hence, Y should have direct relationship with X_{16} .