Explaining Regional Variation in Business Births and Deaths: U.S. 1976–88*

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ABSTRACT. Linear models are developed to determine the relative impact of 15 start-up processes on the annual regional birth rate of new business organizations for all industry sectors in the U.S. over 6 two-year periods. These stable linear models explained from 50–70% of the variation in regional firm birth and death rates up to 16 years into the future. Start-up processes that have the most impact involve regional economic diversity; population growth; greater personal wealth; presence of mid-career adults; low unemployment; and greater flexibility in employment relationships. There was a complete absence of any impact of regional variation associated with higher densities of customers, suppliers, workers, R&D resources; costs of production; or access to national transportation facilities.

There is little question that economic growth and firm foundings are closely related (Birch, 1981; Kirchhoff and Phillips, 1988). Recent analysis has found strong evidence that firm births, as a component of volatility or turbulence among business establishments, have a causal impact on subsequent economic growth (Reynolds and Maki, 1990b). The major question that remains, however, is to determine those features of an economic system will lead to higher rates of firm births.

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There is no shortage of hypotheses or speculation on the origin of new business organizations. Either as a form of social activity (e.g. the institutionalization of bureaucracy) or as classes of social systems (e.g. automobile producers, computer firms) or in terms of specific organizations (e.g. the origins of International Business Machines). Strategies for approaching this issue have varied from intensive case studies, attention to the changes in the form of existing organizations, historical studies of narrowly defined organization types (newspapers, mortuaries), to comparisons of market entry across industry sectors. All have some merit and contribute to the understanding of factors that may have an impact on the founding, emergence, birth, or appearance of new organizations.

The explanations associated with the appearance of new organizations, particularly economic or productive organizations, can be considered in two broad categories. One emphasizes the social conditions or societal contexts that lead to the emergence of new organizations (e.g. money economy, educated participants, specialization of productive activity, etc.) and the other the characteristics of those that take the initiative to form or organize new social system (e.g. the need for achievement, energy, drive for status, protestant ethic, etc.).

The following will report on an analysis of the effect of fifteen different aspects of the immediate context on the regional variation in the annual birth rate (per 10,000 residents) of new business organizations. The analysis encompasses all private business organizations in the entire United States covering virtually all industry sectors over 6 two-year periods, 1976–88.[1] Reliable multi-item indicators were developed to represent 15 organizational start-up process. These were the basis for stable linear models that explain from 50–70% of

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the variation in annual regional firm birth and death rates up to 16 years into the future. Start-up processes that have the most impact involve regional economic diversity, population growth, greater personal wealth, low unemployment, and greater flexibility in employment relationships. There was a complete absence of any impact of regional variation associated with higher densities of customers, suppliers or inputs, R&D facilities, or costs of production.

I. Start-up processes

The following presents fifteen hypotheses or postulates regarding causes of new firm births. They are summarized, in relation to comparisons among regions in Table I. Similar hypotheses could be developed in relation to temporal changes (e.g. as population increases, firm births will increase), but as they are not tested in the following analysis, they are not presented in this material.

1. *Unemployment, desperation.*[2] It is often assumed that desperate individuals, unable to pursue careers in established organizations, will start new firms. If accurate, regions with higher unemployment should have increased levels of new firm birth rates. A recent review of several time-series analyses of the United Kingdom, where this is often called "recession-push," suggests there is systematic empirical support for this process under certain conditions.[3] More recent work on the United Kingdom is consistent with the findings reported below, that higher unemployment is associated with lower rates of firm births (Keeble, Walker, and Robson, 1993).

2. *Career opportunities.*[4] Complementing the unemployment hypothesis, this perspective assumes that individuals start new firms to achieve personal career goals that cannot be achieved in the context of existing organizations. This implies that regions with well educated individuals in mid-career (25–45 years old) with positions that provide experience valuable for successful entrepreneurial activity (managerial and administrative experience) should have higher rates of new firm births, when compared to regions with an absence of potential entrepreneurs.

3. *Volatile industries.*[5] There is some evidence that the turnover of businesses is higher in some industries than other. Consumer services, construction and retail have higher birth and death

TABLE I
Firm birth startup processes

	Hypothesis Label	Differences Among Regions
1)	Unemployment, desperation	More firm births where there is more unemployment.
2)	Career opportunity	More firm births where more mid-career, experienced adults reside.
3)	Volatile industries	More firm births where volatile industries are more prevalent.
4)	Factors of production costs	More firm births where input costs are lower.
5)	Factors of production access	More firm births where factors of production are accessible.
6)	Efficient public infrastructure	More firm births where public infrastructure is better.
7)	Access to customers, clients	More firm births where access is more convenient.
8)	Information, R&D base	More firm births where there is better access to Research and Development, information, innovation.
9)	Greater personal wealth	More firm births where greater personal wealth is present.
10)	Social status diversity	More firm births where there is greater social status diversity.
11)	Population growth	More firm births in regions with more population growth.
12)	Economic system size	Higher firm birth rates in larger economic systems.
13)	Economic diversity	Higher firm birth rates in more diverse economic systems.
14)	National transportation	Higher firm birth rates where access to national transportation is convenient.
15)	Employment policy flexibility	More firm births in contexts with greater employment flexibility.

rates than manufacturing or distributive services. Hence, it is to be expected that overall new firm birth rates would reflect the industry mix. The higher the proportion of more volatile industries, the higher the new firm birth rates.

4. *Factors of production costs.*[6] It is argued that if prices and the demand for products are stable, and there is no change in the nature of the product, that the only factor that can encourage a new firm founding is lower input costs. Without lower input costs, there will be no competitive advantage. Hence, relatively lower business costs – land, capital, labor, equipment, taxes – is assumed to encourage new firm start-ups. A "low cost" region might encourage entrepreneurial in-migration, as entrepreneurs seek a low cost context in which to start new firms.

5. *Factors of production access.*[7] A somewhat different issue is the availability of factors of production. It is argued new firms often require a number of inputs, specialized parts or subassemblies, worker or consultants with unique skills, or access to other firms with distinctive competencies. The cost of acquiring information and assembling these inputs – measured in the time and energy of the start-up team – is reduced when access is convenient. As a new firm will not provide the sales volume that will encourage factors of production (suppliers, workers, capital) to move near a new firm; new firms are more likely to be initiated where factors of production are established.

6. *Public infrastructure costs.*[8] A number of factors, are necessary for smoothly functioning businesses: transportation, communication (electronic and hardcopy), education, health care, police and fire protection, sanitation and utilities. While not always provided by government organizations, most are provided under the supervision of governments and often paid for with public funds. It is argued that as more of these elements are provided in a form appropriate for businesses, they enhance the capacity to start a new firm by reducing the costs or complications of start-up. For example, an educated workforce means that trained, skilled employees are available. The presence of reliable energy (gas, electricity) and suitable transportation systems can expedite the implementation of a new firm.

7. *Access to customers, clients.*[9] Customers and clients, either private citizens or other businesses, are a critical constituency for new businesses. The easier the access to those that will but the goods or services, the greater the opportunity to fulfill their needs. In addition, most new firms have competition, and the best way to be informed of competitor's actions (new products, level of service provided, prices) is to have ready access to their customers.

8. *Access to research and development, information, innovation.*[10] The causal relationship between the presence of innovation and new and small firms is not clear, but they seem to be highly associated. It is argued that where information is readily available and innovation and creativity flourish, the formation rate of new firms is enhanced.

9. *Personal wealth.*[11] Those with higher personal incomes may seek greater diversity in their personal consumption (housing, clothing, food, recreation, etc.). This, in turn, provides more opportunities for small specialized firms. This could be reflected in more new firms.

10. *Social status diversity.*[12] Complimenting the arguments associated with diversity in personal income are arguments related to ethnic-cultural diversity. As this diversity increases, there is a wider range of demand for goods and services and, in turn, more diverse opportunities for new and small firms.

11. *Population growth.*[13] Population growth should provide an increase in demand, certainly for goods and services sought by individuals, and, in turn, opportunities for new firms to be profitable. This should lead to new firm foundings. If new immigrants are more likely to participate in new firm starts, then population growth reflecting in-migration should also provide a greater pool of potential entrepreneurs. Recent preliminary findings in the U.S. suggests that most of those starting new firms have been residents of their country for a substantial period of time, 70%

over 5 years and 50% over 15 years (Reynolds, 1994). This suggests that, at least for the U.S., new immigrants are not the major source of entrepreneurs.

12. *Economic system size.*[14] This argument assumes that a larger socio-economic system will, by virtue of its size, have substantially higher birth rates. Conceptually, it is important to distinguish size from other attributes highly associated with size, such as diversity, complexity, and the density of economic activity. All are considered to improve the climate for new firm development.

13. *Economic diversity.*[15] Distinct from the size of an economic system is the diversity. It is assumed that diversity in productive activities as well as diversity in skills and occupations will provide more opportunities to develop markets, or clientele, for new firms. Further, it is assumed this will enhance the capacity to identify suitable suppliers and human talent. All should encourage new firm births.

In the sections that follow, two regional measures are developed as indicators of economic diversity. One reflects the range of occupations pursued by workers in the region. A wider range of occupations is assumed to be associated with greater economic diversity. The second is related to the size structure of the business organizations in the region. A larger number of smaller organizations is assumed to reflect greater economic diversity. As the two indicators appear to provide a reliable index, they are considered satisfactory for this preliminary analysis. Given the importance found across a number of countries regarding the impact of a greater proportion of smaller firms on firm births, future analysis may benefit by treating the impact of higher proportion of new firms as a separate process (Reynolds, Storey, and Westhead, 1994).

14. *National transportation access.*[16] For new firms oriented toward a national market, convenient access to the entire nation is a major issue. While overnight delivery services and modern communication provide timely exchanges of documents and material, direct face-to-face contact remains critical for maintaining effective relationships with suppliers and customers. Hence, those areas convenient for national transportation, such as access to major airline hubs, provide an advantage not available in more remote areas.

15. *Employment policy flexibility.*[17] The rate of change in economic activity appears to be increasing. There is an accelerated introduction of new products and new production methods. Managers and workers are a major aspect of most economic production, and the ability to respond quickly and efficiently to changes by adjusting the workforce or its duties is considered by many as a major asset. New firms are often introduced in the most volatile of industry contexts. It is suggested that a capacity for flexible employment relationships reduces some of the risks and complications associated with initiating a new firm. Hence, the greater the employment policy flexibility, the higher the rate of new firm formation.

II. Sources of data and measures of processes

Several definitions are critical for the analysis strategy: the geographical unit of analysis, classification of region type, the measurement of establishment birth and death rates, and the sources of the indicators reflecting the processes leading to establishment foundings.

Labor market areas. Labor market or travel-to-work areas (LMAs) are the geographical unit of analysis. They are aggregations of the 3,124 U.S. counties into 382 travel-to-work areas identified in cluster analyses using the 1980 census of population data (Tolbert and Killian, 1987). A map of U.S. labor market areas is provided as Figure 1. It appears unfamiliar because one-third of these LMAs involve counties from two or more states.

Business births and deaths. Data on establishments and their foundings originates with the data from Dun and Bradstreet, the Dun's Market Identifier (DMI) files. The complete national file was leased by the U.S. Small Business Administration in December of every even year from 1976–88 (U.S. Small Business Administration, 1988). Comparisons of two consecutive files are used to identify new or deceased establishments. For each period, establishments present only in the final period file are considered births and

Fig. 1. U.S. labor market areas: 1980.

establishments present only in the initial period file are considered deaths.

"Autonomous firms" (or just firms) are those establishments that are a single establishments firm, a headquarters establishment, or a branch with a headquarters in the same county. "Branches" include all establishments owned by a headquarters outside the county. The full analysis includes all types of establishments, firms and branches, although only firms will be emphasized in this discussion. For each labor market area, data is available on the total number of firms that appear or disappear during six 2-year periods starting in 1976 (1976–78, 1978–80, 1980–82, 1982–84, 1984–86, 1986–88). All industries (except agricultural production, which is not covered by Dun and Bradstreet) are included in the analysis.

Birth and death rates are computed as the annual number of firm births or deaths per 10,000 population in the labor market area. A business volatility index was created by taking the average of the standardized Z-scores (mean of zero, standard deviation of 1.0) for four measures, the birth and death rates of firms and branches. All firm birth and death rate distributions, the dependent variables, are normal for the time periods involved in this analysis.

Multi-Item indicators of start-up processes. All other data on the characteristics of the regions are taken from a diversity (over 15) of federal data sources, many represented in the County-Statistics 3 file provided by the U.S. Census or information derived from the decennial Censuses of Population. They are assembled in terms of their absolute value at the county level and then aggregated into LMAs. This places some restrictions on the precision of some data. For example, industry by employment is available only at the one-digit standard industrial code (SIC) level at the county level. Some data (such as the number of union members or patents approved) was only available at the state level. In these cases the absolute counts were distributed across all counties in proportion to some county level characteristic, such as the number of workers or those over 25 years or older, prior to aggregation to the labor market area.

Multi-item indices were developed for the fifteen processes for five time periods to represent the independent variable (1970; 1978; 1980, 1982; 1984). Examples for two of the five time periods are presented in Table II. This presents the items included in each index and also the estimated reliability (Chronback's alpha) for each index. The effect on the overall reliability from deleting each item is also noted for indices with three or more items.

The reliabilities are, for most indices, quite high. Of the indices to be used in the analysis, reliabilities are in excess of 0.80 for half and in excess of 0.70 for three-quarters. For three indices – access to customers, clients; availability of R&D and information; and size of the economic base – reliabilities are essentially 1.00.

One dependent variable, the measure of business volatility, was a four item index. The reliability of this index (provided at the bottom of Table II) is approximately 0.90 for two time periods (1980–82; 1982–84), it is 0.90 or better for the other four.

No issue in this analysis is more important than the capacity for inferences about causality. Hence, all independent measures are for the period prior to the periods for which firm births and deaths are measured. The time lags vary from none, consecutive periods (but not simultaneous) to 16 years (1970 to 1986–88).

A factor analysis was completed in an attempt to determine the extent to which these fifteen labor market area characteristics might represent a smaller set of stable dimensions. When a data set was assembled treating the 1970 and 1980 indices as independent, a total of 382 × 2 or 764 units of analysis, a very stable seven factor solution accounting for 87% of the common variance emerged. Of the fifteen factor weights, all were above 0.51, 14 were above 0.63, 13 above 0.71, 10 above 0.81 and five above 0.89. The results are represented by the assignment of start-up processes indices in Tables III, IV, and V.

The actual factors are of some interest, for the first three are associated with three different regional characterizations, or models, often found in discussion of entrepreneurial activity. The first model, labeled "agglomerative/access" is associated with an image of some areas favored by agglomeration of a diversity of factors, often associated with the potential for access to knowledge, factors of production, clients and customers, or knowledge and new ideas. The second model, labeled "wealth/costs" is associated with arguments focusing upon money, lower costs of production, lower costs of public services, or the availability of financial support for new firms. These features are often mentioned in discussions of the "business climate," usually associated with discussions of how to reduce costs to enhance new business starts. A third cluster of factors, labeled "growth/turbulence" is associated with changes that may be present in a region that has more volatile industries, population growth, and a higher proportion of mid-career adults.

III. Linear model development and interpretations

A number of linear models were developed with the LISREL procedure.[18] The results of the models designed to predict firm birth rates are presented in Table III and firm death rates in Table IV. In both cases, models for predictions from 0–6 years into the future represent models that fit from 2–4 data sets. Table III and IV, therefore, represent summaries of a total of 20 unique combinations of start-up process indicators used to predict birth or death rates. The entries in the tables are gamma coefficients, which are similar to standardized Beta coefficients in linear regression analysis.

Note that the linear models presented in Tables III and IV are extremely stable. The same start-up indicators are included in almost all the models with the same sign and, generally, the same value of the gamma coefficients. Explained variances, one measure of the fit of the models to the data, is generally quite good, usually above 0.50 and a number are above 0.60. They tend to be higher for models of births than models of deaths. These models are quite stable over time, not only in terms of the future period in which predictions are made, which varies from 0 to 16 years, but in terms of the period in which the model is applied. There was, for example, no evidence of impact from the major U.S. recession of 1980–82 or the recovery that took place in 1982–84.

It is also significant that the models predicting firm birth and death rates are quite similar. In fact, birth and death rates correlate quite highly for any

TABLE II
Multi-item measures: Labor market area characteristics (1/2)

Process represented	Items	Variable Name	1980 reliability		1982 reliability	
			If item deleted[1]	Total Scale[2]	If item deleted	Total scale
1) Unemployment	Annual unemployment rate	GUExxP	N/A		N/A	
	Transfer payments[3] as percentage of total personal income	MWFIN80P	N/A		N/A	
				0.67		0.74
2) Career opportunity	Percent population age 35–44	GPO44xxP	0.90		0.70	
	Percent some college	FPOSCxxP	0.87		0.75	
	Percent college degree	FPOCOxxP	0.85		0.64	
	Percent managers	FEMMAxxP	0.87		0.64	
	Percent professionals	FEMPRxxP	0.86		0.64	
	Percent technical occupations	FEMTLxxP	0.87		0.66	
				0.89		0.85
3) Industry mix	Pct work force:Construction	GEMCNxxP	0.41		0.40	
	Pct work force:Retail	GEMRTxxP	0.37		0.15	
	Pct work force:Consumer services	TEMPLxxP	0.34		–	
	Pct work force:Services	GEMSCxxP	–		0.26	
	Pct establishments:Construction	ESCNxxP	0.59		0.34	
	Pct establishment:Consumer serv	ZESCSxxP	0.42		0.26	
				0.64		0.61
4) Costs of factors of production	Business tax/worker	KBUTXxxJ	0.59		0.68	
	Local government revenue/capita	TLGTXxxC	0.54		0.65	
	Local government debt/capita	TLGGDxxC	0.55		0.62	
	Earned income/worker	EARNxxJ	0.43		0.54	
				0.69		0.69
5) Availability of production factors	Per capita demand deposits	TDMDPxxC	0.91		0.91	
	Per cap savings deposits	TSADPxxC	0.93		0.90	
	Percent with HS Diploma only	FPOHSxxP	0.92		0.90	
	Percent adults age 15-64	C1564xxP	0.91		0.89	
	Sales workers per square mile	SEMSLxxM	0.87		0.85	
	Clerical workers per square mile	SEMCLxxM	0.87		0.85	
	Service workers per square mile	SEMSVxxM	0.87		–	
	Skilled craftsmen per square mile	SEMCFxxM	0.88		0.85	
	Machine operators per square mile	SEMOPxxM	0.88		0.86	
	Transport operatives per square mi	SEMTOxxM	0.88		0.85	
	Laborers per square mile	SEMLBxxM	0.88		0.85	
				0.90		0.89
6) Efficient public infrastructure	Per capita gov't exp: Education	GEDEXxxC	0.40		0.52	
	Per capita gov't exp: Highways	GHIEXxxC	0.44		0.66	
	Per capita gov't exp: Welfare	TPWEXxxC	0.57		0.66	
	Per capita gov't exp: Police	TCPEXxxC	0.44		0.66	
				0.67		0.70
7) Access to customers, clients	Population/square mile	TPOxxM	N/A		N/A	
	Establishments/square mile	ZESxxM	N/A		N/A	
				0.99		0.99
8) Knowledge, R&D base	Post college/1,000 sq miles	SPOGDxxM	0.87		0.98	
	Professionals and technical employees/1,000 square miles	SPRTLxxM	0.88		–	
	Patents granted/1,000 square mile	ZPATxxM	0.89		0.98	
	Doctorates granted/1,000 sq miles	ZGDxxM	0.87		0.97	
				0.99		0.98

TABLE II *(Continued)*

Process represented	Items	Variable Name	1980 reliability		1982 reliability	
			If item deleted[1]	Total Scale[2]	If item deleted	Total scale
9) Personal wealth	Personal income per capita	GPIxxC	0.77		0.71	
	Income per household	GPIOHxx	0.82		0.84	
	Dividend, interest, + rent per capita	DIRxxC	0.85		0.97	
				0.87		0.89
10) Social status diversity	Educational diversity index[a]	FEDxxV	N/A		N/A[b]	
	Household income diversity index[a]	FINESxxV	N/A		N/A[b]	
				0.72		0.72
11) Population growth	Ten year population change	MPOxxyyP	0.55		N/A	
	Percent living in same county five years earlier	JPOCYyyP	0.77		N/A	
	Percent in migration	JPOMGyyP	0.78		–	
				0.79		0.77
12) Size of economic base	Total population	TRESPOxx	0.99		0.99	
	Total labor force	ZREISExx	0.99		0.99	
	Total establishments	ZSBAESxx	1.00		1.00	
				0.99		0.99
13) Economic diversity	Establishment/employees	MEMESxx	N/A		N/A	
	Occupational diversity index[a]	TEMxxV	N/A		N/A	
				0.58		0.65
14) National transportation access	Distance to closest hub airport	HAPDS1	N/A		N/A[b]	
	Difference in distance to closest and 2nd closest hub airports	HAPDS12	N/A		N/A[b]	
				0.79		0.79
15) Flexible employment policies	Labor force, percent unionized	ZNRTWxxP	N/A		N/A	
	Percent employees without state right-to-work laws[4]	ZMLUxxP	N/A		N/A	
				0.88		0.89
Business volatility (For 1982–84 and 1984–86)						
Autonomous Firm Births per 10,000 population		TBRPOxx	0.86		0.87	
Branch/Subsidiary Births per 10,000 population		BBRPOxx	0.88		0.86	
Autonomous Firm Deaths per 10,000 population		TDTPOxx	0.90		0.87	
Branch/Subsidiary Deaths per 10,000 population		BDTPOxx	0.88		0.86	
				0.91		0.89

Notes:

[1] Estimate of Chronbach's alpha without the item from SPSS-PC V3.1 "Reliability" procedure. Provides an estimate of the contribution of the item to overall scale reliability. A negative value indicates serious departures from linearity in the inter-item relationships. Can only be computed if at least three items are candidates for an index.

[2] Chronback's alpha as estimated by SPSS-PC V3.1. Estimate of the extent to which errors of measurement are reduced by an index that gives equal weight to the constituent items.

[3] Transfer payments are mostly welfare and retirement benefits payments.

[4] In about two fifths of the states of the United States, workers have the right to a job in an establishment with a collective bargaining agreement without being a dues-paying member of the union. Such states are referred to as "right-to-work" states.

[a] Diversity index computed the M5 formula discussed in Gibbs and Poston (1975).

[b] Because of lack of data, same values used for several years of data.

TABLE III
Coefficients of linear models predicting firm birth rates

			Short term					Medium term					
		Time lag (yrs)	0	2	4	6	8	6	8	10	12	14	16
Year data represents:	1970							76–78	78–80	80–82	82–84	84–86	86–88
(Predicting from)	1978		78–80	80–82	82–84	84–86	86–88						
	1980		80–82	82–84	84–86	86–88							
	1982		82–84	84–86	86–88								
	1984		84–86	86–88									
		Variable Name											
Factor 1 – Agglomerate/Access													
5) Availability of factors of production		PFAVLxx											
7) Access to customers, clients		ACCSSxx						–1.00					
8) Knowledge, R&D Base		TECHxx											
12) Size of economic base		BASExx			0.58						1.08		
Factor 2 – Wealth/Costs													
4) Costs of factors of production		PFCSTxx											
6) Public infrastructure expenditures		INFEFxx	0.76										
9) Greater personal wealth		WELTHxx	1.38	1.54		1.22	0.79	2.70	2.18	2.45		2.41	2.15
Factor 3 – Growth/Turbulence													
2) Career opportunity		CARERxx	0.23	0.88		1.08	1.23	2.08	2.16	2.24	3.19	1.70	2.02
3) Industry mix (volatile industries)		ESMIXxx	0.70	0.68				3.38	3.02	3.21	3.29	2.71	1.89
11) Population growth		POPxxD	2.10	1.88	1.95	1.67	1.59						0.59
Factor 4 – Employment rigidities													
15) Flexible employment policies (lack of)		LUxx	–0.66	–0.74	–0.44	–0.49	–0.24		–0.58	–1.01		–1.28	–0.98
1) Unemployment/desperation		DESPxx	–0.66								–0.92	0.64	0.62
Factor 5 – Social diversity													
10) Social status diversity		SOCxxV			1.46								–3.80
Factor 6 – Economic diversity													
13) Economic diversity		ECONxxV	2.00	1.42	1.66	1.19	0.99	1.83	1.90	1.69	1.64		
Factor 7 – National transportation difficulties													
14) Lack of national transportation access		AIRPxx											
Average Adjusted Explained Variance (R**2)			0.70	0.64	0.60	0.62	0.57	0.59	0.60	0.65	0.62	0.62	0.61

Note: Table values are gamma coefficients from LISREL analysis and may be interpreted similar to standardized beta weights.

TABLE IV
Coefficients of linear models predicting firm death rates

			Short term					Medium term					
		Time lag (yrs)	0	2	4	6	8	6	8	10	12	14	16
Year data represents:	1970							76–78	78–80	80–82	82–84	84–86	86–88
(Predicting from)	1978		78–80	80–82	82–84	84–86	86–88						
	1980		80–82	82–84	84–86	86–88							
	1982		82–84	84–86	86–88								
	1984		84–86	86–88									
		Variable Name											
Factor 1 – Agglomerate/Access													
5) Availability of factors of production		PFAVLxx											
7) Access to customers, clients		ACCSSxx											
8) Knowledge, R&D Base		TECHxx		–0.36									
12) Size of economic base		BASExx											0.94
Factor 2 – Wealth/Costs													
4) Costs of factors of production		PFCSTxx											
6) Public infrastructure expenditures		INFEFxx	0.58		0.41	0.64		0.65					
9) Greater personal wealth		WELTHxx	0.79	1.40	0.92	0.36			1.30	2.04	1.52	1.33	0.90
Factor 3 – Growth/Turbulence													
2) Career opportunity		CARERxx		–0.16					3.22	2.04	0.97	0.78	2.39
3) Industry mix (volatile industries)		ESMIXxx						0.90	2.01	1.45	1.49	1.64	1.81
11) Population growth		POPxxD	0.88	0.78	0.77	0.90	1.05	–0.74		–0.65			
Factor 4 – Employment rigidities													
15) Flexible employment policies (lack of)		LUxx											
1) Unemployment/desperation		DESPxx				–1.03	–0.90	–0.46		0.46			
Factor 5 – Social diversity													
10) Social status diversity		SOCxxV					1.52	–6.48	–2.48				
Factor 6 – Economic diversity													
13) Economic diversity		ECONxxV	2.02	2.10	2.44	2.83	3.95	1.44	1.96	1.16	1.33	1.47	2.25
Factor 7 – National transportation difficulties													
14) Lack of national transportation access		AIRPxx											
Average Adjusted Explained Variance (R**2)			0.53	0.56	0.55	0.58	0.57	0.37	0.44	0.53	0.52	0.48	0.50

Note: Table values are gamma coefficients from LISREL analysis and may be interpreted similar to standardized beta weights.

given period, usually in excess of 0.80. Indeed, models that predict overall business volatility (which includes not only firm birth and death rates but branch birth and death rate) are more successful than models related to individual components. Linear models developed to predict overall business volatility, an index giving equal weight to firm and branch birth and death rates, are presented in Table V. These linear models are not only simpler than the firm birth and death rate models, but are more stable over time and provide a better fit with the data, as evidenced by the higher explained variances, generally above 0.60.

This suggests that the most critical regional characteristic may be the volatility, turbulence, or churning among the business entities, which is reflected in firm birth and death rates.

IV. Impact of start-up processes

The impact of the various start-up processes in the linear models is summarized in Table VI. Indicators of start-up processes related to economic diversity, career opportunity, volatile industries, greater personal wealth, and employment policy flexibility have consistent impact in linear models predicting short and medium term firm birth rates. Population growth and unemployment/desperation indicators have some impact for short term predictions. Note, however, that the impact of unemployment/desperation is reversed, higher levels tends to depress firm births. Diversity in social status and the size of the economic system have some minor impact for some predictions.

Just as important are the processes that are never incorporated in any of the models. None of the indicators related to cost – factors of production, expenditures on public infrastructure – have any impact in any of the models. None of the indicators related to access – to factors of production, to customers or clients, to national transportation networks, to research and development resources – is incorporated in any of the models. However, this is basically a comparison of labor market areas that are present in the United States. The absence of any impact suggests only that an impact is not present for the range of values found in the U.S. in the 1970–1984 period.

Two of the conceptualizations associated with the factor analysis – related to the agglomerative/access and wealth/costs have very little support in these linear models. In particular, the factors associated with the agglomerative/access conceptualizations are rarely incorporated in the linear models. Only one factor associated with the wealth/costs conceptualization has a consistent impact, that of greater personal wealth. This would suggest that it is more fruitful to emphasize the specific processes themselves, each associated with a different multi-item index.

Each of the major processes incorporated in the linear models as significant factors affecting firm births, deaths, and volatility deserves comment.

The *economic diversity* index included measures of diversity of occupations and a higher proportion of small firms in the regional economy. Future analysis should separate the effects of these two measures. Note that the impact of economic diversity was independent of the size of the region, which suggests that even in smaller regions economic diversity contributed to greater firm births.

The presence of mid-career, educated adults, reflected in the *career opportunity index*, was an important precursor of firm births in all time lags and firm deaths and turbulence in longer term predictions. It is hard to avoid the assumptions that this index was related to pools of adults that were the source of teams starting new firms.

Regions with an economic base emphasizing more *volatile industries* – retail, service, construction – tended to have higher levels of firm births, firm deaths, and turbulence. This is a reasonable result, and highlights the problems associated with separating turbulence that is a normal feature of an industry sector from turbulence representing economic growth and change.

Greater *personal wealth* has a consistent impact on firm births, deaths, and turbulence, although the basis for this impact remains unclear. It is probably a combination of the increased demand – which should increase birth rates in construction, retail, and consumer services – and the availability of capital for investment in new firm startups in all industry sectors.

Greater *flexibility of employment*, associated with an absence of unionization and greater presence of right to work laws, has its major impact on firm births. In regions where employ-

TABLE V
Coefficients of linear models predicting overall business volatility

			Short term					Medium term					
		Time lag (yrs)	0	2	4	6	8	6	8	10	12	14	16
Year data represents:	1970							76–78	78–80	80–82	82–84	84–86	86–88
(Predicting from)	1978		78–80	80–82	82–84	84–86	86–88						
	1980		80–82	82–84	84–86	86–88							
	1982		82–84	84–86	86–88								
	1984		84–86	86–88									
		Variable Name											
Factor 1 – Agglomerate/Access													
5) Availability of factors of production		PFAVLxx											
7) Access to customers, clients		ACCSSxx											
8) Knowledge, R&D Base		TECHxx											
12) Size of economic base		BASExx									0.16	0.17	0.25
Factor 2 – Wealth/Costs													
4) Costs of factors of production		PFCSTxx											
6) Public infrastructure expenditures		INFEFxx											
9) Greater personal wealth		WELTHxx	0.22	0.22	0.22	0.20	0.24	0.35	0.37	0.45	0.32	0.27	
Factor 3 – Growth/Turbulence													
2) Career opportunity		CARERxx						0.10	0.60	0.31	0.32	0.31	0.54
3) Industry mix (volatile industries)		ESMIXxx						0.36	0.43	0.43	0.48	0.50	0.48
11) Population growth		POPxxD	0.33	0.34	0.34	0.34	0.38						
Factor 4 – Employment rigidities													
15) Flexible employment policies (lack of)		LUxx						–0.14	–0.12	–0.15	–0.15	–0.14	
1) Unemployment/desperation		DESPxx	–0.20	–0.24	–0.23	–0.27	–0.19					–0.10	–0.18
Factor 5 – Social diversity													
10) Social status diversity		SOCxxV											
Factor 6 – Economic diversity													
13) Economic diversity		ECONxxV	0.51	0.47	0.48	0.49	0.55	0.38	0.33	0.28	0.30	0.33	0.26
Factor 7 – National transportation difficulties													
14) Lack of national transportation access		AIRPxx											
Average Adjusted Explained Variance (R**2)			0.72	0.72	0.70	0.69	0.64	0.54	0.56	0.60	0.61	0.61	0.63

Note: Table values are gamma coefficients from LISREL analysis and may be interpreted similar to standardized beta weights.

TABLE VI
Summary of influences of major processes

	Differences among regions	Summary of impact	
13) Economic diversity	Higher firm birth rates in more diverse economic systems	Major Major Major	Firm births Firm deaths Volatility
2) Career opportunity	More firm births where more mid-career, experienced adults reside	Major Major Major	Firms Births Firm deaths, long term Volatility, long term
3) Volatile industries	More firm births where volatile industries more prevalent	Major Major Major	Firm births, Firm deaths, long term Volatility, long term
9) Greater personal wealth	More firm births where greater personal wealth is present	Major Major Major	Firm births Firm deaths Volatility, long term
15) Employment policy flexibility	More firm births in contexts with greater employment flexibility	Major None Strong	Firm births Firm deaths Volatility, long term
11) Population growth	More firm births in regions with more population growth	Strong Strong Strong	Firm births, short Firm deaths, short Volatility, short term
1) Unemployment, desperation	More firm births where more unemployment	Minor Minor Minor	Firm births Firm deaths Volatility, short term *direction reversed*
11) Social status diversity	More firm births where there is greater social status diversity	Minor Minor None	Firm births Firm deaths Volatility
12) Economic system size	Higher firm birth rates in larger economic systems	Minor None Minor	Firm births Firm deaths Volatility, long term
4) Factors of production costs	More firm births where input costs are lower	None	
14) National transportation access	Higher firm birth rates where access to national transportation is convenient	None	
5) Factors of production access	More firm births where factors of production are accessible	None	
7) Access to customers, clients	More firm births where access is more convenient	None	
6) Efficient public infrastructure	More firm births where public infrastructure better	None	
8) Information, R&D Base	More firm births where there is better access to R&D, info, innovation	None	

ment relationships are more formal and emphasize union involvement, firm births are reduced. It is one of the few regional characteristics that is asymmetric, as it is not incorporated in models of firm deaths. Variation in this characteristic may be unique to the United States, as few other countries allow sub-national political jurisdictions to influence employment relationships in this way.

Population growth has a strong impact on firm births, deaths, and overall volatility in the short term. This probably reflects a combination of processes, certainly an increase in demand is likely to be significant, but it may also reflect a higher concentration of talented motivated people in some regions.

Of some theoretical significance is not only the systematic inclusion of measures of *unemployment/desperation* in models associated with firm births, firm deaths, and business volatility, but that the direction is *reversed*. Rather striking evidence that higher levels of regional unemployment depress firm births. It seems reasonable, in light of this substantial finding, that higher unemployment reflects a reduction in demand. Surveys of those starting new businesses in the U.S. indicated that less than 10% are unemployed (Reynolds, 1994), which suggests it may be difficult to find any empirical support for the "unemployment/desperation" argument.

Social status diversity is incorporated in a minor way in models of firm births and deaths, but it is one of the few factors where the beta coefficient is reversed in some linear models. Given this, it seems best to assume that social status diversity – as measure – has no consistent impact.

The *size of the economic system* under consideration, which varies by a factor of 120 – from a hundred thousand to twelve million – has a minor influence on firm births and business volatility, none on firm deaths. It would seem that many features normally associated with greater size – economic diversity, the presence of mid-career, experienced adults, greater personal wealth, population growth – have been captured with other measures. As a result, size alone is left with no explanatory power. This should be good news for smaller regions attempting to encourage economic growth.

Equally significant are the regional characteristics that have no impact in any of the models: factors of production costs, national transportation access, factors of production access, access to customers and clients, efficiency of public infrastructure, or the availability of information and R&D.

Some of these were a surprise to the research team. It was not expected that factors of *production costs*, *access to production factors*, or *access to customers and clients* would have NO impact in any models. These features are often given great attention by those actually starting or managing firms. This lack of inclusion may reflect the dependent variables: all businesses in all economic sectors. As such, some factors critical in one or two industries may not have been included in an all industry regression model. Factors of production costs, such as wages, could be of great importance to some types of manufacturing but irrelevant to for retail or consumer service firms. Local people must, whatever their wages, must be used for local businesses. In contrast, access to customers may be critical for a retail or consumer service new firm, but the decision will be made regarding sites within the region. The impact cannot be identified in an analysis that does not distinguish below the region level.

Perhaps most surprising is the absence of impact of the *R&D, innovation, knowledge* measure. There are several possible reasons for this. It is possible that this indicator correlates with other indicators that have a greater impact, but the simple correlation of this indicator (and even its constituent items) with measures of firm birth and death rates is almost zero. It is also possible that the items used in the indicator may not be appropriate. The density of post-college adults, professional and technical employees, patents granted, or doctorates earned may not be appropriate measures of the availability of sophisticated, state-of-the-art technology and information.

On the other hand, this resource is probably of significance to only a small proportion, less than 1%, of new firms. As this analysis involves all new firms in all industries, and over 60% are in retail, construction, and consumer service – rather low-tech industries – there is little impact from measures of the presence of sophisticated knowledge. Further, availability of R&D and advanced knowledge is often associated with the emergence, over several decades, of new industries – cardiac

pacemakers, computers, bio-technology – represented by the emergence of a myriad of new firms that are difficult to classify by prevailing standards. If a new "silicon valley" is emerging in one of the 382 labor market ares used in this analysis, it would be impossible to detect with the available data. In short, a research effort that examines volatility and turbulence in all industries is unlikely to be affect by a subtle processes affecting a tiny portion of new firms. A study of the birth of new industries might find a more significant impact of measures of access to technical knowledge, R&D, etc.

The same reasoning would probably explain why access to national transportation was not included in any of the models. While ease of access to an airport is probably crucial for a number of manufacturing, wholesale, financial, and business consulting firms, it may be of little direct significance to most firms in construction, retail, consumer service and others oriented toward the regional market. As a result, the differences present in the index – which reflected the distance in miles between the center of the labor market area and one of the major hub airports, had no impact once other factors were considered.

This effort is devoted to understanding the general mechanisms that affect the formation of new firms. Several conclusions seem justified. First, this has been a successful effort at developing linear models. The models have been consistent and accounted for a respectable proportion of the measured variation in firm births, firm deaths, and overall business volatility. Second, understanding is advanced by attention to the specific processes that underlay the founding of new firms, rather than a focus on global models, such as the factors of production/business climate or agglomerative/incubator conceptions. Third, among the labor market areas in the U.S., and probably any other large diverse country, there is substantial variation in the basic turbulence, volatility, or churning present in the organizations that make up the economic order. Births and deaths of autonomous firms (as well as births and deaths of branches) are reflections of this overall volatility. Understanding business births and deaths will be, essentially, one aspect of understanding this more fundamental aspect of organizational population dynamics.

Additional research using this data and research paradigm should take several directions. First, give attention to models related to specific industry sectors. There is every reason to expect that some differences may be found between manufacturing firm births and retail or consumer service firm births. Second, to explore the differences for regions with different regional economic structures. Of particular importance are the differences between the 80–90 major urban regions – most of which have diverse economic structures quite similar to each other – and the 300 rural areas, most of which have a more specialized economic structure. Most of the variation in the indices used in this analysis reflect rural regions. Third, it is appropriate to consider the role of business volatility in regional economic growth and change and, in particular, whether some industries may play a more significant role than others in subsequent economic growth.

New firms are, however, started by people, not regional factors, This analysis has made clear that there is substantial variation in both firm birth rates and the nature of the context in which firm births occur. Indeed, the independent variables in this analysis were of two types, those that reflected regional features – economic diversity, volatile industries, employment policy flexibility – and those that reflected the population itself – career opportunity, personal wealth. Research on the entrepreneurial process itself – establishing how individuals and teams create new business entities – can now proceed with two advantages. First, the critical contextual features have been defined. Second, it is clear that some variation in birth rates – a little less than half – remains to be explained. Some of this is no doubt related to measurement errors, but some unexplained variance is related to an absence of a complete understanding of the start-up process. Longitudinal studies of firms-in-gestation that will provide a more complete portrayal of the entrepreneurial process are now in development (Reynolds, 1994).

Notes

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[1] A preliminary version of this analysis, representing only two time periods, is presented in Reynolds, Miller, and Maki (1993). Much of the preliminary discussion is adapted from that presentation.

[2] In various forms, this is among the most popular of processes (Creedy and Johnson, 1983, pp. 178–179; Hamilton, 1986, pp. 1401–1404; Hamilton, 1989; Harrison and Hart, 1984, p. 1406; Highfield and Smiley, 1986, p. 53; Hudson, 1989, p. 72; Johnson, 1986, p. 120; Mason, 1989, p. 332; Moyes and Westhead, 1990, p. 124; Storey, 1990; and Whittington, 1984, p. 255).

[3] Time series analysis provides substantial support for this process in the United Kingdom (Storey, 1990). Time series analysis of the entire United States economy has not provided strong support (Highfield and Smiley, 1986). Further, this is very modest support in cross-regional analysis; there has been some attempts to reconcile the discrepancy (Hamilton, 1989).

[4] Measures have included the proportion of college graduates (Bartik, 1989, p. 1016); presence of managers and skilled craftspersons (Johnson, 1986, p. 110); employees with strong technical knowledge and customer contact (Mason, 1991, p. 99); occupational experience and education (Moyes and Westhead, 1990, p. 124); rates of entrepreneurship for post high school males (O'Farrell and Pickles, 1989, p. 323); individual drive for economic leadership (Schumpeter, 1934, p. 93); occupational experience as managers and educational attainment (Storey, 1982, p. 185); and the absence of manual workers in a regions (Whittington, 1984, p. 255).

[5] Measures that have been proposed include intra-industry mobility (turnover) or turbulence differences (Beesley and Hamilton, 1984, p. 221); loss of employment in various industries, percentage employment in various industries, or age investment in various industries (younger industries have more new investments) (Moyes and Westhead, 1990, p. 124); industry variation in proportion of men starting new firms (O'Farrell and Pickles, 1989, p. 325); and percentage of workforce in low entry barrier industries (Storey, 1982, p. 185).

[6] There is a wide range of specific costs associated with this argument, including the cost of capital, labor, premises, local taxes, land, energy, transportation, living, insurance and so forth (Bartik, 19989, pp. 1015–1016; Creedy and Johnson, 1983, p. 180; Highfield and Smiley, p. 53; Hudson, 1989, p. 72; Morky, 1988, p. 20; Moyes and Westhead, 1990, p. 124; Pennings, 1982a, p. 128).

[7] This has included a wide range of measures, including diversity in social contacts or networks (Aldrich and Zimmer, 1986; Birley, 1985); presence of statewide rather than unit banking (Bartik, 1989, p. 1016); access to capital, skilled specialists, universities, supporting services, distance to suppliers, availability of premises, skilled specialists, and so on (Brusco, 1982, p. 173; Johnson, 1986, p. 110; Mason, 1991, p. 99; Morky, 1988, p. 20; Moyes and Westhead, 1990, p. 124; Oakey, 1984, p. 146; Pennings, 1982a, p. 127; Schumpeter, 1934, p. 72; and Storey, 1982, p. 185).

[8] Public infrastructure expenditures may be considered in terms of the spending per capita on fire protection, local schools, highways and roads, police services, welfare services (Bartik, 1989, p. 1015) or on services not privately provided that enhance regional economic efficiency, such as child care or low cost housing and commercial space (Brusco, 1982, p. 182).

[9] This has received less explicit attention, although it is part of the general incubator analysis (Oakey, 1984, p. 146; Hoover and Vernon, 1959).

[10] A number of writers have emphasize the importance of a "high information" ambiance (Brusco, 1982, p. 179; Mason, 1991, p. 99; Oakey, 1984, p. 146; Sabel and Zeitlan, 1985, p. 144; Schumpeter, 1934, p. 66).

[11] A number of discussions present this view (Brusco, 1982, p. 171; Hudson, 1989, p. 72; Johnson, 1986, p. 110; Mason, 1991, p. 99; Whittington, 1984, p. 255; and Storey, 1982, p. 185).

[12] Morky, 1988, p. 19.

[13] Morky, 1988, p. 19.

[14] Two opposite processes are included in this discussion. Some emphasize the size of the population, larger regions are expected to have higher birth rates (Bartik, 1989, p. 1013; Morky, 1988, p. 19; Pennings, 1982, p. 127). Others expect a reverse relationship, with higher birth rates in more rural areas (Johnson, 1986, p. 115; Moyes and Westhead, 1990, p. 124; O'Farrell and Crouchley, 1984, p. 233; and O'Farrell and Pickles, 1989, p. 318). Higher rural areas birth rates may reflect differences in industry structure, with a greater presence of more volatile industries (construction, retail, consumer services) in rural areas.

[15] This is treated as a separate issue in a number of discussions (Chinitz, 1961, p. 288; Morky, 1988, p. 19; Pennings, 1982b, p. 126; Whittington, 1984, p. 255).

[16] This is a more subtle issue, often related to dominance associated with the restructuring of the relationships among urban areas (Pennings, 1982a, pp. 124, 125). Major causal effects of airline hubs on urban economic dominance have been suggested (Irwin and Kasarda, 1991).

[17] This may be indicated by the presence of "Right to Work Laws," which allow employees to work in a plant with collective bargaining and not be dues-paying members of the bargaining unit as well as the percentage of all workers that are members of unions (Plaut and Pluta, 1983). It Italy, firms with more than 15 employees have a more difficult time releasing workers for any reason (Brusco, 1982).

[18] The linear models were developed with the use of LISREL PC 7.16, a computer program designed for structural equation modeling (Joreskog and Sorbom, 1989; Hayduk, 1987). It is useful for developing linear models similar to those developed with standard multiple regression procedures and is designed to facilitate model development on multiple data sets. Referred to as "groups" in the literature, each set of independent variable-dependent variable predictions, 1980 data predicting 1984 birth rates, would be considered a single group. For the models that involved multiple data sets the following procedure was followed.

First, a multiple group best fitting analysis (each set of

independent-dependent variable models was considered a single group) was completed on all relevant data sets, up to four for each measure of births, deaths, or volatility. This unconstrained model developed the best fitting linear model for each data set separately but provided, in addition, an indicator of the overall fit of all models to the respective data sets. This program uses a maximum likelihood modeling procedure and includes independent variables that provide a statistically significant contribution to the fit of the model to the data.

Second, the set of linear models was examined and a single model was developed based on the patterns found in all data sets. For example, if an independent variable was included in three or four of four data sets, it was included in the single overall model.

Third, an additional LISREL analysis was completed with the overall model developed in Step 2. A final analysis forced this one model on all the relevant data sets. The LISREL procedure then provides a single set of gamma coefficients that represents the optimal fit to all the data sets.

While different in implementation, it is similar to a pooled standard multiple regression analysis. It provides evidence of the statistical significance each independent variable and the overall fit of the single model to the multiple data sets. In all cases the measures of statistical significance of the overall model (using a single Chi-square test and considering the distribution of the residuals) and the contribution of specific individual variables was far beyond that normally accepted as appropriate (0.01 and greater in all cases). This final single model is then presented in the chapter Tables.

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