Understanding Rural Entrepreneurs at the County Level: Data Challenges

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Entrepreneurship is increasingly being recognized as a primary engine of economic growth. By combining existing resources with innovative ideas, entrepreneurs add value through the commercialization of new products, the creation of new jobs, and the building of new firms. The Global Entrepreneurship Monitor indicates that nations with higher levels of entrepreneurial activity enjoy strong economic growth. In short, entrepreneurs are the link between new ideas and economic growth.

The benefits of entrepreneurship – new jobs, higher incomes and increased wealth – are especially strong in the United States. However, research suggests that the spatial benefits from entrepreneurial activity are highly variable. In particular, rural (sparsely-populated) areas often find it difficult to sustain high-growth entrepreneurs (Acs 2001; Low, Henderson, Weiler 2005). Research based on U.S. labor market areas finds a strong link between entrepreneurship and economic growth, even in the smallest regions (Acs and Armington 2004, Camp 2005). However, labor market areas include both rural and highly urbanized economies. As a result, insight into the impact of entrepreneurship on rural growth is limited. Yet this type of

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information is crucial as entrepreneurs account for a greater share of employment in rural areas than in metro areas.

The objective of this article is to analyze the link between rural entrepreneurship and economic growth using county level data. The first section of this article summarizes the emerging literature surrounding entrepreneurship and economic growth. The second section identifies various measures of entrepreneurship at the county level. The third section presents a straightforward growth model to analyze the relationship between entrepreneurial activity and economic growth. The fourth section summarizes the empirical results and provides direction for future research and the need for additional county level measures of entrepreneurship.

Literature Review

Researchers are increasingly recognizing the importance of entrepreneurship in economic growth. The first link between entrepreneurship and economic growth has been attributed to Schumpeter's (1934) notion of creative destruction where new innovations by entrepreneurs destroyed older markets and fuel new growth. Recent work recognizes that entrepreneurship supports economic growth by turning knowledge into new products, new jobs, and new firms. Empirical studies are now confirming the strong relationship between entrepreneurship and economic growth at various levels of economic aggregation.

Entrepreneurship stimulates economic growth through the creation and transformation of knowledge. Audretsch and Thurik (2004) and Carree and Thurik (2005) recognize that entrepreneurship stimulated growth through knowledge spillovers, increased competition, and expanded diversity. The theoretical building blocks of their argument stem from the earlier writings of Romer (1986) and Lucas (1988) that established the important role of knowledge

spillovers in endogenous growth models. Recognizing the role of knowledge spillovers, Audretsch and Thurik (2004) and Carree and Thurik (2005) indicate that entrepreneurship leads to economic growth because it is the mechanism by which knowledge spillovers develop. Knowledge is endowed in a person or economic agent. As a result, it requires an individual entrepreneur to start a new enterprise thereby capturing the value of the knowledge embodied in the individual. Thus, entrepreneurship is the mechanism in which knowledge is commercialized and used to stimulate economic growth.

The second way entrepreneurship stimulates economic growth is through increased competition brought on by the creation of new enterprises. Interestingly, this second conduit by which entrepreneurship influences growth also contains a knowledge component. Audretsch and Thurik (2004) and Carree and Thurik (2005) recognize that knowledge externalities, both within industries and across industries, emerge from competition for new ideas not the competition of product markets.[2] As a result, knowledge externalities are more likely to emerge in competitive environments than in environments of local monopolies. By creating new firms, entrepreneurship stimulates the competition for new ideas and fuels the process of developing knowledge externalities. Empirical evidence in Glaeser et al. (1992) and Feldman and Audretsch (1999) supports the notion that local competition is more conducive to innovative activity and economic growth.

The third way entrepreneurship supports economic growth is by spawning diversity among firms in a specific location. Jacobs (1969) develops a model where a diverse economic

[2] Porter (1990) indicates that knowledge spillovers between specialized, geographically concentrated firms stimulate growth, similar to Marshall-Arrow-Romer (MAR) externalities. Thus, a concentration of firms in a core industry is important fueling knowledge spillovers and economic growth. In contrast, Jacobs (1969) indicates that the most important knowledge externalities emerge from outside the industry. As a result, the diversity of industries is important in knowledge transfer, innovation, and economic growth. Both Porter and Jacobs indicate that competitive environments are more conducive to knowledge transfers.

environment allows for increased knowledge spillovers across industries that yield a larger economic return than spillovers simply internal to industries. Audretsch and Thurik (2004) and Carree and Thurik (2005) argue that entrepreneurship contributes to economic growth by creating diversity and developing channels for knowledge spillovers across firms.

Recent economic research has empirically tested the links between entrepreneurship and economic growth at various levels of aggregation. van Stel, Carree, Thurik (2005) analyze the impact of entrepreneurial growth on national gross domestic product growth in a sample of 36 countries. This study used multiple measures of entrepreneurial activity from the *Global Entrepreneurship Monitor (GEM)*. Using data from 1999 to 2003, entrepreneurial activity, the number of nascent entrepreneurs and owners of businesses less than 42 months old, was found to have a positive relationship with national economic growth. However, the relationship did depend on the level of per capita income.

Acs, Audretsch, Braunerhjelm, and Carlsson (2006) also analyze the relationship between entrepreneurship and economic growth at the national level. Using data on 18 countries from 1981 to 1998, Acs et al focus on the role of entrepreneurs as facilitators of knowledge spillovers where entrepreneurship is defined as the rate of self-employment. The relationship between entrepreneurship and GDP growth is tested in an endogenous two-stage least squares model of economic growth that also accounted for the country's knowledge stock, labor, capital, and institutional factors. Countries with a greater degree of entrepreneurial activity exhibited higher rates of economic growth.

Empirical work has also studied the relationship between entrepreneurship and economic growth at the sub-national level. Using proprietary Census Bureau data on establishments, Acs

and Armington (2004) analyze employment growth in labor market areas from 1991 to 1996.[3] Labor market areas with more business starts, both single and multi-units establishments, and a larger share of proprietors had higher levels of employment growth. They found that business starts were more important to employment growth than proprietors and suggest that the flow or creation of entrepreneurial activity is more important than the stock of entrepreneurs.

Camp (2005) analyze entrepreneurial activity and economic growth in U.S. labor market areas. Recognizing the multiple facets of entrepreneurship, an index of entrepreneurial activity was developed and used in the analysis. Using Census Bureau data from 1990 to 2000, the entrepreneurial index was composed of new firm births, the rate of new firm births, and the share of young firms that are growing. Regions with a higher entrepreneurial index activity were found to have higher levels of employment, wage, and productivity growth. For example, in the most entrepreneurial labor market areas, employment growth was 1.9 percent compared to 0.7 percent in the least entrepreneurial labor market areas. When analysis was conducted by labor market size, among the smallest regions, the most entrepreneurial regions realized 73 percent greater annual employment growth than the least entrepreneurial. Regions with smaller populations, however, were found to have greater difficulty reaching their entrepreneurial potential as they produced less entrepreneurship than predicted in the empirical models.

Using data from West German regions, Audretsch and Keilbach (2005) analyze the relationship between entrepreneurial capital and regional growth. They find that regions with higher levels of entrepreneurial capital, measured as new business start-ups from 1989 to 1992,

[3] Labor Market Areas (LMAs) are geographically designated areas according to commuting patterns to reflect local labor markets. County-to-county flows of computers were analyzed with a hierarchical cluster algorithm to define commuting zones, a cluster of counties with strong commuting ties. In 1990, 741 commuting zones were identified. Labor Market Areas are groups of commuting zones combined to meet a population threshold of 100,000 people as established by the Census Bureau. In 1990, 349 labor market areas were identified. See Tolbert and Sizer (1996) for more information on the creation of Labor Market Areas.

had higher levels of gross value added output and higher rates of labor productivity. The study also hypothesized that the importance of entrepreneurial capital to economic growth would vary according to its level of urbanization since knowledge spillovers tend to be greater in urban setting and entrepreneurs are theorized to be the mechanism creating knowledge spillovers. Essentially, entrepreneurial capital would have a stronger impact in urban areas and a weaker impact in rural places. Empirical testing confirmed this hypothesis as the relationship between entrepreneurial capital and growth was stronger in urban areas. In rural regions, entrepreneurial capital did not have a strong relationship with economic growth or labor productivity.

In sum, research has found entrepreneurship to be highly correlated with economic growth both at the national and regional level. Yet, research analyzing the impact of entrepreneurship on rural economic growth in the U.S. is sparse. Research by Boden (2000) found the survival duration of new establishments differed across metropolitan status. Audretsch and Kielbach (2005) analyze the entrepreneurship impact of growth in rural West Germany. Both found that the impact of entrepreneurial activity was weaker in rural regions. Acs and Armington (2004) and Camp (2005) suggest that the impacts of entrepreneurship on economic growth could differ in rural locations.

These studies used labor market areas as their level of geographic analysis. A labor market area is a central city surrounded by counties with integrated economic activity based on commuting patterns. Unfortunately, any variation among the counties of the LMA would be lost by such an aggregation. The question is if we look more closely, using counties instead of LMAs, does entrepreneurship have a different impact on economic growth in rural counties compared to metro counties?

Measuring Rural Entrepreneurs

The starting point in analyzing the relationship between rural entrepreneurship and economic growth is to identify a measure of rural entrepreneurship. The first step is to define rural. The second step is to define entrepreneurship.

Analysis of rural economic activity is always challenged by the definition of "rural". The Census Bureau defines rural areas as place with less than 2500 people or places not incorporated.[4] Yet, information on rural places consists of only basic population and housing statistics, thus limiting insight into rural economic activity. As a result, researchers are left with defining "rural" as non-metropolitan regions to help gain insight into the economic dynamics of small, sparsely populated regions. Due to the limitation of rural data and the wealth of information at the county level, rural will be defined as counties outside of metropolitan areas. Consequently, analysis at the county level improves upon the work of Acs and Armington (2004) and Camp (2005) that looked at entrepreneurship at the LMA level.

Studying rural entrepreneurship or entrepreneurship in general, is challenged with defining an entrepreneur. Entrepreneurship is an elusive concept that is easy to discuss, difficult to describe, and even harder to define. In fact, after more than 200 years, a commonly accepted definition of entrepreneurship has failed to emerge. One of the earliest definitions arose in 1734 where entrepreneurship was said to be self-employment with an uncertain return (Sharma and Chrisman 1999).[5] Two hundred years later, the importance of innovation was highlighted as entrepreneurship was described as the process of creating new combinations of products,

[4] The Census Bureau defines an urban area as "all territory, population and housing units in urban areas, which include urbanized areas and urban clusters. An urban area generally consists of a large central place and adjacent densely settled census blocks that together have a total population of at least 2,500 for urban clusters, or at least 50,000 for urbanized areas. Urban classification cuts across other hierarchies and can be in metropolitan or non-metropolitan areas." Rural areas are defined as "territory, population and housing units not classified as urban. Rural classification cuts across other hierarchies and can be in metropolitan or non-metropolitan areas."

[5] See Malecki (1994) and Dabson (2001) for discussions of entrepreneurship definitions.

processes, markets, or organizational forms (Schumpeter 1934). Entrepreneurship has also been defined as simply the "creation of an organization" (Hoy 1987; Gartner 1988). Recent research analyzing the impact of entrepreneurship on economic growth at the regional level has used measures of entrepreneurship based on new business starts. (Acs and Armington 2004, Camp 2005, and Audretsch and Kielbach 2005).

Even if researchers reached agreement on defining an entrepreneur, actual measurement would still be an area of concern. For example, many studies have used measures of self-employment as a proxy for entrepreneurs because of the availability of public data (Evans and Jovanovic 1989; Evans and Leighton 1989; Fairlie and Meyer 1996; Folster 2000; Kuhn and Schultze 2001). Recently, studies that have used business starts data based on newly available Census datasets (Acs and Armington 2004; Camp 2005). This paper uses both publicly available proprietor data and business starts/deaths data to analyze entrepreneurship at the county level.

The first set of analysis identifies entrepreneurs as the number of non-farm proprietors in the county according to the Regional Economic Information System available from the Bureau of Economic Analysis (REIS). REIS derives the total number and income of farm and nonfarm proprietors at the county level from income tax information collected on the Schedule C of form 1040 for sole proprietorships and form 1065 for partnerships. Self-employed are total full and part-time self-employed but exclude limited partners in partnerships. BEA takes the national data and estimates county level estimates of proprietorships and their income with additional adjustments based on other data collected by the U.S. Department of Commerce. REIS data and detailed methodology are available at www.bea.gov/bea/regional/data.htm. Research has used the self-employment and proprietor data to analyze entrepreneurship activity (Evans and Leighton; Evans and Jovanovic; Kuhn and Schuetze; Folster; Fairlie and Meyer). Henderson

(2002) and Low, Henderson, and Weiler (2005) used proprietor data to analyze entrepreneurship levels across rural counties.

The proprietor data are used to construct two measures of entrepreneurship. The first measure, E_{DEN} , identifies the number of entrepreneurial activity in a county on a per capita basis. Specifically, it is defined as the average share of non-farm employment in the county accounted for by non-farm proprietors.[6] The second measure, E_{GROW} , is defined as the average annual growth rate in entrepreneurs. The rate of growth in entrepreneurs may be just as important to economic growth as the absolute number of entrepreneurs in the economy. Both E_{DEN} and E_{GROW} are posited to have a positive relationship with employment growth in U.S. counties.

The proprietor data has some limitations in regard to identifying new firms and attributing growth to new entrepreneurial start-ups. This is especially troubling for researchers that view new activity as core criteria for defining entrepreneurial activity. For example, Lugar and Koo (2005) indicate that the literature on start-ups uses three different criteria for entrepreneurs: new, active, and independent.

The relatively new Longitudinal Business Database (LBD) from the Census Bureau is used to develop entrepreneurship measures based on business starts.[7] The database is constructed from the Census Bureau's Business Register (SSEL), a proprietary list of businesses, which is also the basis for construction of the County Business Patterns (CBP) data. The LBD identifies private sector establishments with non-farm employees and contains FIPS code geographic identifiers that allow establishments to be matched to their county location. Employment, payroll

[6] E_{DEN} is the number of proprietors divided by total non-farm employment and is based on the entrepreneurial breadth measures used in Low, Henderson, and Weiler (2005). E_{DEN} is obtained for the 1980s to measure conditions prior to the 1991 to 2001 period and the decade average is used to mitigate the potential that a single year may be a short-term externality and not represent longer run conditions.

[7] Jarmin and Miranda (2002) provide a detailed description of the development of the Longitudinal Business Database (LBD).

and industry information are also included. The LBD covers a long time frame as data are available from 1976 to 2001.[8]

The most unique feature of the LBD is its longitudinal construction. Establishments are linked over time, even through ownership changes using a sophisticated matching procedure. In each year of appearance in the LBD, establishments are identified as either a birth, death, or continuer establishment. For example, in 1995, a birth is an establishment that was active in 1995, but not active in 1994. A death is an establishment that was active in 1994, but not active in 1995.[9] A continuer is an establishment that was active in both 1994 and 1995. Establishments that change ownership (sold to another owner) are not considered an establishment death. An establishment is only identified as a death when the activity of the establishment ceases to exist. Moreover, the LBD also provides information on the first and last year of inclusion in the database, allowing for an expedited analysis of establishment tenure.

The LBD provides establishment level data in two distinct data files. The first is a data file of single-unit establishments, firms with only one physical location conducting business. The second file contains multi-unit establishments, establishments owned by firms with many different locations. The analysis is limited to the single-unit establishment file as it is highly unlikely that a multi-unit establishment birth would represent a new firm birth. In fact, over ninety percent of multi-unit establishment births are new branch openings from existing establishments. Analysis of the multi-unit establishment births that were associated with new firm births revealed that many of these were actually due to the reorganization of ownership of

[8] As of July 2006, the LBD provided data from 1975 to 2001. Additional years of data are added each year. Acs and Armington (2004) used the Business Information Tracking System formerly known as the Longitudinal Establishment and Enterprise Microdata BITS/LEEM database that provided data from 1989 to 2001. See Jarmin and Miranda (2002) for a comparison of the LBD and the BITS/LEEM databases. See Armington (2004) for a description of the BITS/LEEM databased developed by the Small Business Administration.

[9] Similar to the BITS/LEEM database, the LBD does not identify all establishment births in a given year. The LBD only identifies firms that were in existence in the March. Thus establishments that were started after March and

an existing firm. The conversion of single-unit establishment firms to a multi-unit establishment firm also does not appear to be an issue as well. Less than one percent of single-unit establishment firms in any single year expanded to a multi-unit establishment firm

A potential drawback of the LBD is its exclusion of firms with no employees. Establishments with no payroll in a given year are dropped from the LBD. As a result, the economic impacts of firms without employees are omitted from the analysis. Once a firm hires an employee, however, the LBD identifies it as a firm birth. Additionally, instances where firms alternate between having no employees and having employees are accounted for by the LBD matching procedures.

With the ability to identify a new single-unit establishment/firm birth and its county location, the LBD data allows for the creation of various measures of rural entrepreneurial activity at the county level. The first measure of rural entrepreneurship measures the number of new business starts at the county level. Only establishments in private, non-farm sectors were included in the analysis. The data series, *BIRTH*, was constructed as the number of single-unit establishment births in a county.

While firm births are one important indicator of entrepreneurial activity, many new firm births fail. Thus, the number of firm births that survive past a certain threshold may be a more important measure of entrepreneurship's impact on economic growth than the number of firm births. The LBD data indicates that a third of single-unit establishment births from 1981 to 1996 survived five years, almost two-thirds survived two years, and three quarters survived one year. Thus, a second entrepreneurship indicator, *SURVIVE*, is the number of single-unit establishments that survived for five years after initial birth.[10] Five years was selected as the survival threshold

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closed before March of the following year would not be identified in the LBD database.

[10] Single-unit establishments that became part of a multi-unit establishment during the their first five years in

to ensure that a firm had the potential to be identified in a following economic census.[11]

Different types of entrepreneurs yield different benefits to their community and high-growth entrepreneurial businesses are often perceived as providing the largest economic value to communities (Henderson 2002).[12] Their enhanced value comes from providing more jobs, more income, more wealth and a larger tax base for their communities. To make some distinction between high-growth and other business starts, a third entrepreneurship indicator created out of the LBD data is the number of surviving firms that produced high-growth. In the variable, *HIGROWTH*, a surviving firm is identified as high-growth if employment at the firm grew and annualized fifteen percent per year over the first five years of operation as an employer firm and added at least 10 employees. The criteria for high-growth classification is patterned after the criteria used by the National Commission on Entrepreneurship (NCOE) to map high-growth companies across labor market areas (National, 2001). An interesting by-product of the fifteen percent annual growth criteria is that after 5 years employment levels at the firm would have doubled. One problem with the NCOE criteria is that firms with one employee would be considered high-growth if they doubled employment and achieved 15 percent growth per year by adding a single employee in five years. Thus, the criteria for high-growth used in this paper contain a minimum employment growth hurdle of at least 10 employees, which is approximately double the average employment growth for five years in new business starts.

At this stage, three different measures of entrepreneurship were created from the LBD

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operation were counted as a surviving firm.

[11] Jarmin and Miranda (2002) indicate that the coverage of single-unit and multi-unit breakouts decline after economic census years due to a spike in resources spent on enhancing the coverage of the Economic Census. As a result, the five year survival threshold increases the chance that the firms will be more accurately identified and characterized as single or mulit-unit establishments.

[12] Several entrepreneurship studies have recognized the variation in entrepreneurs and grouped entrepreneurs into different types to study entrepreneurship (Woo, Cooper, and Dunkelberg). Another stream of literature focuses on analyzed the characteristics of entrepreneurs and describing the relationship between these characteristics and firm start-up and success (Van de Ven, Hudson, and Schroeder; Low and MacMillan).

database. The number of new business starts, *BIRTH*, the number of new business starts that survived five years, *SURVIVE*, and the number of new business starts that survive and achieved high-growth, *HIGROWTH*, are used to measure the various dimensions of entrepreneurship growth. The sheer size of a county, in terms of population, will influence the number of business starts, surviving firms, and high-growth firms. As a result, these numbers are standardized by the county's labor force in each year following Acs and Armington (2004).[13]

Empirical Model and Data

To analyze the relationship between entrepreneurship and economic growth, a straight-forward reduced form model of county level employment growth was developed. Employment growth for U.S. counties was regressed against various characteristics of counties that are believed to influence economic growth. Equation 1 represents this reduced form equation,

$$EMP_{1991\text{-}2001} = f\,(\boldsymbol{E}, \boldsymbol{L}, \boldsymbol{I}, \boldsymbol{U}, T, \boldsymbol{A}) \qquad (1)$$

where $EMP_{1991\text{-}2001}$ is the county employment growth rate from 1991 to 2001 and $\boldsymbol{E}$, $\boldsymbol{L}$, $\boldsymbol{I}$, $\boldsymbol{U}$, T and $\boldsymbol{A}$ represent vectors of entrepreneurship, labor, infrastructure, agglomeration, taxes, and amenity characteristics in the county. The 1991 to 2001 time frame was selected because it encompasses the complete business cycle that starts with the recession of 1991 and ends with the recession of 2001. The model was applied to nearly all U.S. counties. Table 2 provides a description of the data used in the analysis.

Various county characteristics that impact firm costs and thus encourage business activity and employment growth are included as independent variables in the empirical model. The

[13] Acs and Armington (2004) indicate that labor force is a preferred measure of potential entrepreneurs than population or employment, because people in the labor force are actively seek employment, whether that is wage and salary employment or self-employment.

multiple measures of entrepreneurship will be included as independent variables to measure the impact of entrepreneurship on economic growth. Other variables measuring labor quality, infrastructure, agglomeration, natural amenities, and other community characteristics are included to control for other types of features of the local economic landscape that would influence employment growth. To avoid potential problems with simultaneity issues concerning the dependent and independent variables, independent variables will be constructed using data measuring the economic landscape prior to 1991, when possible.

Entrepreneurship: Counties with higher levels of entrepreneurial activity are expected to experience higher levels of entrepreneurial growth. The two measures of entrepreneurship based on proprietor data are based on levels in the 1980s. E_{DEN} is defined as the average share of non-farm employment in the county accounted for by non-farm proprietors during the 1980s. The second, E_{GROW} , is the average annual growth rate in entrepreneurs from 1980 to 1990. The three measures of entrepreneurship based on LBD data are also used to test this hypothesis. *BIRTH* is the average number of per capita new business starts from 1981 to 1991. *SURVIVE* is the average number of per capita new business starts from 1981 to 1991 that survived five years. *HIGROWTH* is the average number of per capita new business starts from 1981 to 1991 that produced high-growth during their first five years of operation. All entrepreneurship measures are expected to be positively related to the county level employment growth.

Transportation Infrastructure: The presence of various types of transportation infrastructure is expected to lower the average cost of production for firms and is expected to support employment growth. Access to national road and rail transportation systems allows firms to distribute finished products to customers or acquire inputs from suppliers in distant markets at a lower cost. Therefore, positive relationships are expected between the transportation

infrastructure measures that measure access to road and rail transportation systems. The density of interstate mileage in the county, *INTDEN*, is included in the empirical model to measure access to the national interstate road system. The density of railroad mileage, *RAILDEN*, measures access to the rail system.

Labor: Local labor characteristics influence the average cost of production for firms. The quality of the labor force also influences the average cost of production for firms. A higher skilled labor force is expected to be more efficient and reduce the costs of production. Thus, locations with higher quality should lead to higher rural employment growth. The percentage of the county's population that is 25 years or older with a high school diploma in 1980, *GRAD80*, measure the quality of labor force in the county.

Agglomeration: Employment growth has been found to be positively related to agglomeration forces that can reduce the search costs for knowledge and information (Henderson, Kuncoro, and Turner 1995). First, the presence of inter-related firms allows for easier communications and the potential for more knowledge spillovers that improve knowledge transfer, reduce the cost of acquiring knowledge, and facilitate knowledge creation, innovative activity, and economic growth (Glaeser et al. 1992). Second, agglomeration benefits the yield knowledge spillovers also arise from the general size and diversity of the community (Henderson, Kuncoro, and Turner). Areas with larger and more diverse economies result in larger knowledge pools. The small size of rural communities limits the overall knowledge pool available in the community, simply because of the lack of people. Yet, rural communities with larger and more diverse economies are expected to provide large pools of knowledge and be more supportive of knowledge-based activity. Remoteness is also thought to limit rural knowledge-based activity by limiting the ability of rural people to obtain knowledge that exists

in other communities. Rural businesses in remote locations must overcome a larger distance hurdle to tap into knowledge pools in more distant locations.

Multiple agglomeration measures were incorporate into the empirical model. The county's population density in 1980, *PopDen* is included as one measure of agglomeration. A dummy variable, *METRO*, identifying metropolitan counties in 1990 is used to identify areas with more agglomerated economic activity. To measure remoteness, the variable, *ADJACENT*, identifying counties adjacent to a metro area is included. All agglomeration measures are expected to be positively associated with employment growth.

Natural Amenities: Higher levels of natural amenities should lead to faster employment growth in rural areas, as natural amenities attract workers, firms, retirees, and tourists. The USDA provides six individual measures of natural amenities that cover two broad types – weather and geographic landscape amenities (McGranahan 1999). A composite weather index, *WEATHER*, that indicates places with temperate summers and warmer winters is developed by summing the standardized values of the winter and summer weather measures calculated by USDA using data from 1941 to 1970. Two measures of winter weather, the average January temperature and the number of hours of January sunlight, along with two measures of summer weather, the average July temperature and the average July relative humidity level are included in the index. A positive relationship between *WEATHER* and employment growth is expected.

In a similar fashion, a composite geographical landscape index, *GEOG*, is developed to indicate places with increased topographical variation and more water. *GEOG* is created by summing the standardized values of the topography and water measures provided by USDA. The percentage of the total acreage in the county covered by water and a scale measure of topographical variation are included in the index. Coastal settings, lake areas, and mountain

ranges are appealing natural amenities for most people and provide recreational activities for tourists and residents. A positive relationship between *GEOG* and employment growth is expected.[14]

Other characteristics: Public policies are used to alter the economic landscape for businesses. Financing the provision of local expenditures raises the costs of production for firms. The cost of government is measured by *Taxcap82*, property taxes per capita in 1982 and is expected to be negatively related to employment growth. Regional dummy variables were also included to account for regional characteristics that shape the cost of business activity which are not included in the empirical model.

Empirical Results

Multiple specifications of the model represented in equation 1 were used to analyze the relationship between the entrepreneurship measures and the employment growth. Initial analysis analyzed the entrepreneurship-employment growth relationship in all counties from 1991 to 2001. A second set of analysis tested whether the entrepreneurship-employment growth relationship varied by metropolitan/non-metropolitan status.

Two sets of models were estimated according to the type of entrepreneurship measure included in the model. The first model used the proprietor based measures of entrepreneurship. The second set used the business start measures from the LBD. The models were estimated in STATA using a robust error estimator to control for heteroskedaticity as indicated by specification tests. Multi-collinearity across independent variable was not found to be an issue as variance inflation factors were all below 2.0. The estimated models controlled for spatial

[14] Henderson and McDaniel (2005) use found a positive relationship between these natural amenity measures and rural employment growth from 1990 and 1997.

autocorrelation following Rappaport (2003).[15]

Proprietor-based Measures

Most of the variables used to control for the impacts of transportation infrastructure, labor, agglomeration, natural amenities and other community characteristics were significant with the expected hypothesized signs. The quality of the labor force, measured by college graduation attainment, was found to be positively associated with employment growth. Agglomeration factors were significantly related to rural employment growth as metropolitan counties and counties adjacent to metropolitan areas had higher levels of employment growth. The presence of natural amenities – warm winters, temperate summers, topographic variation and water access – were found to be related to higher employment growth. Transportation infrastructure was significantly related to employment growth. While counties closer to an interstate on-ramp had stronger employment growth, counties with greater railroad density had slower growth, contrary to expectations. The negative relationship between railroad density and growth may be due to its link to "old", "heavy", goods-producing industries such as mining and manufacturing that produced slower growth than other "light", service-producing industries. Finally, rural counties with higher taxes had lower employment growth.

The empirical models using the proprietor-based entrepreneurship measures clearly

[15] Rappaport (2003) used a generalization of the Huber-White heteroskedastic-consistent estimator to report standard errors to account for spatial autocorrelation among disturbance terms. The following declining weighting function for estimating the covariance between disturbances is imposed on counties with a Euclidean distance less than 100 kilometers between county centers, where s_{ij} is the estimate of σ_{ij} and u_i is the regression residual.

$$S_{i,j} = g(distance_{i,j})\, u_i u_j \quad \text{where}$$

$$g(distance_{i,j}) \begin{cases} = 1 & : distance_{i,j} = 0 \\ = 1 - \left(\dfrac{\text{distance}_{i,j}}{100}\right)^2 & : 0 < distance_{i,j} \leq 100 \text{ km} \\ = 0 & : distance_{i,j} > 100 \text{ km} \end{cases}$$

indicate that entrepreneurial activity is positively related to employment growth at the county level (Table 1).[16] Both E_{DEN} and E_{GROW} were positive and significant at the 0.01 level. The existence of a large number of entrepreneurs appears to be important to employment growth as counties with larger entrepreneurial densities in the 1980s enjoyed higher employment growth from 1991 to 2001. Entrepreneurial dynamism also appears to be important as proprietor growth during the 1980s was positively associated with employment growth from 1991 to 2001.

While entrepreneurial activity was associated with strong employment growth in all U.S. counties, is the relationship between entrepreneurship and economic growth different in rural counties than in metro counties? Many economists believe that entrepreneurship is influenced by the level of agglomeration. For example, innovations associated with radical patents are more likely to emerge in larger cities and emerge less frequently in place distance from metro areas (O'hUallachain 1999, Anselin, Varga, and Acs 1997; Audretsch and Feldman 1996; Jaffe, Trajtenberg, and Henderson 1993; Verba, Orlando, and Weiler 2005). Regions with more agglomeration economies appear to spur more innovation and also are more supportive of entrepreneurial development. One explanation for this linkage is that agglomeration makes it easier to share information across firms, workers, and public officials. This has the effect of reducing costs, especially transaction costs associated with product development (Wood and Paar 2005; Glaeser 2000). Moreover, larger, more agglomerated cities provide a bigger local market in which to sell new products (Schmookler 1966). For the budding field of research on the links between entrepreneurship and regional growth, therefore, one implication is that the benefits of entrepreneurial activity may be *greater* in agglomerated economies.

[16] The empirical analysis does not test for a causal relationship between entrepreneurial activity and employment growth. As a result, the empirical findings can only suggest that a causal relationship may be present because the high levels of entrepreneurship growth and employment growth may be jointly determined by some other unobserved factor.

Table 1: Empirical Results Using Proprietor Measures

	Model 1		Model 2	
Variables	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**
E_{DEN}	0.078**	0.008	0.0635**	0.007
E_{GROW}	0.158**	0.020	0.128**	0.018
$METE_{DEN}$			0.078**	0.015
$METE_{GROW}$			0.0893**	0.042
METRO	0.777**	0.097	-0.009**	0.003
ADJACENT	0.35**	0.084	0.369**	0.077
POP_{DEN80}	0.0003	0.0013	0.0002	0.0013
GRAD	0.064**	0.007	0.065**	0.007
TAX	-1.398**	0.192	-1.318**	0.170
ROAD	4.046**	1.389	3.545	2.525
RAIL	-0.005*	0.003	-0.00012	0.0029
WEATHER	0.085**	0.031	0.0968**	0.0279
GEOG	0.095**	0.030	0.1084**	0.0266
REGION1	-0.036	0.260	0.06829	0.2095
REGION2	-0.049	0.229	0.0378	0.1865
REGION3	0.988**	0.257	1.080**	0.212
REGION4	0.743**	0.235	0.828**	0.1985
REGION5	0.713**	0.225	0.751**	0.1837
REGION6	0.423**	0.206	0.474**	0.175
REGION7	1.342**	0.251	1.407**	0.215
Constant	-1.615**	0.323	-1.381**	0.289
R-square	0.2984		0.3140	
Observations	3035		3035	

** Significant at the 0.01 level. *Significant at the 0.05 level.

In fact, the benefits of entrepreneurship are found to be bigger in agglomerated economies. Two interaction variables were added to the base model (Model 1) to test the hypothesis that entrepreneurship has a bigger impact on economic growth in agglomerated economies. Interaction variables, $METE_{GROW}$ and $METE_{DEN}$, were created by multiplying entrepreneurship growth and density at the county level by the dummy variable identifying metropolitan counties. In Model 2, both $METE_{GROW}$ and $ADJE_{GROW}$ were found to be positively related to wage and salary employment growth, suggesting that the benefits of entrepreneurship

are stronger in metropolitan and adjacent counties, counties with more agglomeration (Table 1).

Business Start Measures

The empirical models using the business start measures of entrepreneurship also indicate that entrepreneurial activity is positively and significantly related to rural employment growth (Table 2). In Model 3, the coefficient on *BIRTH*, the number of start-up firms per capita was positive and significant. In Model 4, the coefficient on *SURVIVE*, the number of per capita start-up firms that survived five years, was positive and significant. In Model 5, the coefficient on *HIGROW*, the number of per capita start-up firms that produced high levels of growth, was also positive and significant.

When all three entrepreneurial measures were included in the regression, only the coefficient on *HIGROW* was positive and significant. The coefficients on *BIRTH* and *SURVIVE* became negative and insignificant and the variance inflation factors surged well above 2.0 suggesting a high correlation between these two variables. The correlation between *BIRTH* and *SURVIVE* was 0.92. Therefore Model 6 includes only *BIRTH* and *HIGROW*. In this model, the coefficients on *BIRTH* and *HIGROW* were both positive, but only the *HIGROW* coefficient was significant at the 0.01 level, suggesting that the ability to foster the creation of high growth businesses is more important to employment growth at the county level.[17]

One of the unique features of this article is the use of gross firm start-ups in the empirical analysis. However, gross start-ups do not account for establishment deaths. As a result, a per capita measure of firm deaths is included in Model 7. The results from this model reveal that the coefficient on gross firm deaths is positive and significant.

[17] Similar regression analysis was also performed on a data set for only rural (non-metropolitan) counties. The results, variable signs and significance, from the analysis including only rural counties were strikingly similar to the results presented in Table 1 that included all US counties.

Table 2: Empirical Results

Variables	Model 3	Model 4	Model 5	Model 6	Model 7
BIRTH	1.048**			0.444**	
	(0.293)			(0.289)	
SURVIVE		1.153**			
		(0.474)			
HIGROW			37.007**	34.134**	
			(4.447)	(4.679)	
DEATH					1.154**
					(0.316)
METRO	1.291**	1.239**	1.146**	1.210**	1.278**
	(0.148)	(0.146)	(0.134)	(0.144)	(0.144)
ADJACENT	0.596**	0.566**	0.560**	0.592**	0.582**
	(0.097)	(0.095)	(0.092)	(0.096)	(0.098)
POP_{DEN80}	0.307*	0.314*	0.377**	0.366**	0.312*
	(0.174)	(0.177)	(0.180)	(0.179)	(0.176)
GRAD	4.993**	5.284**	2.641**	2.619**	5.064**
	(0.918)	(0.932)	(1.011)	(1.006)	(0.889)
TAX	-1.191**	-1.146**	-0.951**	-1.040**	-1.057**
	(0.325)	(0.312)	(0.274)	(0.313)	(0.292)
ROAD	3.945**	3.815**	2.910**	3.147**	3.728**
	(1.507)	(1.536)	(1.390)	(1.389)	(1.485)
RAIL	-0.025**	-0.025**	-0.029**	-0.028**	-0.027**
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
WEATHER	0.104**	0.122**	0.087**	0.078**	0.107**
	(0.037)	(0.037)	(0.037)	(0.038)	(0.036)
GEOG	0.184**	0.189**	0.121**	0.128**	0.164**
	(0.035)	(0.036)	(0.035)	(0.035)	(0.036)
REGION1	0.299	0.330	0.216	0.211	0.316
	(0.294)	(0.305)	(0.289)	(0.282)	(0.300)
REGION2	0.301	0.279	0.217	0.250	0.292
	(0.249)	(0.249)	(0.243)	(0.245)	(0.251)
REGION3	1.301**	1.284**	1.120**	1.164**	1.253**
	(0.271)	(0.272)	(0.272)	(0.273)	(0.272)
REGION4	1.006**	1.041**	1.062**	1.034**	1.029**
	(0.243)	(0.247)	(0.247)	(0.244)	(0.245)
REGION5	0.883**	0.885**	0.769**	0.807**	0.848**
	(0.237)	(0.239)	(0.234)	(0.235)	(0.238)
REGION6	0.926**	0.963**	0.993**	0.991**	0.901**
	(0.220)	(0.224)	(0.217)	(0.215)	(0.222)
REGION7	1.565**	1.606**	1.641**	1.615**	1.565**
	(0.281)	(0.285)	(0.282)	(0.280)	(0.276)
CONSTANT	-0.472*	-0.247	-0.352	-0.567**	-0.418**
	(0.282)	(0.269)	(0.237)	(0.270)	(0.281)
Adjusted R-square	0.1793	0.1691	0.1989	0.2002	0.1710
Observations	3065	3065	3065	3065	3065

** Significant at the 0.01 level. * Significant at the 0.05 level.
Data in parentheses are standard errors

Entrepreneurship Across Metro and Non-metro Status

While rural (non-metropolitan) counties appear to be generating new firm births at a faster rate than their metropolitan counterparts, metro counties are generating more high-growth businesses than rural counties (Table 3). From 1976 to 2001, the average number of single-unit establishment births per 100 people was 0.473 in metropolitan counties and 0.606 in non-metropolitan counties based on the 1990 metropolitan county definitions. In contrast, the average number of business starts per 100 people that grew 15 percent annually in their first five years was 0.027 in metropolitan counties and 0.022 in non-metropolitan counties.

Table 3: Single-Unit Establishments by Metropolitan Status
(Average starts per 100 people in the county's labor force)

	1976-2001	1976-1991	1991-2001
Metropolitan Counties			
Business Starts	0.478	0.506	0.435
Surviving 5 years	0.264	0.251	0.280
High-growth in first 5 years	0.027	0.027	0.030
Non-metropolitan Counties			
Business Starts	0.610	0.629	0.590
Surviving 5 years	0.344	0.322	0.380
High-growth in first 5 years	0.022	0.022	0.023

In fact, the benefits of entrepreneurship are found to be bigger in agglomerated economies. Empirical models using the business start measures of entrepreneurship were re-estimated with an interaction term between the various entrepreneurship measures and a metro dummy variable to test if the coefficient associated with the entrepreneurship indicators were significantly different between rural and metro counties. The model results are presented in Table 4. The empirical results reveal that in Models 8 and 11 the relationship between business

starts and employment growth was stronger in metropolitan counties. [18] Moreover, in Model 9, the relationship between new business starts that survived five years and employment growth was also stronger in metropolitan counties. However, the relationship between high-growth business starts and employment growth was not significantly different between metropolitan and non-metropolitan counties. Thus, at the margin, the ability to support new business start-ups appears to provide larger employment benefits in metropolitan areas. However, rural areas appear to enjoy similar benefits as metropolitan areas with the creation of high-growth firms.

Table 3: Empirical Results

Variables	**Model 8**	**Model 9**	**Model 10**	**Model 11**
BIRTH	0.881**			0.365
	(0.297)			(0.294)
SURVIVE		0.925**		
		(0.475)		
HIGROW			35.681**	33.381**
			(4.553)	(4.771)
Metro Interaction Variables				
BIRTH	1.832**			1.457*
	(0.627)			(0.816)
SURVIVE		4.039**		
		(1.299)		
HIGROW			9.533	-9.850
			(9.490)	(12.780)
Adjusted R-square	0.1784	0.1733	0.1990	0.2010
Observations	3065	3065	3065	3065

** Significant at the 0.01 level. * Significant at the 0.05 level.
Data in parentheses are standard errors

[18]The results are consistent when the 2003 metropolitan definitions are used in the descriptive analysis.

Conclusions and Future Research

Research has shown that entrepreneurship is an increasingly important factor in the economic growth in the U.S. and across the globe. However, analysis of the impact of entrepreneurship on rural economic growth is limited. One primary reason is the lack of data on entrepreneurial activity. This paper used both publicly and privately available data on proprietors to measure entrepreneurship. By accessing the Longitudinal Business Database (LBD), a proprietary establishment level database from Census Bureau data, this paper also uses a unique data set to measure entrepreneurial activity and its relationship to employment growth in rural places.

The results using both data sets demonstrate that entrepreneurship is related to employment growth in all counties, metropolitan and rural. Counties that have more entrepreneurs per capita and stronger proprietor growth had higher levels of employment growth. Not only is the fostering of new business starts related to rural employment growth, but how fast these firms grow after initial start-up is also important.

The benefits of entrepreneurship appear to vary by metro and non-metropolitan status of the county. Metropolitan areas appear to reap larger benefits from proprietor growth and new business starts than rural areas. However, the benefits to stimulating high-growth businesses appear to be the same across metropolitan and rural areas. Traditionally, entrepreneurship has not played the lead role in traditional economic development policy (Leicht and Jenkins, 1994). However that trend is beginning to change. Empirical results in this paper suggest that a renewed focus on entrepreneurship might be beneficial.

The empirical results indicate that to increase the understanding of rural economic growth, researchers could extend their analysis of rural entrepreneurship by analyzing the factors

supporting entrepreneurship development in rural places. Insight into what types of people become entrepreneurs, where they tend to start businesses, how they start firms, and in what types of industries these firms evolve would help policy makers and economic development officials build strategies and programs to support the development of rural entrepreneurs and ultimately rural growth.

Yet, the biggest limitation to rural entrepreneurial research is the lack of data on entrepreneurs at the county level. While proprietary establishment level data at the Census Bureau provides an opportunity for investigations into rural entrepreneurship, the creation and distribution of publicly available county level data on business starts and deaths could stimulate new research on entrepreneurship. The creation of a data set on business starts and deaths similar to County Business Patterns could potentially fuel the next generation of entrepreneurial research. While the LBD provides information on establishments with employees, similar data on establishments without employees is also needed.

Due to its strong relationship with economic growth, entrepreneurship is a key determinant of economic growth at many different economic levels. As rural communities search for new engines of growth, entrepreneurs will be a mechanism that transforms opportunity into prosperity. Counties with more entrepreneurs that start firms producing high-growth have faster employment growth. As counties, especially rural counties, aim to rejuvenate their economies, additional insight into the process of growing more entrepreneurs and building stronger firms is needed. Development of new county-level data on business starts and deaths would be a starting point in the process to building additional insight into entrepreneurship.

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