The Determinants of New Firm Formation Dynamics

Vinod Sutaria, Ph.D.

Independent Consultant

Dallas, Texas 75063

vsutaria@attbi.com

and

Donald A. Hicks, Ph.D.

School of Social Sciences

The University of Texas at Dallas

Box 830688

Richardson, Texas 75083-0688

dahicks@utdallas.edu

ERSA Congress Reference Number: 399

Abstract:

Empirical studies on determinants of new firm formations undertaken so far have yielded contradictory results with respect to their impact on new firm formations primarily due to two reasons: (1) lack of appropriate data for a longer period of time, and (2) use of regression methods that are incapable of controlling for 'immeasurable' region-specific and time-specific effects. This paper, representing the first ever effort in filling these gaps, analyzes determinants of new firm formations by employing a new regression modeling technique (fixed effects regression technique) on a unique data set available for a longer period of time (16 years longitudinal data). We found a positive and significant impact of unemployment rate change, mean establishment size, entry and exit rates (lagged one year), and total bank deposits on new firm formations.

1. Introduction

The determinants of new firm formations have been extensively examined during the last decade. These studies used different determinants, were carried out for different sectors and in different countries using different units of analysis. But there was one problem with these studies: they produced contradictory results regarding the impact of determinants (contextual factors) on new firm formations. For example, Reynolds (1994), Guesnier (1994), and Armington and Acs (2002) found significant and positive impact while Audretch and Fritsch (1994) and Garofoli (1994) found no impact of a change in population on new firm formations. For change in unemployment rate, Highfield and Smiley (1987) and Audritsch and Fritsch (1994) found significant and positive impact on new firm formations while Guesnier (1994) and Garofoli (1994) found that relationship to be significant but negative. For mean establishment size, Audretch and Fritsch (1994) found no significant impact while Armington and Acs (2002) found significant and negative impact on new firm formations. These results not only created confusion among scholars about the true nature of impacts of contextual factors on new firm formations, but also made it more difficult for policy makers to implement them.

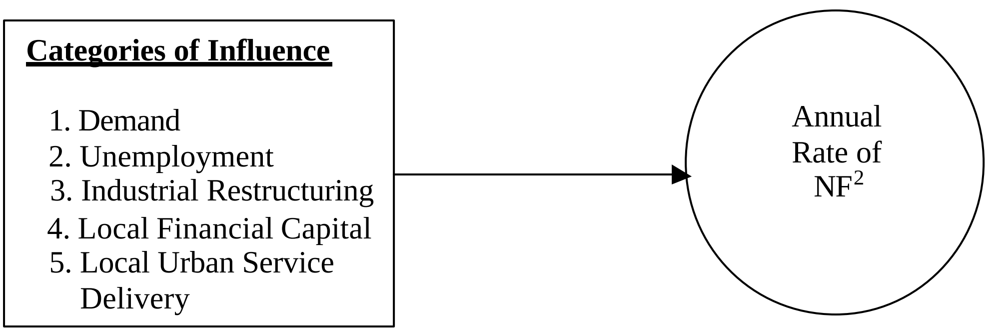
What could be the reasons for such a state of research on determinants of new firm formations, particularly the research that is based on quantitative methods? It is common knowledge that entrepreneurship research, particularly the research involving utilization of quantitative methods, is at pre-paradigmatic phase. This phase is identified with lack of theories, data and clear understanding of definitions and concepts, lack of common starting points and unconsciousness of selection of rational research problems and quantitative methods; and accumulation of empirical studies with contradictory findings. Data representing local level economic dynamism, such as new firm formations, terminations, and survival rates, are very difficult to find simply because the current data collection system is based on neoclassical economics where emphasis is placed on static and aggregate analysis. The subject of determinants of new firm formations is very complex with multiple independent factors and interactions between them playing a key role in influencing new firm formations. Though these underlying complexities have been recognized by scholars, relatively less sophisticated quantitative techniques that are unable to control for 'immeasurable' region-specific and time-specific effects have been employed often yielding contradictory results. In this paper, in trying to fill the deficiency of previous studies, we propose and utilize a new approach (the fixed-effects regression modeling approach) which is relatively more sophisticated than simple OLS regression approach used in most of the previous empirical studies on new firm formations. According to our knowledge, such an advanced approach that accounts for 'immeasurable' region-specific and time-specific effects on new firm formations has not yet been conducted, primarily due to unavailability of data at a smaller regional scale for a longer period of time. In this study, we utilize a unique data set providing information on annual rates of new firm formation, termination, and survival in the manufacturing sector for all Texas metropolitan statistical areas (MSAs) over the period 1976-91.

The study is organized as follows. We start with an overview of hypotheses (section 2) followed by database development and concept measurement issues (section 3). Key data issues and ordinary least square (OLS) violations and remedies employed are explained in section 4 and 5 respectively. Section 6 introduces basic regression model followed by analysis of zero order correlation in section 7. Model estimation techniques employed for data analysis are explained in section 8; and further elaboration of these techniques using regions and time as controls is explained in section 9. Finally, we draw some conclusions and suggest directions for further research.

2. Hypotheses: Predictor Variables Exerting Independent Influences

The conceptual framework within which the hypotheses about regional factors influencing NF^2 will be derived and tested is illustrated in the following figure.

Figure Categories of Influence



Ten predictors judged to exert independent influences on NF^2 were conceptualized for this study (Table 1). Taken together, these ten predictors were then categorized to represent five start-up mechanisms operating across the 1976-91 period for all 27 Texas MSAs and PMSAs. Annual data across the 1976-91 period were developed for each of the associated indicators and then merged with Hicks' original data on entries and exits of establishments. The identification individual predictors reflects previously published research on the general topic, as well as informed judgments regarding regional factors likely to account for NF^2 that have not yet been tested in the literature. In the following section, we justify theoretically each of the five influence categories along with their specific indicators and offer testable a hypothesis for each independent variable.

(1) Demand: Expanding demand for goods and services are considered stimulative to NF^2. It is reasonable to hypothesize that new firms emerge to satisfy rising new demands for goods and services. We have developed two indicators representing change in local demand: (1) annual change in a region's population, and (2) annual change in a region's per capita personal income. An increase in either can be expected to drive rising demand for goods and services (Reynolds, 1994: 431), which in turn can lead to rising rates of NF^2.

Testable Hypotheses:

(1) A region's rate of population growth is positively related to its rate of NF^2.

(2) A region's rate of per capita personal income growth is positively related to its rate of NF^2.

(2) Unemployment: When a person loses his job and fails to find another one that is comparable, he may well seek to choose to create a new one for himself by starting his own business. The formation of new firms, in turn, may reduce unemployment rate as the person starting a new firm employees not only himself but also others. At the same time, a higher level of unemployment may reduce aggregate disposable income, effectively reducing local demand for goods and services, thereby putting downward pressure on its rate of new firm formation (Reynolds et al., 1994). These two opposite influences combined with a reverse causation effect – new firms reducing unemployment rate – create uncertainty about the *net* impact of unemployment on NF^2. Ultimately, the net impact of unemployment depends on which of the two influences, unemployment push or demand pull, dominates for a region, as well as the way in which the essential relationship is specified by other factors.

Two indicators of unemployment were developed for this study: the unemployment rate measured as the number of civilian unemployed as a share of a region's total civilian labor force, and the year-to-year *percent point*[1] change in a region's civilian unemployment rate. Whereas the first indicator, the level of unemployment rate for a given year, reflects the existing status of an economy *at a particular point in time* in terms of number of people unemployed, the second indicator, the year-to-year change in a region's unemployment rate, reflects the pace and direction of changing market conditions and the risks involved in starting a new business.

Testable Hypotheses:

1. *A region's level of civilian unemployment and its rate of* NF^2 *are related, although the direction of this relationship is indeterminate.*
2. *The extent of year-to-year change in a region's level of civilian unemployment and its rate of* NF^2 *are negatively related.*

(3) Industrial Restructuring: Noyelle and Stanback (1984) have provided a clear description of the sectoral and industrial restructuring by focusing their attention on the rise of a dominant producer services sector within a broader employment shift-to-services that have been reshaping the advanced economies at the national and sub-national levels. While the service sector has grown in terms of both employment and output, the conceptual boundary between goods production and services provision has been blurring. Today, it is important to note that there has not been a significant change in the manufacturing sector's contribution to the larger economy measured as a share of total GDP. What are the implications of these complex processes of industrial restructuring for the economic dynamics registered as NF^2? Does the waning importance of manufacturing employment also indicate a decline in NF^2 throughout the sector? At first glance, it may seem that the growth of the service sector could be detrimental to the growth of manufacturing sector. On the contrary, however, the growth of the service sector has actually created new demand for the development and manufacture of new products (Nivin, 1998).

In this paper, we have assumed that the growth of the service sector is stimulative to the formation of new firms in the manufacturing sector. Moreover, given the relatively high rate of productivity growth throughout advanced manufacturing, and increasing throughout technology-intensive service industries, which can function to decouple a firm's output growth from its employment growth, we have used earnings rather than employment as a measure of industrial restructuring. Specifically, the rate of change in the producer service's[2] share of total metropolitan earnings was calculated to reflect the influence of the growth of the producer service sector on NF^2.

A second predictor, mean establishment size (MES), defined as the mean number of employees, reflects the influence of firm size on the efficiency of its production and its linkages to suppliers. It is hypothesized that as a region's MES increases, its dependence on small independent firms for different types of specialty tasks and services also increases. It may be more efficient for the larger firms to outsource some of their tasks or projects to smaller firms at a cheaper rate. As a result, larger firms are able to provide not only a stable environment in which newly-established small firms can survive and prosper, but they may also stimulate the expansion of the regional supplier base.

According to Schumpeter's "creative destruction" argument, the replacement of less efficient and less innovative establishments by newer, smaller and more innovative establishments plays a key role in the industrial restructuring of a region. This is reflected in the growing literature on the interdependence between firm entries and exits. However, given the reciprocal relationship between firm entry and exit, the direction of the influence of current entries and exits on subsequent entries and exists may be ambiguous in most instances. According to Johnson and Parker (1996: 681), the ambiguity in sign may be because of two opposite effects, competition and multiplier effects, which seem to work at the same time when an entry or exit occurs. For example, more entries may cause more exits in subsequent periods due to enhanced competition (a competition effect), or may cause fewer exits because the demand for all businesses' products has increased (a multiplier effect). Similarly, exits may have both competition and multiplier effects on subsequent entries and exits. We propose four different hypotheses to analyze the effects of industrial restructuring on new firm formations.

Testable Hypotheses:

1. The rate of change in the producer service's share of total regional earnings is positively related to a region's rate of NF^2.
2. A region's mean establishment size is positively related to its rate of NF^2.
3. A region's rate of firm exit is related to its rate of new firm entry; however, the *direction of that relationship is indeterminate.*

4. A region's rate of firm entry (one-year lag) is related to its rate of new firm entry; however, the direction of that relationship is indeterminate.

(4) Local Financial Capital: Regions endowed with relatively high levels of per capita financial assets such as local bank deposits are more likely to be areas where access to capital is comparatively easy (Garofoli, 1994: 387). Such pools of capital are available not only for new startups but also for the expansion of existing businesses. The availability of business expansion capital, which usually represents an amount larger than what is likely to be financed through borrowing from friends or by using personal credit, may facilitate entrepreneurs' efforts to start new businesses.

In this study, level of per capita bank deposits in a metro region, calculated by dividing total bank deposits by the total population of a region, is introduced as an indicator of the availability of local financial capital. The resulting quotient is then introduced into the model in the form of a natural logarithm in order to make the relationship linear.

Testable Hypothesis:

The level of per capita bank deposits in a region is positively related to its rate of NF^2.

(5) Local Urban Service Delivery: Spending by local governments may have opposing influences on NF^2, a demand-pull effect and a tax-push effect. The demand-pull effect results when spending on local physical and service infrastructure improvements, in the form of improving or expanding local road systems, building more schools, and parks, lead to more contract and subcontract work and hence increased opportunities for new business. In addition, an amenity benefit resulting from local government spending on schools, roads, police, parks, fire and other services may increase a region's attractiveness to investors and entrepreneurs within and outside the region, thereby increasing a region's prospects for attracting new rounds of business formation and residential relocation. By contrast, the tax-push effect can be evident as higher spending comes to reflect higher income, and increased local government spending triggers higher local taxes and higher average cost structures for all business. Together, these pressures may depress NF^2 (Reynolds, 1994: 431). In such instances, the eventual impact of government spending on NF^2 depends on which influence – the demand-pull or the tax-push – dominates. Local government spending per capita is calculated by dividing total local government expenditure by total local population; resulting values are also introduced into the model in natural log form.

Testable Hypothesis:

The rate of local government spending is related to a region's rate of NF[2]; however, the direction of the relationship is indeterminate.

Table 1 Determinants of New Firm Formation

Dependent Variable:

Variable Name	Code	Operational Definition	Data Source
Annual Rate of New Firm Formation	ENTRY	New firms starting in a given year as a share of total firms operating at the end of the previous year	Hicks, 1993; Office of Comptroller, State of Texas

Independent Variables:

Start-up Mechanisms	Variable Name	Expected Effect	Code	Operational Definition	Data Source
Time-series Data (1976-1991)					
1. Demand	a. Population change	+	cPOP	Annual rate of population change	USDC and BEA
	b. Per capita personal income change	+	cPCPI	Annual rate of per capita personal income change	USDC and BEA
2. Unemployment	a. Unemployment rate	+/–	UER	Share of civilian labor force unemployed	U.S. Bureau of Census
	b. Unemployment rate change	–	cUER	Percent point change in unemployment rate	U.S. Bureau of Census
3. Industrial restructuring	a. Earnings: shift-to-services	+	SHIFT	Annual rate of change in producer service share of total earnings	USDC and BEA
	b. Mean establishment size	+	MES	Mean number of employees per firm	USDC, BEA and Hicks, 1993; Office of the Comptroller, the State of Texas
	c. Exit rate	+/–	EXIT	Existing firms exiting the business base as a share of total firms operating in a given year	Hicks, 1993; Office of the Comptroller, State of Texas
	d. Entry rate	+/–	ENTRYL1	New firms starting in a given year as a share of total firms operating at the end of the previous year, lagged one-year	Hicks, 1993; Office of the Comptroller, State of Texas
4. Local financial capital	a. Local bank deposits	+	DEPpc	Per capita local bank deposits in commercial and savings banks	U.S. Bureau of Census and the *Texas Almanac* (1976-1991)
5. Local urban service delivery	a. Local government spending	+/–	GEXpc	Per capita expenditure by local government on service delivery	U.S. Bureau of Census

3. Database Development and Concept Measurement

In order to analyze regional factors influencing new firm formations, we extend a database originally developed by Hicks (1993) containing information about new firm formations (entries) and terminations (exits) in the manufacturing base of the State of Texas over the 1970-91 period. The data on exist and entries were developed by linking the latest current sales tax data files (1991), containing information on unique taxpayer identification codes for individual business establishments, with those archived annually for the years 1969-1990. A new database was developed by merging Hicks' data on exits and entries with the data on independent variables for the period 1976-91. The newly developed database is of superior quality to the data sets used in previous empirical studies in three different ways: (1) The periodicity of the data is annual, (2) The data covers a longer time period (1976-91), and (3) The data are consistent with respect to time span and periodicity across all variables used in the model. Because the data used in this study are able to capture more completely the simultaneous annual variation in all variables for a period of sixteen years (1976-91), the empirical results should have greater precision and reliability compared to any of the previous studies that have attempted to account for rates and patterns of NF[2].

Unit of Analysis: In this study, all Metropolitan Statistical Areas (MSAs) and Primary Metropolitan Statistical Areas (PMSAs) in the State of Texas are used as the geographical units of analysis. There are 27 MSAs/PMSAs in the State of Texas, and they comprise a total of 59 counties, including one from Arkansas[3]. We have used 1997 definitions of county composition of each MSA and PMSA as determined by the Office of Management and the Budget. Data were then developed using constant geographic boundaries for each metro-region across the entire study period, 1976-91.

Unit of Measurement: The unit of analysis used in this study is the *establishment*, rather than the larger enterprise. This means that if an existing firm opens up a new branch at a different location, the new branch would be considered an entry to the state's manufacturing base. Similarly, a relocating establishment from inside or outside Texas is also considered as an entry allocable to a specific Texas metropolitan region or rural location (Hicks, 1993: 9).

4. Key Data Issues

The Treatment of Missing Data: Data for the development of the predictors were collected from a variety of sources, as indicated in Table 1. For several predictors, county level data were aggregated to the unit of analysis (MSA/PMSA) used in this study.

Graphs of time versus available values of a particular variable under consideration were plotted to determine the value for a missing data point. This method allowed us to capture a trend, linear or non-linear, that may exist in a data series, thus making the estimation of a missing data value more appropriate.

The Selection of Referents for Regional and Time Dummy Variables: The possibility of estimating the independent influences of a specific year (time) and a specific metro-region (place) is introduced into the analysis in the form of dummy variables. The selection of a reference point for a set of dummy variables requires careful consideration because it significantly influences the meaning and values of resulting coefficients.

Regional referent: For the purpose of this study, the regression coefficients for all regional dummy variables will be estimated and evaluated relative to the Brazoria PMSA as it has the median value for entry rate. Since the dependent variable is NF^2 rate (entry rate), a reference point that reflects the median value for the NF^2 rate is preferred. This will allow us to distinguish region-specific influences on entry rate that are greater or lower than the median influence represented by the selected regional referent. Accordingly, the average value of the entry rates for each Texas metro-region (MSAs or PMSAs) was calculated for the 1976-91 period and is reported in Appendix A. The average entry rate values ranged from 15.15 to 27.65 with 20.06 as median value for Brazoria PMSA. Operationally, assigning Brazoria PMSA as a regional referent is achieved by omitting its dummy variable from the model. The regression coefficients of all other regional dummy variables will then be evaluated relative to the Brazoria PMSA.

Time Referent: Similarly, the regression coefficients for all year dummy variables will be evaluated relative to a selected reference year. In this case, the year 1976 at the beginning of our time series was chosen so the influence of each successive year on regional rates of NF^2 across the entire study period could be assessed.

5. Ordinary Least Square (OLS) Assumptions: Violations and Remedies

In this section, we explain problems associated with violations of OLS assumptions and discuss various techniques employed to resolve or minimize the impact of violations.

Heteroscedasticity: The problem of heteroscedasticity is more prevalent in cross-sectional data because they (cross sectional data) involve units or groups that are heterogeneous in nature. Heteroscedasticity was suspected in the data set used in this study due to the cross-sectional nature of the data. Two diagnostic tests, Breusch-Pagan and Cook-Weisberg, were employed in order to check for the presence of heteroscedasticity (see Table 3). The presence of heteroscedasticity was confirmed by both tests. The Breusch-Pagan test indicated that heteroscedasticity was significant at the 0.01 level of significance; the Cook-Weisberg test indicated the presence of heteroscedasticity at the 0.10 level of significance. At this juncture, estimation with OLS was rejected, and two alternative estimation techniques capable of correcting for heteroscedastic errors were rendered: the robust regression method[4], and the estimated weighted least squares method (EWLS).

Multicollinearity: One of the problems that may arise in regression analysis is multicollinearity. The presence of a high level of multicollinearity makes it difficult to disentangle the separate influences of independent variables on the dependent variable. Technically, the CLR assumption pertaining to the absence of exact linear relationships among some of the independent variables is violated only in the case of exact multicollinearity. However, the presence of multicollinearity (an approximate linear relationship among independent variables) leads to estimation problems important enough to warrant our treating it as a violation of the CLR model (Kennedy, 1994: 176-77). It must be noted that OLS estimators in the presence of multicollinearity remain unbiased and are still BLUE; however, the variances of the OLS estimates of the parameters of the collinear variables are quite large, thus rendering many t-ratios insignificant. As a result, it becomes more difficult to find support for hypotheses.

In general, multicollinearity is not a common problem in the case of cross-sectional time-series data. In fact, combining cross-sectional and time-series data is very often used as a remedial measure to the multicollinearity problem (Gujarati, 1988: 303). Transformation of variables is another technique that is commonly used. The presence of both of these features, cross sectional time series data and transformed variables, in our data makes it less likely that multicollinearity remains a problem. Nonetheless, we decided to conduct a number of diagnostic tests to check for the presence of high multicollinearity. These tests include: (1) Analyzing the presence of High R^2 with few significant t-ratios, (2) Checking for high zero-order correlations between independent variables, (3) Checking for the presence of correlations between estimated regression coefficients, and (4) use of

Variance-Inflation Factor (VIF) method. As a result of these diagnostic tests, we conclude that multicollinearity among the predictors in our model is not a concern.

Serial Correlation: According to Kendall and Buckland (1971), serial correlation may be defined as "correlation between members of series of observations ordered in time (as in time-series data) or space (as in cross-sectional data)" (see Gujarati, 1988: 353-54). The CLR model assumes the absence of serial correlation, meaning the disturbance term relating to any observation is not influenced by the disturbance term relating to any other observation (Gujarati, 1988: 354). The OLS estimators in the presence of serial correlation are still linear-unbiased and consistent, but are not efficient, meaning they do not have minimum variance. In other words, in the presence of serial correlation we are likely to declare a coefficient statistically insignificant even though in fact it may be significant.

Serial correlation is a common problem for the data involving multiple time periods. For the purpose of this study, a regression model ($u_t = \rho \; u_{t-1} + \varepsilon_t$, where $-1 < \rho < 1$)[5] was estimated to see if the value of ρ, the first-order coefficient of serial correlation, is significant. It was found that the value of ρ (-0.023) was not significant ($t = -0.464$) indicating an absence of first-order serial correlation in the data.

6. Model Development

Given the cross-sectional and time-series nature of the data developed for this study, the fixed-effects regression model is used. This model is appropriate when the merger of panel and cross-sectional data is envisioned. In the resulting model, NF^2 dynamics are "located" in both time and space. The space dimension is incorporated into the model through the use of a dummy variable for each of twenty-six metro-regions (the Brazoria, PMSA is used as regional referent); the time dimension is incorporated through the use of a dummy variable for each of fifteen years (the year 1976 is used as the time referent) covered by the study design. Region dummies are used to control for unmeasured region-specific influences on the dependent variable, while year dummies control for unmeasured time-specific (period) influences, either or both of which may be related to the primary predictors in the model in ways that are capable of registering an effect on the dependent variable.

The fixed-effects modeling technique has never been used before for studying the phenomenon of NF^2. No study dealing with NF^2 has controlled for the effects associated with time and region. As these effects are very often intrinsically related to regional factors influencing NF^2, the results obtained using a modeling technique that does not control for such unspecified effects should be viewed with considerable caution. For example, as we will see in the Section 9, the population and bank deposit variables yielded significant effects in the absence of controls for region and time specific effects; however, both variables lost their significance as those controls were introduced in the model. The fixed-effects modeling technique is able to specify relationships between dependent and independent variables in a more precise manner, and therefore it should be considered as a significant improvement over the techniques used by previous empirical studies.

Review and evaluation of both extant literature[6] and the data used in this study led to the conclusion that my primary predictors would take approximately one year to influence localized processes of NF^2. For that reason, a one-year lag for all predictor variables is built into the model for predicting NF^2 rates. However, separate models with two-year lags and zero-year lags (concurrent) also were estimated to check for their appropriateness. The results of these alternative lag specifications, presented in Appendix B, indicate that models with either zero or two year lags are associated with adjusted R^2 values and F-values that are essentially the same for all models regardless of lag structure, although the models with either a zero or a two-year lag yield fewer significant variables compared to one-year lag model. These results support the appropriateness of using a one-year lag structure for the purpose of final model estimation.

The basic regression model analyzed is given as follows.

ENTRY = f ($cPOPL1_{ry}$, $cPCPIL1_{ry}$, $UERL1_{ry}$, $cUERdfL1_{ry}$, $SHIFTL1_{ry}$, $MESL1_{ry}$, $ENTRYL1_{ry}$, $EXITL1_{ry}$, $LDEPpcL1_{ry}$, $LGEXpcL1_{ry}$, $MSA_{1\ldots26}$, $YEAR_{'77\ldots'91}$)[7]

Where:

$cPOPL1_{ry}$ = Percentage change in population in region r for year y, lag = 1
$cPCPIL1_{ry}$ = Per capita personal income change in region r for year y, lag = 1
$UERL1_{ry}$ = Unemployment rate in region r for year y, lag = 1
$cUERdfL1_{ry}$ = Percent point change in unemployment rate in region r for year y, lag = 1
$SHIFTL1_{ry}$ = Percentage change in producer services share of total earnings in region r for year y, lag = 1
$MESL1_{ry}$ = Mean establishment size in region r for year y, lag = 1

$ENTRYL1_{ry}$ = Entry rate (New firm formation rate) in region r for year y, lag = 1
$EXITL1_{ry}$ = Exit rate in region r for year y, lag = 1
$LDEPpcL1_{ry}$ = Per capita bank deposits in region r for year y, lag = 1 (in natural logarithmic form)
$LGEXpcL1_{ry}$ = Per capita local government expenditure in region r for year y, lag = 1 (in natural logarithmic form)
MSA = Metropolitan Statistical Area, a regional dummy variable for location in space
YEAR = Year, a time dummy variable for location in time

7. The Analysis of Zero-order Correlations

Is the entry into a region's business base of new manufacturing establishments influenced by key socio-economic attributes of that region? We can begin the quest for evidence of such possible relationships by examining the degree to which correlations among the variables marked for inclusion in the model to be tested actually covary with one another.

Table 2 Zero-order Correlation Matrix

Independent Variables	Entry Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Population change (annual)	**0.21*** **	1.00									
(2) PCPI change (annual)	**-0.00**	0.19	1.00								
(3) Unemployment rate	**0.07**	-0.04	-0.42	1.00							
(4) Unemployment rate change (annual level)	**-0.00**	0.25	-0.26	0.18	1.00						
(5) Earnings: Shift-to-services	**-0.06**	0.15	-0.08	0.03	0.12	1.00					
(6) Mean establishment size	**-0.07**	0.08	0.23	0.01	0.02	0.05	1.00				
(7) Entry rate (one-year lagged)	**0.35*** **	0.14	0.03	0.02	-0.14	-0.08	-0.07	1.00			
(8) Exit rate	**0.25*** **	-0.14	-0.43	0.13	-0.06	-0.12	-0.41	0.23	1.00		
(9) Bank deposits, per capita (ln)	**0.04**	-0.23	-0.44	0.04	-0.10	-0.12	-0.46	0.10	0.51	1.00	
(10) Local government spending, per capita (ln)	**0.18*** **	-0.31	-0.51	0.27	-0.14	-0.20	-0.33	0.27	0.60	0.64	1.00
Mean	**20.50**	1.89	7.55	7.27	0.18	0.99	49.98	20.15	14.70	8.68	6.82
Standard Deviation	**5.54**	1.89	4.73	3.36	1.61	6.82	18.20	5.64	5.27	0.46	0.47

Note: *** Significant at 0.01 level. (Significance is shown for only dependent variable, the entry rate, given in column two).

Table 2 presents zero-order correlations, means, and standard deviations of the variables (except dummy variables) included in the model. Correlation coefficients for four variables, change in population, entry rate, exit rate, and local government expenditure are found to be statistically significant (at 0.01 level) and have their directions consistent with the relevant hypothesis proposed in this study.

8. Model Estimation: Alternative Estimation Techniques and Results

The original model was tested using three distinct estimation techniques: Robust and EWLS techniques were used to correct for heteroscedasticity, and OLS estimates were included for comparison purposes. In all cases, estimates were developed using the ten predictor variables suggested by theory and intuition, as well as the region and year dummy variables to control for unmeasured region and period specific influences. The original OLS model was rejected due to the presence of heteroscedasticity. The estimates yielded by both heteroscedasticity-corrected estimation techniques, together with those from the OLS procedure, can be compared by examining Table 3.

Comparing the estimates yielded by the robust and EWLS techniques, we can see that all the predictors associated with statistically significant effects in the robust model are also significant in the EWLS model. While the population variable is statistically significant (0.01 level) in the results of the EWLS estimation, it does not reach statistical significance using robust estimation. This differing outcome doubtless reflects the fundamental technical difference between the two estimation techniques as each attempt to adjust the data to alleviate the problem of heteroscedasticity. The main objective motivating the comparison of the results of these two alternative heteroscedasticity-corrected models is to see if the statistical significance of a variable persists when we move from one model (robust) to another (EWLS). It is reasonable to argue that we can have a greater degree of confidence in a given predictor found to have a statistically significant effect in both models than we can in one which is found to be significant in only one of the two models.

Regression Results: Independent Predictor Effects

Table 3 presents the heteroscedasticity-adjusted results of models predicting the rate of NF^2 using a variety of process attributes of metro-scale regional economies. For the purposes of the analyses that follow, the results of the robust estimation will be regarded as primary; however, the results of EWLS and OLS models will also be considered for comparative purposes. In the robust model, five predictors, percent point change in unemployment rate, MES, entry rate, exit rate, and per capita bank deposits are found to have a statistically significant influence on the dependent variable. Let us consider these results separately.

1. Unemployment rate change: Previous empirical studies have reported contradictory evidence with respect to the relationship between unemployment rate change and entry rate. Highfield and Smiley (1987) and Audretsch and Fritsch (1994) found a positive relationship, while Reynolds (1994), Guesnier (1994), Garofoli (1994), and Davidsson et al. (1994) found a negative relationship. In the present study, the results of both estimation techniques offer confirmation of a relationship whereby a region's rate of NF^2 and unemployment rate are essentially unrelated. However, the year-to-year *change* in unemployment rate appears to have a statistically significant negative relationship with NF^2 and thus is consistent with the original hypothesis. It could be argued that the pace of change in a region's unemployment situation may serve as a leading indicator of both the general market conditions conducive to localized business base growth and development, as well as of the current market situation and risk levels facing entrepreneurs starting a new business. Since current market conditions play a critical role in the survival of a firm, specifically a new firm, a careful analysis of current and future labor market conditions can play a key role in the decision to start a new firm. When the current market conditions are characterized by high risk levels, as would be indicated by an increasing rate of unemployment, the rate of NF^2 is likely to be slower because it would be more difficult to survive, as compared to the situation when market conditions are more favorable.

2. Mean Establishment Size (MES): Audretsch and Fritsch (1994)[8] found no relationship while Armington and Acs (2002) found negative relationship between MES and entry rate. In the present study, however, a statistically significant positive relationship between NF^2 rate and MES, as revealed by both robust and EWLS estimation techniques, challenges these earlier findings. The positive relationship between MES and NF^2 indicates a positive role for large firms in stimulating NF^2. It may be more efficient and economical for larger firms to outsource some of their tasks or projects to smaller firms. As a result, larger firms may be able to provide a more stable environment in which newly-established small firms can emerge, survive and prosper. The results produced support the hypothesis originally ventured regarding the role of firm-size structure in stimulating NF^2.

3. Previous-year Entry Rate: Despite sound reasons to expect otherwise, Johnson and Parker (1996) found no apparent relationship between the entry rates of the current and previous years. The results of the present study challenge that finding. Both estimation techniques, confirming our hypothesis, yield positive and statistically significant coefficients. Indicative of what amounts to the "momentum" of a key dynamic operating within a regional economy, the higher the rate of NF^2 the year before, the higher the current rate.

Two types of arguments can be used to make sense of this finding. The first involves the domination of a multiplier effect over a competition effect as explained in Section 2 (3). More entries in the previous year may cause fewer exits during the current year because the demand for all businesses' products has increased, reflecting a multiplier effect (Johnson and Parker, 1996: 681). Such a multiplier effect may also operate to create an atmosphere conducive to business survival through demand availability. The second argument views the current year entry rate as essentially a continuation of the momentum of the entry rate that prevailed during the previous year.

4. Previous-year Exit Rate: Johnson and Parker (1996) found no relationship between exit rate and entry rate. However, in the present study the relationship between the previous year's exit rate and the current rate of NF^2 is both positive and significant in the robust model (at 0.05 level), as well as in the EWLS model (at 0.10 level). As more firms leave the market place, voluntarily or involuntarily, they may create a kind of 'vacuum' inviting to be filled in by the new firms that may be better able to satisfy existing market demand with innovative new products and services. Moreover, with the exit of firms from a region's market, the degree of competitiveness within the market may subside, thus offering a less hostile environment for new entrants.

The results involving both entry and exit rate influences taken together would appear to support the conclusion that the previous year's entry rate is a stronger predictor of the current year's entry rate than is the previous year's exit rate. Once again, this may reflect the "momentum" argument whereby the continuation of a trend, rather than its opposite, is ultimately more conducive to NF^2. While it may follow that a region experiencing new business entry last year can expect to respond by experiencing even more this year, it does not follow that a region's most likely endogenous response to firm exit the previous year is an effort to compensate through NF^2 the following year.

Table 3 Original Model and Results of Heteroscedasticity-adjusted and Unadjusted Estimation Techniques

Dependent Variable: New Firm Formation Rate

Independent Variables (One-year lag)	Heteroscedasticity-adjusted Models Model 1 Robust	Model 2 EWLS	Model 3 OLS
Intercept	**-2.122**	-12.055	-2.122
	(27.277)	(24.088)	(25.642)
Demand			
Population change (annual)	**0.328**	0.543***	0.328*
	(0.209)	(0.160)	(0.178)
PCPI change (annual)	**0.030**	-0.084	0.030
	(0.105)	(0.083)	(0.099)
Unemployment			
Unemployment rate	**0.254**	0.122	0.254
	(0.216)	(0.180)	(0.193)
Unemployment rate change (annual level)	**-0.432****	-0.574***	-0.432**
	(0.206)	(0.171)	(0.199)
Industrial Restructuring			
Earnings: Shift-to-services	**0.038**	-0.002	0.038
	(0.037)	(0.035)	(0.040)
Mean establishment size	**0.092*****	0.055*	0.092***
	(0.036)	(0.030)	(0.034)
Entry rate	**0.172*****	0.115**	0.172***
	(0.054)	(0.050)	(0.050)
Exit rate	**0.194****	0.129*	0.194**
	(0.097)	(0.073)	(0.085)
Local Financial Capital			
Total bank deposit, per capita (ln)	**4.115***	3.223*	4.115**
	(2.253)	(1.753)	(1.907)
Local Urban Service Delivery			
Local government spending, per capita (ln)	**-3.309**	1.216	-3.309
	(3.696)	(3.431)	(3.501)
Adjusted R^2	**0.50**	0.61	0.50
N	**432**	432	432
F-value	**13.60*****	14.53***	9.33***
Accounting for heteroscedasticity treatment	**Corrected+**	Corrected~	BP-test***? CW-test*

Notes: 1. The regression coefficient values for regional and time dummies are not mentioned in the table.
2. Standard errors are given in parentheses.
3. *** Significant at 0.01 level, ** at 0.05 level, and * at 0.10 level.
4. ? The Breusch-Pagan test showed the presence of heteroscedaticity to be significant at 0.01 level; while the Cook-Weisberg test showed the presence of heteroscedasticity to be significant at 0.10 level.
5. + Standard errors have been corrected by means of White's (1980) method which yields a heteroscedasticity consistent estimator of the standard errors.
6. ~ Standard errors have been corrected by means of EWLS method.

5. Per Capita Bank Deposits: The influence of local financial capital on the rate of NF^2, heretofore not tested in the published literature, is found to be both positive and statistically significant in the results produced by both the robust and EWLS estimation procedures. Once again this result is consistent with the proposed hypothesis. Access to financial capital is one of the most important factors that influence the decision to start a new business, and it seems reasonable to assume that when local entrepreneurs enjoy access to potential pools of local financial capital, and the appropriate relationships with institutional intermediaries (banks, venture capital sources) can be established, the prospects for localized new business formation are improved.

6. Other Variables: Finally, none of the following influences, population, per capita personal income, unemployment rate, industrial restructuring as measured by an earnings shift-to-services, and level of local government spending were revealed to exert a demonstrable influence on NF^2 one way or another. The insignificance of unemployment rate, per capita personal income, and local government spending could be due to their collinearity with the dummy variables.

9. Elaboration by Systematic Deletion of Region and Year Controls

Several models were estimated to assess the separate contributions of controls for unmeasured place (region) and time (year) influences. The elaboration models employing robust estimation techniques are presented in the Table 4. Model 1 includes all variables including region and year dummies; model 2 replicates model 1 except for the deletion of the region controls. Model 3 replicates model 1 except for the deletion of the year controls. And Model 4 excludes both sets of time and place controls.

When model 4 is compared to model 1, we find that the overall explanatory power of model 4 is only 40.0 percent that of model 1. Obviously, the addition of controls for location (region) and period (year) contributes substantial explanatory power to the overall model. There are three other categories of outcomes that merit attention, however. First, while two of the predictors (entry rate and exit rate) generally retain statistical significance across specifications, the coefficient on per capita bank deposits, although retaining its statistical significance in model 4, experienced a sign reversal. This outcome casts one or more of the individual region and year influences in the role of a distorter influence.

Indeed, in the absence of controls for locational and period influences, the relationship between the availability of local financial capital and the rate of NF^2 would inexplicably be negative.

A second category of outcomes involves identification of suppressor influences exerted by unmeasured factors for which region and year serve as proxies. In the absence of controls for these influences (model 4), there is no evidence that unemployment rate change contributes to our understanding of variation in the rate of NF^2. However, once those controls are instituted, evidence of a statistically significant negative effect emerges (model 1). The same uncovering of an otherwise suppressed effect involves the MES predictor. While we remain uncertain which of the two categories of controls – region or year – wielded a suppressor influence in the case of unemployment rate change, by examining models 2 and 3 we are able to identify the suppressor influence in the case of MES. Because models 1 and 3 yield relatively similar coefficients on the MES variable, we can assume that unspecified regional influences operate to suppress the MES effect in model 4 and that, in turn, permitted the suppressed effect to emerge in the full model (model 1). Therefore, in these two instances were it not for our decision to control such amorphous influences as locational and period influences, otherwise important effects would have remained suppressed.

A third category of outcomes involves the identification of the spuriousness of certain relationships. For example, in model 4 per capita public spending appears to exert a statistically significant positive impact on the rate of NF^2. However, the inclusion of either region and/or year controls (model 3 and 2, respectively) explains away that relationship. Thus the influence of local per capita government spending on NF^2 can be assumed to be spurious. The same logic can be applied to the population variable. In model 4, the population variable appears to exert a statistically significant positive influence on NF^2. However, the inclusion of region and year controls (model 1) or the region control alone (model 3) explains away that relationship. The fact to be noticed here is that the inclusion of a control for year alone (model 2) does not explain away the relationship. Therefore, we can assume that unspecified regional influences operate through the population variable, rendering the population influence statistically significant (model 4), when in fact it is not as evidenced in model 1. Therefore, in these two instances were it not for our decision to control for such amorphous influences as location and period, otherwise insignificant effects would have remained significant.

Now, what can we conclude about the contributions made by specific regional controls to the explanatory power of the fully-specified model? Model 1 indicates that Austin, Bryan-College Station, San Antonio, and Galveston experienced long-term rates of new firm formation significantly greater than that experienced by the median regional economy, the Brazoria PMSA. For the former three, at least, the knowledge-spillovers traceable to institutions of higher education, notably the Universities of Texas at Austin and San Antonio and Texas A&M University at Bryan-College Station, respectively, are likely to account for some portion of these regions' vigorous NF^2 performances. Moreover, the presence of Southwest Research Institute (SRI) in San Antonio, which conducts a substantial amount of contract research in the area of advanced manufacturing, may also contribute to the region's NF^2 performance as well. The presence of the Health Sciences Center (HSC) at Galveston, which hosts substantial research and development of health-related equipment and instruments, may have contributed to the stimulation of NF^2 in health-related manufacturing. At the same time, however, the Beaumont, Texarkana, and Waco metro-regions experienced a rate of NF^2 that was significantly lower than that of the median Texas metro-region (Brazoria PMSA). However, the effect for Waco did not emerge until controls for period effects were introduced (model 1). At least part of the reason for the Beaumont experience may have been the continued decline in demand for drilling and related oil field equipment as the energy sector continues its contraction and accounts for an ever smaller share of total state and national output. Waco's proximity to both the Dallas-Fort Worth and Austin metro regions may have made it relatively less attractive by comparison, thus depressing its rate of NF^2. Presence of a variety of agglomeration economies in larger urban areas such as Dallas and Austin may have made them more attractive for starting a new business compared to smaller urban centers such as Waco. In the case of the Corpus Christi, Dallas, Fort Worth, Houston, and McAllen-Edinburg metro regions, evidence of statistically significant effects did not persist once period influences were controlled (model 1).

The coefficient values for regional dummies (model 3) indicate that sixteen metro regions have NF^2 rates higher – and ten metro regions have NF^2 rates lower – than that of the median Texas metro region (Brazoria PMSA). The largest metro regions of the State of Texas – Dallas, Fort Worth, Houston, Austin, and San Antonio – all have positive coefficient values. This pattern suggests that there is a positive relationship between the size of a metro region and its rate of NF^2. The remaining metro regions with negative coefficient values such as Amarillo, El Paso, Odessa-Midland, and Abilene are in relatively geographically isolated parts of the state. This pattern suggests that the coefficients on regional dummies are expressing effects of 'relative location' of a metro regionon NF^2.

The influence of 'controls for the period influences' tied to specific years can be discerned as well in Table 4. Model 2 indicates that for each year between 1977 and 1991, excluding 1979, 1988 and 1990, NF^2 proceeded at rates significantly below that for 1976. This is stark evidence of the long-term restructuring of the Texas manufacturing base originally explored by Hicks (1993). The energy crisis that followed OPEC's oil-embargoes during the late 1970s resulted in rapidly rising energy prices in the United States. This resulted in a booming economy in Texas, a major oil-producing state. However, after 1976, energy prices began to subside and with them the high-flying Texas economy. Therefore, compared to 1976, all subsequent years recorded relatively lower rates of NF^2. Moreover, in the majority of instances these negative effects associated with specific years were replicated even after regional controls were introduced (model 1). The period-specific influences on NF^2 reveal a pattern with three distinct phases: for the 1977-86 period (with the exception of the year 1979), the rate of NF^2 was substantially lower, for the 1987-90 period, the rate of NF^2 increased (i.e. became less negative) and stabilized, and then after 1990 it decreased again (i.e. became more negative).

Finally, the adjusted-R^2 values for model 2 (R^2=0.44) and model 3 (R^2=0.29) indicate that period effects, that is, unspecified time-specific influences, make greater contributions to the explanatory power of our understanding of patterns of NF^2 than do locational influences. Once again, this would appear to indicate that the restructuring of the industrial base of the State of Texas was unfolding so vigorously as to register powerful year-to-year changes in new business formation. However, because these changes were unfolding relatively uniformly across Texas metro-regions, powerful regional effects were somewhat less pronounced by comparison.

Table 4 Elaboration by Deletion of Region and Year Controls: Robust Models

Dependent Variable: New Firm Formation Rate

Independent Variables	**Robust Models**			
(One-year lag)	**Model 1**	**Model 2**	**Model 3**	**Model 4**
	(region and year dummies included)	(year dummies included)	(region dummies included)	(region and year dummies excluded)
Intercept	**-2.122**	8.091	-4.897	8.090
	(27.277)	(9.334)	(12.911)	(7.816)
Demand				
Population change (annual)	**0.328**	**0.804*****	0.036	**0.623*****
	(0.209)	**(0.153)**	(0.216)	**(0.177)**
PCPI change (annual)	**0.030**	0.073	0.125	0.120
	(0.105)	(0.102)	(0.085)	(0.084)
Unemployment				
Unemployment rate	**0.254**	0.048	0.174	0.073
	(0.216)	(0.080)	(0.212)	(0.089)
Unemployment rate change (annual level)	**-0.432****	-0.291	0.053	0.090
	(0.206)	(0.119)	(0.177)	(0.169)
Industrial Restructuring				
Earnings: Shift-to-services	**0.038**	0.026	0.003	-0.021
	(0.037)	(0.039)	(0.034)	(0.039)
Mean establishment size	**0.092*****	-0.001	**0.128*****	0.001
	(0.036)	(0.014)	**(0.038)**	(0.016)
Entry rate	**0.172*****	**0.382*****	0.046	**0.233*****
	(0.054)	**(0.051)**	(0.053)	**(0.052)**
Exit rate	**0.194****	**0.116***	**0.346*****	**0.235*****
	(0.097)	**(0.066)**	**(0.083)**	**(0.072)**
Local Financial Capital				
Total bank deposit, per capita (ln)	**4.115***	-0.691	0.863	-1.232*
	(2.253)	(0.729)	(1.989)	(0.765)
Local Urban Service Delivery				
Local government spending, per capita (ln)	**-3.309**	1.780	0.128	**1.802****
	(3.696)	(1.122)	(1.325)	**(0.825)**
Adjusted R^2	**0.50**	0.44	0.29	0.20
N	**432**	432	432	432
F-value	**13.60*****	15.95***	7.71***	9.24***

Notes: 1. Standard errors are given in parentheses.
2. *** Significant at 0.01 level, ** at 0.05 level, and * at 0.10 level.

Table 4 (Continued)

Dummy Variables	**Robust Models**			
	Model 1	**Model 2**	**Model 3**	**Model 4**
	(region and year dummies included)	(year dummies included)	(region dummies included)	(region and year dummies excluded)
Abilene	-1.144 (3.062)		3.156 (2.976)	
Amarillo	-0.275 (2.491)		1.997 (2.242)	
Austin	**7.388***** **(2.100)**		**10.068***** **(2.097)**	
Beaumont	**-3.139**** **(1.623)**		**-3.026*** **(1.636)**	
Brownsville	-0.809 (1.954)		1.094 (2.012)	
Bryan-College Station	**6.967**** **(2.734)**		**10.371***** **(2.762)**	
Corpus Christi	3.327 (2.068)		**4.448**** **(1.991)**	
Dallas	1.588 (2.414)		**4.905**** **(2.248)**	
El Paso	-0.159 (1.897)		0.765 (1.848)	
Fort Worth	1.892 (1.826)		**4.006*** **(1.681)**	
Galveston	**3.429*** **(2.013)**		**3.130**** **(1.528)**	
Houston	2.584 (2.358)		**5.861***** **(2.066)**	
Killeen-Temple	1.237 (2.355)		2.111 (1.819)	
Laredo	-0.440 (3.537)		5.131 (3.511)	
Longview-Marshall	-1.511 (1.708)		0.186 (1.724)	
Lubbock	-0.842 (2.359)		2.093 (2.421)	
McAllen-Edinburg	2.916 (2.678)		**5.336**** **(2.543)**	
Odessa-Midland	-1.009 (3.259)		0.562 (2.905)	
San Antonio	**2.938*** **(1.661)**		**4.580***** **(1.715)**	
San Angelo	-3.402 (2.600)		-0.039 (2.404)	

Table 4 (Continued)

Dummy Variables	Robust Models			
	Model 1	**Model 2**	**Model 3**	**Model 4**
	(region and year dummies included)	(year dummies included)	(region dummies included)	(region and year dummies excluded)
Sherman-Denison	-1.846 (1.819)		-0.889 (1.936)	
Texarkana	**-6.776**** **(3.145)**		**-4.741**** **(2.354)**	
Tyler	-2.794 (2.352)		-0.011 (2.336)	
Victoria	-2.545 (2.964)		1.693 (2.636)	
Waco	**-3.468*** **(1.939)**		-1.518 (1.774)	
Wichita Falls	-2.066 (2.409)		0.605 (2.436)	
Year77	**-5.625***** **(1.354)**	**-6.984***** **(1.281)**		
Year78	**-10.064***** **(1.409)**	**-10.477***** **(1.188)**		
Year79	0.262 (1.765)	0.669 (1.367)		
Year80	**-5.591***** **(2.095)**	**-7.591***** **(1.430)**		
Year81	**-3.435*** **(2.118)**	**-5.371***** **(1.231)**		
Year82	**-5.723***** **(2.403)**	**-8.236***** **(1.259)**		
Year83	**-5.957**** **(3.040)**	**-7.216***** **(1.429)**		
Year84	-4.848 (3.400)	**-5.583***** **(1.581)**		
Year85	**-8.612**** **(3.819)**	**-9.394***** **(1.672)**		
Year86	-5.283 (4.135)	**-5.221***** **(1.742)**		
Year87	-3.129 (4.485)	**-3.968*** **(2.290)**		
Year88	-2.394 (4.802)	-3.011 (2.169)		
Year89	-2.103 (4.977)	**-3.939**** **(2.025)**		
Year90	-0.597 (5.028)	-3.194 (2.066)		
Year91	-4.372 (5.235)	**-7.923***** **(2.021)**		

10. Conclusions

In this paper, we have re-examined the issue of determinants of new firm formations in a unique manner by using a rarely available dataset and by employing an advanced econometric technique (fixed effect modeling technique) that has not been used before in analyzing determinants of new firm formations.

The major objective of this study was to test models developed to account for variation in rates of NF^2 across the major metropolitan-scale economies of the State of Texas. The specific focus has been on linking metro-region-scale assets and attributes to the rates and patterns of NF^2 that took place during the 1976-91 period within the state's manufacturing sector.

The following conclusions appear to be especially noteworthy:

1. All estimated effects were consistent with their respective hypothesis:

a. Change in unemployment rate was found to be negatively related to NF^2 rate.

b. MES, exit rate, entry rate, and bank deposit variables were found to be positively associated with NF^2 rate.

2. There was no evidence of an impact on NF^2 of per capita personal income growth, unemployment rate, an earnings-denominated sectoral shift-to-services, or local government spending. One of the influence introduced in this study, earnings shift-to-services, had not been tested in any previous studies of NF^2.

3. The use of entry rate (1-year lag), exit rate (1-year lag) and MES as explanatory variables is also relatively rare. Yet, each of these influences was discovered to be positively related to rate of NF^2.

These conclusions point us in a new direction, one which highlights the importance of understanding the role of *contextual factors* in the processes of economic growth and development. The status of regional characteristics indicates the quality and nature of the context in which economic activities, such as formations and terminations of new firms, take place. Since new firm formations are linked to economic growth (Reynolds, 1994: 439), it is important to understand the role of contexts in which new firms are formed. A thorough understanding of such contexts will help us in understanding the spatial variation in NF^2, and thereby continuing economic development.

This study, using a high density data-set and advanced modeling techniques, has been able to sort out contextual factors important in stimulating economic growth and development through NF^2. It also makes a contribution in a broader sense, however. It offers further empirical evidence of the limitations of a neoclassical perspective on economic growth and change, underscoring that in the future more explicit attention should be given to exploring the capitalist dynamics whereby economies experience incessant change – deep churning – as indicated by business base and employment turnover and replacement. To the extent that conventional neoclassical theory discounts the dynamic contributions of technology and innovation to economic change, it renders itself increasingly incomplete and irrelevant. In this regard, Kirchhoff observed:

> "The process by which the dominant theory in a field of study changes is called paradigm shift. This occurs when a body of falsifying empirical evidence becomes so overwhelming that it cannot be ignored and the theory is discarded while a search for new theory begins. This is the state of economic theory today" (Kirchhoff, 1994: 10).

Where Should Research on NF^2 Proceed From Here?

We suggest following 5 areas for further research:

1. More attention is required to develop and use analytical tools and techniques capable of separating out the effects of regional factors on NF^2. The simple regression technique, opposed to the fixed effects regression technique used in this study, is incapable of controlling for the region and time specific 'unmeasured' effects, therefore giving misleading results.

2. Studies linking new firm formations to subsequent economic growth and development in a region are still relatively rare. More empirical research is needed to clarify the nature and intensity of relationships that may exist between them.

3. More studies are needed to see if the determinants of new firm formations vary by space (region), time and sector.

APPENDIX A

Average Entry Rate for All Texas Metro Regions, 1976-91

	Texas MSAs/PMSAs	Average Entry Rate
1	Waco	15.15
2	Texarkana	16.14
3	San Angelo	16.17
4	Wichita Falls	16.99
5	Lubbock	17.25
6	Beaumont-Port Arthur	17.61
7	Amarillo	18.14
8	Victoria	18.38
9	Killeen-Temple	18.61
10	Abilene	18.62
11	Brownsville-Harlingen-San Benito	18.77
12	Longview-Marshall	19.63
13	Odessa-Midland	20.04
14	**Brazoria (PMSA)**	**20.06 (Median Value)**
15	Sherman-Denison	20.38
16	Corpus Christi	20.55
17	San Antonio	20.66
18	Galveston-Texas City (PMSA)	20.71
19	Tyler	20.90
20	Fort Worth-Arlington (PMSA)	21.71
21	Laredo	22.38
22	El Paso	22.44
23	Houston (PMSA)	22.48
24	Dallas (PMSA)	22.86
25	McAllen-Edinburg-Mission	23.30
26	Bryan-College Station	26.17
27	Austin-San Marcos	27.65

APPENDIX B

Lag-structure Comparison: Zero-, One-, and Two-year Lag Models

Dependent Variable: New Firm Formation Rate

Independent Variables	**Robust Models**		
	Model 1	**Model 2**	**Model 3**
	LAG-1	**LAG-2**	**Concurrent**
Intercept	**-2.122**	-22.789	6.181
	(27.277)	(29.013)	(31.121)
Demand			
Population change (annual)	**0.328**	-0.120	-0.024
	(0.209)	(0.220)	(0.215)
PCPI change (annual)	**0.030**	0.172*	0.216*
	(0.105)	(0.101)	(0.117)
Unemployment			
Unemployment rate	**0.254**	0.337*	0.244
	(0.216)	(0.197)	(0.248)
Unemployment rate change	**-0.432****	-0.098	0.128
(annual level)	**(0.206)**	(0.209)	(0.262)
Industrial Restructuring			
Earrings: Shift-to-services	**0.038**	-0.323	0.023
	(0.037)	(0.040)	(0.039)
Mean establishment size	**0.092*****	0.126***	0.131*
	(0.036)	(0.037)	(0.038)
Entry rate	**0.172*****	-0.014	
	(0.054)	(0.054)	
Exit rate	**0.194****	0.081	0.269***
	(0.097)	(0.103)	(0.090)
Local Financial Capital			
Total bank deposit, per capita (ln)	**4.115***	6.921***	3.937*
	(2.253)	(2.260)	(2.242)
Local Urban Service Delivery			
Local government spending, per capita (ln)	**-3.309**	-3.999	-4.925
	(3.696)	(4.004)	(4.115)
Adjusted R^2	**0.50**	0.49	0.47
N	**432**	405	432
F-value	**13.60*****	12.67***	12.41***

Notes: 1. The regression coefficient values for regional and time dummies are not mentioned in the table.
2. Standard errors are given in parentheses.
3. *** significant at 0.01 level, ** at 0.05 level, and * at 0.10 level.

ENDNOTES

1. For example, a change in unemployment rate from 5.0 percent to 7.0 percent indicates a 2.0 percent point change in unemployment rate.
2. The definition of the producer service sector was taken from Noyelle and Stanback (1983). The producer services sector is defined to include finance, insurance, and real estate (SIC 60 to 67), business services (SIC 73), legal services (SIC 81), membership organizations (SIC 86), miscellaneous services (SIC 89), and social services (SIC 83).
3. Two counties, one from Texas (Bowie) and one from Arkansas (Miller), constitute the Texarkana MSA.
4. In this study, robust regression method means OLS method with standard errors corrected for heteroscedasticity by White's method.
5. u_t and u_{t-1} are unobservable disturbances associated with observations taken at time t and t-1, respectively. μ_t is an error term.
6. Reynolds (1994), employed a one-year lag approach for understanding regional factors influencing the rate of new firm formation.
7. The Brazoria PMSA and the year of 1976 are used as regional and time referents respectively in this study. They are designated as omitted values for the purposes of estimating and interpreting region and year coefficients. (see section 3.3.3).
8. This result pertains to entry rate defined as the number of entrants relative to the number of firms in existence.

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