Determinants of Growth in Entrepreneurship Across U.S. Labor Market Areas, 1970–2006

by

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Executive Summary

This study explores the factors important in determining growth in the number of entrepreneurs and the entrepreneurial share of total employment across regions, time, and by groups based on age, gender, and industry.[1] The variation among regions has important implications for regional development. As Audretsch and Keilbach (2005), Shrestha et al. (2007), and Camp (2005) have suggested, entrepreneurs play a crucial role in facilitating "knowledge spillovers" in local economies, by bringing new ideas (sometimes generated in large firms that decide not to pursue them) to the market. These new ideas potentially benefit all firms in the community. Further, Acs and Armington (2005) have found that more entrepreneurial regions exhibit faster employment growth.

This paper explores the trends and examines the factors determining growth in entrepreneurship within labor market areas (LMAs) in terms of the number of entrepreneurs and their share of LMA employment in the United States over three and a half decades from 1970 to 2006. We explore regional differences in entrepreneurship across U.S. LMAs and we also examine the determinants of entrepreneurship in specific demographic and industry subgroups from 2000 to 2006.

Using proprietorship data from the U.S. Bureau of Economic Analysis (BEA) and self-employment data from the U.S. Census Bureau Public Use Micro Sample (PUMS) to measure entrepreneurship in LMAs, we test three specific research hypotheses.[2] These are: 1) higher levels of human capital in a local LMA are likely to be associated with higher growth in the number and share of entrepreneurs in that LMA, 2) the impact of human capital on growth in entrepreneurship within LMAs differs over time and across metropolitan and nonmetropolitan LMAs, and 3) Higher levels of human capital in local LMAs are associated with higher growth in the proportion of entrepreneurs within specific gender, age, and high-technology industry subgroups in LMAs (2000–2006).

Using data from BEA, we find evidence of substantial change (growth or decline) in the proportion of proprietorships in all LMAs. There is only limited evidence that proprietorship shares are becoming more similar across LMAs. While proprietorship shares are much higher in nonmetropolitan LMAs than their metropolitan counterparts, these shares have risen faster in metropolitan than nonmetropolitan LMAs during the past 36 years. The result is that the average proprietorship share of metropolitan LMAs is much closer to that of nonmetropolitan LMAs in 2006 than it was in 1970. In addition, we find relatively high proprietorship shares in LMAs in the West Census region and relatively

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[2] Other researchers have used these data sets as a reasonable proxy for entrepreneurship.

low shares in the Midwest. We note particularly strong proprietorship share growth in LMAs in the Northeast Census region.

In addition, we find that proprietorship shares tend to vary (measured by the standard deviation) more across nonmetropolitan LMAs than across metropolitan LMAs and there is little evidence that this difference in variation has been changing over time. This suggests that growth in the share of entrepreneurs in an LMA is more likely to be driven by regional characteristics than by a long-term trend toward national convergence in the proportion of proprietorships within LMAs.

Our multivariate regression results using BEA data, suggest that natural amenities, wealth, and lower initial unemployment contribute to growth in the number of entrepreneurs and the entrepreneurial share within LMAs. These regressions also suggest support for the first hypothesis that higher levels of education are associated with faster growth in the number of proprietors in an LMA. However, we find somewhat less evidence that human capital contributes to growth in the proportion of proprietors in an LMA. This suggests that education contributes to the growth of the total work force, i.e., both proprietorships and wage-and-salary workers within LMAs.

Regarding the second hypothesis, we find evidence that the impact of human capital on growth in the number of proprietors and shares differs across time periods and across metropolitan and nonmetropolitan LMAs. We find evidence indicating that human capital has a positive impact in the more recent time periods (especially the 1990s). We also find evidence that while human capital contributes more to growth in the number of proprietors in nonmetropolitan LMAs than their metropolitan counterparts, human capital contributes more to growth in the proprietorship share within metropolitan than nonmetropolitan LMAs.

Regression results are less clear, however, when using alternative measures of human capital. The impact on entrepreneurship measures of local spending on education and the presence of universities within an LMA varies across time periods and across metropolitan/nonmetropolitan LMAs. We note that the impact of universities on growth in the number of proprietorships is positive and significant in the most recent period, and that this impact is most often significant in nonmetropolitan LMAs.

To address hypothesis three, we disaggregate self-employment measures along several dimensions, including gender, age group, and industry, using PUMS. We focus on 942 PUMS-county regions in the contiguous U.S. states, available for the 2000–2006 period. The PUMS data suggest that growth in the number and share of self-employed was strong during the 2000–2006 period, outpacing wage-and-salary employment growth. We also note that this self-employment growth was stronger for women than for men, that growth in the 45-64 age group outpaced growth in the age 20–44 group, and

that this growth was much faster in professional and business services than for health care, both high-tech sectors.

Our regression results suggest a positive role for education in stimulating the growth in the number of self-employed in a region, particularly for the self-employed age 45-64, and for the self-employed in the health care industry. Results, however, vary depending on the measures of human capital used in the analysis. Overall, the results suggest that there might be a role for policies to expand education opportunities in order to promote entrepreneurial activities, and therefore, economic growth.

Importantly, our analysis highlights key differences in the two data sources (BEA and Census) used in the analysis. Specifically, each data source measures entrepreneurship and geographic regions differently. While BEA data defines LMAs as a geographic economic unit in terms of commuting patterns, the PUMS data does not permit as precise a definition of an LMA and might include parts of one or multiple LMAs. Regression techniques are used to adjust for regional spillovers in the PUMS data to make a Census multi-county region more comparable to BEA's definition of an LMA. Second, the two data sources differ significantly in the measurement of nonfarm self-employment. These differences result in widely different numbers of nonfarm self-employed and the self-employment share as well as changes in these measures over time.

1. Introduction

A handful of studies have examined the factors correlated with growth of entrepreneurs across geographic regions (in their number or share). However, little is known about how the relative importance of these factors changes over time, across regions, and by sub-groups based on age, gender, and industry. Our analysis contributes to this literature by examining the relative effects of factors, including higher education, on growth in the number of entrepreneurs and the share of entrepreneurial activity, measured as the proportion of regional employment attributable to entrepreneurs. This research is of increasing policy importance as small businesses, which are often associated with entrepreneurship, are expected to play a key role in economic recovery (Headd, 2009).

Recent research (Audretsch and Keilbach, 2005; Shrestha et al., 2007; and Camp, 2005) has explored the relationship between entrepreneurship and local economic growth, with entrepreneurs playing a crucial role in facilitating "knowledge spillovers" in local economies.[3] Initial results from this research suggest that greater concentrations of entrepreneurs in a local economy may generate stronger local economic growth. Other factors related to this growth include industry mix, race, geography, amenities, taxes, human capital, private physical capital investment, public capital investment and sometimes social capital. This research, in turn, points to the development of local entrepreneurship as an important economic development policy consideration.

In any study of entrepreneurship, the first challenge is deciding how to measure entrepreneurial activity. Entrepreneurship as a concept cannot actually be directly measured; nearly every individual has some element of the entrepreneurial spirit within. Like all earlier studies, then, we must resort to a measurable proxy for entrepreneurship. We follow much of the literature and measure entrepreneurship as self-employment. Henceforth, our use of the terms "entrepreneur," "entrepreneurship," and "entrepreneurial activity" refer to this more limited but measurable concept.

The variation in regional growth of entrepreneurship shares as a proportion of total employment has important implications for regional development. Differences in the number and share of entrepreneurs across regions will tend to cause different regional economic growth rates. These differences could contribute to convergence of regional economic conditions or could cause more inequality in regional economic outcomes. If high concentration regions tend to add entrepreneurs at a higher rate than low concentration regions, the distribution of entrepreneurship (measured in terms of the self-employment or proprietorship rate) among regions will become less equal over time as entrepreneurial concentration levels increase in these regions relative to low concentration regions.

[3] Knowledge spillover is the exchange of ideas among individuals.

Likewise, if low concentration regions tend to add entrepreneurs at a higher rate than high concentration regions, the distribution of entrepreneurship will become more equal over time. If entrepreneurship concentration affects regional growth, these trends can have wide ranging policy implications. Thus, investigations into the determinants of growth in regional entrepreneurship concentration are particularly important for selecting amongst policy alternatives. For example, one policy might increase entrepreneurship shares across all regions equally but do little to change interregional inequalities while another policy might increase entrepreneurial shares by more in regions of low economic growth, which might lead to more equal regional economic outcomes.

Research on individual characteristics suggests that a number of factors influence the decision to become an entrepreneur, i.e., self-employed. These include education, prior military service, wealth, race, age, and metropolitan versus nonmetropolitan residence. Thus, human capital turns up as an important determinant of the individual decision to pursue entrepreneurship or self-employment. This suggests that regions with relatively highly educated residents should have relatively large concentrations of entrepreneurs.

In this research, we contribute to the literature on entrepreneurs in local labor markets in the United States. Our approach adds to the literature by focusing on various measures of human capital, including the presence of college and universities and local government education expenditures per capita, while controlling for other important regional characteristics suggested by the literature. We examine these determinants of the growth of entrepreneurship concentration during the 1970–2006 period, as well as during each of the sub-periods defined by decades (1970–1980, 1980–1990, 1990–2000, and 2000–2006). In addition, we summarize overall trends in the number of entrepreneurs and the entrepreneurial share across metropolitan and nonmetropolitan labor markets. Finally, we separate entrepreneurs into important subgroups (by gender, age, and selected industry) and seek to understand the relation of human capital and other factors to self-employment within each subgroup during the 2000–2006 period.

The paper proceeds as follows: Section 2 details the background and literature for our study. Section 3 summarizes our data and empirical approach, Section 4 provides the results and Section 5 presents conclusions.

2. Background and Literature

Within the United States, there are well established literatures examining the factors related to economic growth at the state and metropolitan levels. In addition, there is a growing literature examining growth on a more complete (and sometimes more disaggregated) scale, so that nonmetropolitan regions

(or counties) are included in the analysis as well. Studies using a comprehensive set of regions, such as Hammond and Thompson (2006, 2008), Hammond (2006), Higgins, et al. (2006), Hammond (2004), Henry et al. (2004), Huang et al. (2002), Rupasingha et al. (2002), Beeson et al. (2001), Nissan and Carter (1999), and Carlino and Mills (1987), explore the issue of growth in metropolitan and nonmetropolitan regions, and find that a number of key factors are associated with regional growth. This list often includes industry mix, race, geography, amenities, taxes, private physical capital investment, public capital investment and sometimes social capital. In addition, human capital often appears as an important source of regional growth, and sometimes as the most important driver of growth.

Further, the impact of entrepreneurship on regional growth has recently begun to attract attention. This emerging literature characterizes entrepreneurship as a link between knowledge creation at the firm level and "knowledge spillovers" that generate economic growth at the city or LMA level (Audretsch 2007). Thus, regions with higher levels of entrepreneurship (specifically, "entrepreneurship capital") tend to grow at higher rates, even after controlling for levels of private physical capital (plant and equipment), public capital (highways, roads, water, sewer), and human capital (education). Evidence of the positive influence of entrepreneurship capital on local economic growth has been identified in several papers so far, including Audretsch and Keilbach (2005), Shrestha et al. (2007), and Camp (2005).

Human capital, defined by various education measures, has been shown to be an important factor driving local economic growth, both for metropolitan and for nonmetropolitan labor market areas (LMAs). For metropolitan areas, Shapiro (2006), Berry and Glaeser (2005), and Moretti (2004) find a positive correlation between the concentration of college-educated residents and subsequent economic growth. Similar results have been obtained for nonmetropolitan counties by Higgins et al. (2006) and nonmetropolitan LMAs by Hammond and Thompson (2008), although the impact of human capital on economic growth appears weaker in nonmetropolitan regions. Each of these studies attempts to control for endogeneity between economic growth and educational attainment by accounting for regional generation of human capital, generally by including an indicator of the number or concentration of higher education institutions in the region or by including a measure of local government education expenditures per capita (see also Hammond and Thompson, 2004).

Human capital has also been identified as an important factor affecting individual entrepreneurship decisions, including the decision to pursue self-employment. Weaver, Dickson, and Solomon (2006) survey the literature on the link between education and entrepreneurship and conclude that: "An individual's educational level is positively associated with the probability of selection into entrepreneurship (or self-employment)." Further, a more recent study by Moutray (2007) surveys a large literature linking education to entrepreneurship and presents empirical evidence supporting this link from the Panel Study of Income Dynamics. In particular, he finds that the probability of self-employment is 4.4

percent greater for heads of household with a bachelor's degree and 8.3 percent greater for those with graduate experience. There appears to be ample evidence that an individual's education has a significant impact on entrepreneurship. Further, there is evidence that college-attainment has a particularly large impact. Finally, he finds strong evidence of a link between military service and entrepreneurship.

A related issue that has received less attention to date is the connection between human capital accumulation and the concentration of entrepreneurs (or the self-employed) in local labor markets. Georgellis and Wall (2000) examine some of the sources of regional differences in entrepreneurship in ten geographic regions in the U.K. They regress regional entrepreneurship shares, measured as self-employment shares, on socio-economic variables, also measured at the regional level, using a panel from 1983-1993. They find that regional characteristics like unemployment rates, average wage rates, gender, industry, and region affect the self-employment share in a region. They also find that education level (A-level qualification or better, roughly equivalent to high school or better in the United States) is significantly correlated with entrepreneurship, although the signs on the coefficients of these variables are unexpectedly negative, i.e., an increase in one variable is associated with a decrease in the other. That is, areas with the least educated populations were found to have the highest shares of self-employment while the areas with the most educated populations and areas, where more individuals have A-level education, have the lowest shares of self-employment. This is perhaps not entirely unexpected as those areas with the lowest education levels are likely to have the fewest opportunities in the wage-and-salary sector and those with the most education might face earnings ceilings in the wage-and-salary sector. Thus, the least and most educated might experience the greatest gains from entrepreneurship relative to those areas with medium education levels.

Acs and Armington (2005) use the Business Information Tracking Series to analyze firm formation (net new firms relative to the labor force) and employment growth across 394 local LMAs, defined by Tolbert and Sizer (1996) using 1990 Census county commuting patterns. They examine the relative contribution of high school and college attainment to firm formation rates during the 1988-2001 period. They find that high school attainment makes a more significant contribution to firm formation rates than college attainment during the period, but overall their results are supportive of the positive impact of education on entrepreneurship.

Low, Henderson, and Weiler (2005) examine variation in entrepreneurship across U.S. counties. They examine both self-employment income and self-employment shares across metropolitan and nonmetropolitan counties. They find that college attainment tends to be positively correlated with self-employment income, but not with self-employment shares. This suggests that skills and knowledge acquired in college improved one's ability to operate a business but that college attainment did not affect

the decision to become self-employed in the first place. That is, the self-employed would have chosen to start their own business regardless of whether they attended college or not.

Goetz (2006) examines county-level drivers of entrepreneurship development in 2004. This analysis identifies correlations between numerous county-level socio-economic characteristics in 2000 and the nonfarm proprietors' share of nonfarm employment in 2004, using spatial econometric methods. With respect to human capital, the research identifies a positive correlation between the share of the population with at least a college degree and the nonfarm proprietors' share of nonfarm employment, although after controlling for college attainment, there is little variance in this employment explained by the presence of an institution of higher education. This possibly suggests that institutions of higher education generally provide benefits to the individuals receiving degrees but do not create benefits in terms of self-employment activity to the larger community.

Goetz and Rupasingha (2009) examine factors influencing the growth in proprietorship share over the 1990–2000 period. Utilizing county data, the authors examine the influence of educational attainment; demographic characteristics including age, ethnicity; and regional characteristics such as income level, housing values, and unemployment rates. The research identifies a positive and significant correlation between the share of the population with a high school education and growth in entrepreneurship share. However, no correlation was identified between the share of the population with a college education and growth in entrepreneurship share.

Our analysis contributes to the understanding of the determinants of growth in entrepreneurship concentration as measured by the self-employment or proprietorship share of total employment, especially the impact of human capital on entrepreneurship at the local labor market level. For comparison, we also examine whether the factors that affect growth in the relative share of entrepreneurship also affect growth in the number of entrepreneurs. If the factors that increase the number of entrepreneurs also proportionately increase the number of wage-and-salary employees, each share within the total labor market employment would not change. Analysis of growth in the number of entrepreneurs will identify factors associated with change in the number of entrepreneurial ventures while the analysis of growth in entrepreneurial shares will identify factors that have a greater effect on the proportional change of entrepreneurs relative to wage-and-salary workers.

We examine the changes in the self-employment and proprietorship shares across labor markets in the United States. We first address trends in regional entrepreneurship during the 1970–2006 period (and sub-periods), expanding the previous literature by examining dynamic issues of growth and change over a long period of time (1970–2006). Further, we employ a regression model to examine those factors which previous research suggest are likely to affect the number and share of entrepreneurs, with special

attention paid to the role of higher education. We also focus on differences across metropolitan and nonmetropolitan labor markets, which Hammond and Thompson (2008) suggest may be important in this context, as well as for differences across types of entrepreneurs (gender, age, industry).

3. Data, Trends, and Multivariate Methodology

The analysis relies on data from two Department of Commerce data sources: the Regional Economic Information System of the Bureau of Economic Analysis (BEA) and the Public Use Microsample from the Bureau of Census. The first data source allows us to conduct a long run analysis of aggregate trends in the evolution of entrepreneurship concentration, measured by proprietorship shares, over time. Census's microsample allows us to conduct an analysis of the recent change in entrepreneurship concentration, measured by self-employment shares, based on disaggregated categories such as age, gender, or industry. We also examine factors that affect change in the number, or level, of entrepreneurs using both data sets.

The analysis consists of an examination of basic trends in entrepreneurship shares, regression analysis of growth in entrepreneurship and entrepreneurship shares in long run data, and regression analysis of subgroups in order to address three main hypotheses:

1) Higher levels of human capital (based on measures of education) in a local labor market are associated with higher growth in entrepreneurship numbers and shares (i.e., self-employment or proprietorship shares) over time and in both metropolitan and nonmetropolitan regions.

2) Human capital has different impacts on growth in entrepreneurial numbers and shares across time periods and across metropolitan and nonmetropolitan regions. Thus, we expect the coefficients on our measures of human capital to differ in magnitude and significance across time periods and across metropolitan and nonmetropolitan regions

3) Higher levels of human capital in local LMAs are associated with higher growth in the proportion of entrepreneurs within specific gender, age, and high-technology industry subgroups in LMAs during the 2000 to 2006 period.[4]

[4] As indicated earlier, to address hypothesis 3, we disaggregate self-employment measures along several dimensions, including gender, age group, and industry, using PUMS. We focus on 942 PUMS-county regions in the contiguous U.S. states, available for the 2000–2006 period.

A. Comparability of Data Sets

Ideally, the results for nonfarm self-employment from the PUMS and BEA data would be directly comparable.[5] However, an analysis of overall self-employment levels and growth rates indicates that the data sets clearly contain different measures of self-employment; for the reasons detailed in this section these differences are likely to be increasing over time. For example, the number of non-farm self-employed in the United States was 25.5 million in 2000 according to the BEA measure and 15.8 million according to PUMS estimates. The gap is even larger for more recent years; in 2000, the PUMS measure was 61.8 percent of the BEA total and by 2006, PUMS represented 56.3 percent of the BEA total indicating that growth rates for the two self-employment measures were substantially different. Between 2000 and 2006 the BEA measure increased by 26.3 percent while the PUMS measure increased by 15.6 percent.

Three important differences in the construction of the BEA and PUMS self-employment numbers are likely to account for most of the difference. First, the BEA data counts jobs, not workers as in the case of the PUMS data, and includes primary and secondary jobs. For example, an individual who is primarily employed in the wage-and-salary sector but operates two small businesses part-time (one sole proprietorship—IRS form 1040, and one partnership—IRS form 1065) would be counted three times in the BEA data, once for the wage-and-salary job and twice for nonfarm self-employment. Conversely, the same individual in the PUMS data would be counted only as a wage-and-salary worker as PUMS data are based on the individual's primary employment.

Second, BEA data include sole proprietorships and partnerships (excluding limited partners) based on administrative tax return data. The PUMS data used for this analysis define self-employment based on whether the individual reports working for themselves or for someone else. The PUMS measure includes all business forms including incorporated businesses. The relatively recent increase in the growth of partnerships might be driving the divergence in the BEA and PUMS measures. Based on data from the Internal Revenue Service (IRS), Statistics of Income Division (SOI), the number of partnership filings increased by 11 percent from 1980 to 1990, 20 percent from 1990 to 2000, and 30 percent from 2000 to 2006. This in part reflects the option to organize as a limited liability company (LLC) beginning in 1993. All general partners are counted in the BEA measures, but the PUMS measure only includes the partner as self-employed if it is their primary job.

Third, the BEA data reflect a count of self-employment over the period of one year. Any proprietor or partner in business at any point in the year is counted in the BEA measure. The PUMS data

[5] In this paper, BEA data are used to test hypotheses 1 and 2, while the PUMS data are used to test hypothesis 3.

are more likely to reflect one point in time as the status of each worker is collected at the time of the survey.

B. Long-Run Growth and Convergence Trends of Proprietorship Shares

First, we analyze basic trends and patterns in proprietorship growth during the 1970–2006 period using data on self-employment from the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). This data is published in the Regional Economic Information System at the county level and is based on Schedule C filings from tax form 1040 and partnership filings from tax form 1065, which each sole proprietor or partnership files with the Internal Revenue Service. We focus on nonfarm self-employment and nonfarm employment to construct our main variable of interest: the nonfarm proprietors' share of nonfarm employment where proprietors are either self-employed or partners.

We aggregate county-level data on nonfarm proprietors and nonfarm employment to the local labor market level. We use 722 local labor market areas (LMAs) in the contiguous U.S. states. These mutually exclusive and exhaustive local labor markets were developed by the U.S. Department of Agriculture's Economic Research Service (ERS) to capture commuting zones in nonmetropolitan as well as metropolitan areas. These ERS commuting zones are aggregations of counties, and, of the 722 LMAs in the data set, 256 are metropolitan and 466 are nonmetropolitan. Metropolitan areas include one or more metropolitan statistical areas (MSAs); nonmetropolitan areas are those which do not contain any counties included in an MSA (Tolbert and Sizer, 1996). These LMAs, which county-to-county commuting data from the 1990 Census reveal to be integrated labor markets, are an appropriate aggregation of counties for the study of variables influenced by the labor market, such as per capita personal income growth. We also prefer aggregating county data to the LMA level because this should reduce the influence of "spatial spillovers" on our results, particularly when compared to county data. Spatial spillovers affect regional growth when factors that affect growth in one region (e.g. opening a new factory) are transmitted to other regions. These spillovers may be caused by commuting connections across regions. For example an increase in employment opportunities in region A might increases the economic performance in a neighboring region B as its residents that commute to A for employment now have higher wages, increasing the amount of disposable income spent in the region where they live, B.

The regional concentration of proprietors varies considerably over time, across regions, and across metropolitan and nonmetropolitan region types (Table 1).[6] For the United States, the nonfarm proprietorship share has risen from 11.2 percent in 1970 to 18.8 percent by 2006, and there is

[6] Metropolitan and nonmetropolitan regions are defined using local commuting zones defined in Tolbert and Sizer (1996). The aggregation of counties to commuting zones in discussed in detail in Section 4.

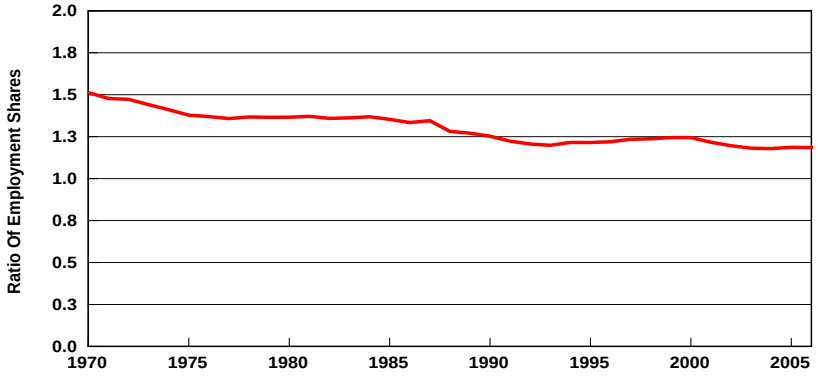
considerable variation in proprietorship shares across LMAs in the United States For instance, for the 722 local LMAs in the data, the nonfarm proprietorship rate varied from a high of 51.7 percent (for the Rosebud, South Dakota, labor market) to a low of 11.7 percent (for the Oberlin, Kansas, labor market).

We also find variation across geographic regions and across metropolitan and nonmetropolitan areas. For instance, the proprietorship share varied from a high of 20.3 percent in the New England region to a low of 17.5 in the East North Central region in 2006. In addition, the share was higher in nonmetropolitan areas, at 21.8 percent, than in metropolitan areas, at 18.4 percent, in 2006.

There is considerable variability in proprietorship share growth during the 1970–2006 period (Table 1).[7] Note that the higher average growth by far occurred during the 2000–2006 period and that there is considerable variation, both geographically and across metropolitan and nonmetropolitan regions. Indeed, growth in the proprietorship share was very low during the past six years in the West, at 1.0 percent per year, compared to 4.8 percent annual growth in the East North Central region. Further, growth in metropolitan areas has tended to outstrip gains in nonmetropolitan regions, with annual growth in metropolitan regions more than double the nonmetropolitan rate from 1970 to 2006.

Higher growth in metropolitan regions implies that the metropolitan/nonmetropolitan gap has been closing during the last 36 years. Indeed, the gap has declined considerably (Figure 1). The proprietorship share in nonmetropolitan areas in 1970 was 50.9 percent above the metropolitan average. However, by 2006, the nonmetropolitan proprietorship share was just 18.5 percent above the metropolitan level.

Figure 1
Nonfarm Proprietor's Share
Nonmetro/Metro Ratio



[7]Average annual growth is calculated by the formula ((employment share$_t$/employment share$_{t-T}$)-1)/(# of years between t-T and t).

Table 1
Nonfarm Proprietor's Employment Shares By Census Region And Metropolitan Status
(In Percent)

	Nonfarm Proprietor's Employment Share					Annual Percent Change				
	1970	1980	1990	2000	2006	1970-198	1980-1990	1990-2000	2000-2006	1970-2006
United States	**11.2**	**12.5**	**14.3**	**15.6**	**18.8**	**1.2**	**1.5**	**0.9**	**3.4**	**1.9**
Metropolitan	10.6	12.0	14.0	15.2	18.4	1.4	1.6	0.9	3.5	2.1
Non-metropolitan	16.0	16.5	17.5	18.9	21.8	0.3	0.7	0.8	2.6	1.0
Northeast	**10.2**	**11.4**	**13.4**	**14.5**	**18.6**	**1.1**	**1.8**	**0.8**	**4.6**	**2.3**
Metropolitan	10.1	11.2	13.3	14.4	18.4	1.1	1.8	0.8	4.7	2.3
Non-metropolitan	14.3	16.0	17.4	19.5	23.1	1.2	0.9	1.2	3.1	1.7
New England (CT, ME, MA, NH, RI, VT)	10.1	12.1	14.5	15.9	20.3	2.0	2.0	0.9	4.6	2.8
Metropolitan	10.0	11.9	14.3	15.6	20.0	1.9	2.0	0.9	4.7	2.8
Non-metropolitan	13.8	17.9	19.9	22.0	26.5	3.0	1.1	1.0	3.4	2.6
Middle Atlantic (NJ, NY, PA)	10.3	11.1	13.0	14.0	17.9	0.8	1.7	0.8	4.6	2.0
Metropolitan	10.2	11.0	12.9	13.9	17.8	0.8	1.8	0.8	4.7	2.1
Non-metropolitan	14.6	14.9	15.8	17.7	20.6	0.2	0.6	1.2	2.8	1.1
Midwest	**10.9**	**12.2**	**13.3**	**14.1**	**17.8**	**1.1**	**0.9**	**0.6**	**4.3**	**1.7**
Metropolitan	9.8	11.1	12.5	13.3	17.0	1.4	1.2	0.6	4.7	2.1
Non-metropolitan	17.5	17.8	18.1	18.9	22.0	0.2	0.1	0.5	2.7	0.7
East North Central (IN, IL, MI, OH, WI)	10.1	11.3	12.7	13.6	17.5	1.3	1.2	0.7	4.8	2.1
Metropolitan	9.6	10.8	12.3	13.2	17.1	1.3	1.4	0.7	5.0	2.2
Non-metropolitan	15.5	16.7	17.1	18.0	21.4	0.8	0.3	0.5	3.2	1.1
West North Central (IA, KS, MN, MO, NE, ND, SD)	13.4	14.3	14.9	15.4	18.4	0.6	0.4	0.4	3.2	1.0
Metropolitan	10.7	12.2	13.2	13.6	16.7	1.4	0.8	0.3	3.8	1.6
Non-metropolitan	19.0	18.7	18.8	19.7	22.5	-0.2	0.1	0.5	2.4	0.5
South	**11.3**	**12.5**	**14.1**	**15.2**	**18.7**	**1.1**	**1.3**	**0.7**	**3.8**	**1.8**
Metropolitan	10.7	12.1	13.9	14.9	18.4	1.3	1.5	0.7	4.0	2.0
Non-metropolitan	14.9	15.1	16.1	17.5	20.8	0.2	0.7	0.8	3.1	1.1
South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, WV)	10.2	11.8	12.9	14.2	18.1	1.6	0.9	1.0	4.5	2.2
Metropolitan	9.9	11.7	12.7	14.0	17.9	1.8	0.9	1.0	4.6	2.2
Non-metropolitan	12.5	13.0	14.4	15.9	19.9	0.4	1.1	1.1	4.2	1.7
East South Central (AL, KY, MS, TN)	11.4	12.7	13.4	15.1	18.5	1.2	0.5	1.3	3.8	1.7
Metropolitan	10.4	12.0	12.8	14.5	18.0	1.6	0.7	1.3	4.1	2.1
Non-metropolitan	13.7	14.4	14.7	16.5	19.8	0.5	0.2	1.3	3.3	1.2
West South Central (AR, LA, OK, TX)	13.0	13.5	16.5	16.8	19.7	0.3	2.3	0.1	2.9	1.4
Metropolitan	12.1	12.8	16.1	16.3	19.3	0.6	2.6	0.1	3.1	1.7
Non-metropolitan	19.2	18.5	20.1	20.7	23.0	-0.4	0.9	0.3	1.9	0.5
West	**12.8**	**14.3**	**16.7**	**18.7**	**20.1**	**1.2**	**1.7**	**1.2**	**1.3**	**1.6**
Metropolitan	12.4	14.0	16.4	18.3	19.8	1.3	1.7	1.2	1.3	1.7
Non-metropolitan	16.7	17.4	20.2	22.3	23.7	0.4	1.6	1.0	1.1	1.2
Mountain (AZ, CO, ID, NM, MT, UT, NV, WY)	13.5	14.5	16.9	17.9	20.0	0.8	1.6	0.6	1.9	1.4
Metropolitan	12.4	13.8	16.1	16.9	19.1	1.2	1.7	0.5	2.2	1.5
Non-metropolitan	16.7	16.8	19.9	22.1	23.6	0.0	1.9	1.1	1.1	1.1
Pacific (CA, OR, WA)	12.5	14.2	16.6	19.0	20.1	1.3	1.7	1.4	1.0	1.7
Metropolitan	12.4	14.0	16.5	18.9	20.0	1.3	1.8	1.4	1.0	1.7
Non-metropolitan	16.8	18.7	20.7	22.6	24.0	1.2	1.0	0.9	1.0	1.2

Nonfarm proprietor's employment shares are calculated as the ratio of nonfarm proprietor's employment divided by total nonfarm employment.
Source: Authors' calculation based on data from U.S. Bureau of Economic Analysis, Regional Economic Information Service.

For the all-region distribution, the unweighted mean share rises steadily from 16.5 percent in 1970 to 22.0 percent by 2006 (Table 2).[8] In addition, the standard deviation of the distribution falls from 6.0 in 1970 to 5.1 in 1980 and 1990. Thereafter the standard deviation rises a bit to 5.7 by 2006. Thus, the spread of the distribution initially closes, but then gradually widens slightly during the 36-year period. Further, the distribution gradually becomes more right skewed during the period, with skewness rising from 0.9 in 1970 to 1.3 by 2006. This implies that relatively high nonfarm proprietors' employment shares become more likely over time. Finally, the kurtosis (or relative "peakedness") of the distribution rises strongly, from 0.4 in 1970 to 2.5 by 2006. This means that the distribution is becoming more concentrated around the mean over time, compared to the normal distribution.

Table 2
Summary Statistics For Nonfarm Proprietor's Employment Shares
(In Percent)

		Count	Mean*	St.Dev.	Skew.	Kurtosis	Min	Max
All Regions								
	2006	722	22.0	5.7	1.3	2.5	11.7	51.7
	2000	722	19.1	5.5	1.1	1.6	7.1	44.5
	1990	722	17.9	5.1	0.8	0.7	9.4	37.8
	1980	722	16.6	5.1	0.9	0.8	8.0	38.3
	1970	722	16.5	6.0	0.9	0.4	6.7	36.2
Metropolitan								
	2006	256	18.6	2.7	0.7	0.6	12.1	27.4
	2000	256	15.7	2.9	1.0	0.8	10.1	25.2
	1990	256	14.7	3.0	1.0	0.8	9.4	24.3
	1980	256	13.1	2.8	1.0	1.4	8.0	24.5
	1970	256	12.1	2.9	0.9	0.6	6.8	21.6
Nonmetropolitan								
	2006	466	23.9	6.0	1.0	1.7	11.7	51.7
	2000	466	21.0	5.6	0.9	1.2	7.1	44.5
	1990	466	19.7	5.1	0.6	0.4	9.6	37.8
	1980	466	18.5	5.0	0.6	0.6	8.3	38.3
	1970	466	18.9	5.8	0.6	0.1	6.7	36.2

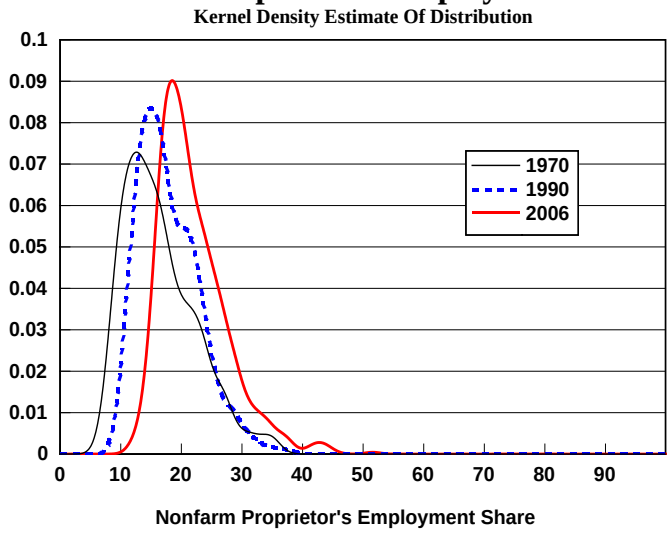
*Unweighted mean.
Source: Authors' calculation based on data from U.S. Bureau of Economic Analysis, Regional Economic Information Service.

The distribution has evolved over time as can be seen using kernel density estimates[9] for 1970, 1990, and 2006 (Figure 2). The distribution drifts to the right during the period, reflecting the rising mean

[8] These mean shares differ from results presented in Table 1, which contains weighted average shares.
[9] Kernel density estimation is a non parametric method of estimating the probability density function of a random variable.

of the distribution. The spread of the distribution narrows from 1970 to 1990, but then widens again by 2006.

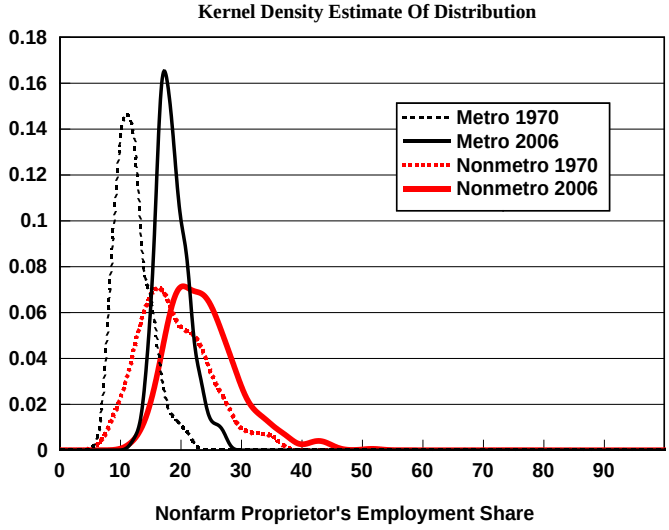
Figure 2
All ERS Regions
Nonfarm Proprietor's Employment Share



Comparing metropolitan and nonmetropolitan regions, the mean of the metropolitan distribution is always lower than the mean for the nonmetropolitan distribution, as expected (Table 2). Both means gradually rise over time, reflecting the growing importance of self-employment for both region types. Note as well that the standard deviation for the metropolitan distribution is much lower than the standard deviation for the nonmetropolitan distribution. Indeed, in 2006 the metropolitan standard deviation (at 2.7) is less than half the standard deviation for the nonmetropolitan distribution (at 6.0). Thus, there is much more variation in the importance of nonfarm proprietors' employment across nonmetropolitan regions than for metropolitan regions. Figure 3 gives a graphical depiction of these trends and differences.

Overall, the distribution dynamics suggested by the change in the standard deviation over time show that there has been little convergence in nonfarm proprietors' employment shares during the past 36 years. We find similar trends in dispersion (again measured by the standard deviation of the distribution) for metropolitan and nonmetropolitan regions. Overall, the evidence from the standard deviation suggests little tendency for within-distribution convergence across all regions, metropolitan regions, or nonmetropolitan regions measured by changes in the standard deviation over time.

Figure 3
Metro And Nonmetro Regions
Nonfarm Proprietor's Employment Share



Another way to investigate the distribution dynamics of proprietorship shares is to regress the growth rate of employment shares during a given period on employment shares at the beginning of the period.[10] Thus, we estimate a regression of the following form:

$$\Delta \ln\,(nonfarm\ proprietor's\ share)_{i,t} \;=\; \alpha + \beta \Delta \ln\,(nonfarm\ proprietor's\ share)_{i,t-T} + \varepsilon_{i,t}, \quad (1)$$

where nonfarm proprietors' share is the ratio of nonfarm proprietors' employment to total nonfarm proprietors employment, *I* indexes local labor markets, and *T* indicates the span of time over which the growth rate is calculated. Our dependent variable is the percentage change, or growth in the nonfarm proprietors' share of nonfarm employment during the period, defined as the difference in natural logs[11]:

$$\Delta \ln(nonfarm\ proprietor's\ share)_{i,t} = \ln(nonfarm\ proprietor's\ share)_{i,t} - \ln\,(nonfarm\ proprietor's\ share)_{i,t-T}. \quad (2)$$

The results of this regression tell us whether regions that begin with high proprietorship shares tend to have higher growth rates in proprietorship shares than regions that begin with lower proprietorship

[10] This approach is known as the absolute beta convergence test in the convergence literature. This test provides information on distribution dynamics, including mobility within the distribution. It does not, on its own, provide conclusive evidence of convergence. Evidence from the evolution of the standard deviation of the distribution is known as a sigma convergence test.
[11] Differences in logs generate a percentage change between time periods.

shares. The results of this regression do not tell us conclusively whether or not proprietorship shares are "converging," but they do give us useful information about one dimension of distribution dynamics. If the estimated slope coefficient (β) is negative and significantly different from zero, it implies that regions that begin with relatively low proprietorship shares tend to experience faster growth in proprietorship shares than regions that begin with relatively high proprietorship shares. If the estimate of β is positive and significant, it implies that regions that begin the period with relatively high proprietorship shares tend to have proprietorship shares that grow faster than regions that begin with relatively low shares.

Table 3 shows the results of the regressions for the 1970–2006 period, as well as by decade, for all regions, metropolitan regions, and nonmetropolitan regions. For all regressions the estimated β coefficients are negative and significant at the 1 percent level. This shows that regions that began with higher proprietorship shares tended to have shares that grow slower than regions that began with lower shares. The sub-period results suggest that this form of mobility is present in each decade, but it was strongest during the 1970s and weakest during the 1990s.

We come to similar conclusions for both metropolitan and nonmetropolitan regions, in that the results show that regions that begin with higher proprietorship shares tend to grow slower than regions that began the period with lower shares. We also find that the estimated β coefficients differ significantly across metropolitan and nonmetropolitan regions, for the 1970–2006 estimation. However, the sub-period results suggest that this is primarily due to a significant difference during the 2000–2006 period, because we find no significant differences between estimated β coefficients during any other sub-period.

Table 3
Univariate Growth Rate Regression Results
$\Delta \ln(\text{Proprietors Share})_{i,t} = \alpha + \beta \ln(\text{Proprietors Share})_{i,t-T} + \varepsilon_{i,t}$

		Estimated β	t-Stat	Adj. R^2
All Regions				
	1970-2006	-0.51***	-29.5	0.55
	2000-2006	-0.18***	-15.1	0.24
	1990-2000	-0.09***	-6.4	0.05
	1980-1990	-0.18***	-11.1	0.14
	1970-1980	-0.23***	-18.7	0.33
Metropolitan				
	1970-2006	-0.68***	-20.6	0.62
	2000-2006	-0.31***	-12.3	0.37
	1990-2000	-0.16***	-6.8	0.15
	1980-1990	-0.22***	-6.1	0.12
	1970-1980	-0.21***	-9.6	0.26
Nonmetropolitan				
	1970-2006	-0.5***	-18.6	0.43
	2000-2006	-0.15***	-9.2	0.15
	1990-2000	-0.11***	-5.4	0.06
	1980-1990	-0.19***	-7.8	0.11
	1970-1980	-0.23***	-12.1	0.24

*** indicates significance at the 1% level.
Source: Authors' calculation based on data from U.S. Bureau of Economic Analysis, Regional Economic Information Service.

Overall, the results from this section suggest that nonfarm proprietorship shares differed significantly across Census regions and across metropolitan and nonmetropolitan region types. We find relatively high proprietorship shares in the West Census region and relatively low shares in the Midwest. In addition, we find much higher proprietorship shares in nonmetropolitan regions than in metropolitan regions. We also find large differences in the growth of proprietorship rates across Census regions and across metropolitan and nonmetropolitan regions. We note particularly strong growth in proprietorship rates in the Northeast Census region and much stronger growth in metropolitan regions than in nonmetropolitan regions (2.3 versus 1.7 percent per year). We find some evidence of convergence in the mean proprietorship share between metropolitan and nonmetropolitan regions, as strong metropolitan growth has caused the gap in the rate with nonmetropolitan regions to close during the period. In addition, we find little evidence of within-distribution convergence at any level: all regions, metropolitan regions, or nonmetropolitan regions, based on the standard deviation of the distribution. In other words, there is

little reduction in the dispersion of proprietorship shares during the period. However, we also find that regions that begin with relatively low proprietorship shares tend to have shares that grow faster than regions that begin with higher shares. This suggests that regions tend to "catch up" and "fall back" depending on the initial level of their proprietorship share.

C. Multivariate Regression Methodology

1. Growth of the Number of Proprietorships

We next turn our attention to a multivariate analysis of growth in proprietorship numbers and shares across U.S. regions (measured as the difference in natural logs). In that effort, we regress our dependent variable on determinants of entrepreneurship identified in the literature, including demographics (gender, race, age), industry structure (measured by employment shares), income, the unemployment rate, amenities (measures developed by the USDA Economic Research Service for climate, proximity to water, and topography), presence of military installation(s), wealth, and human capital. We estimate the model using standard ordinary least squares (OLS), which provides estimates of the effects a variable holding the other variables constant.

Within the growth literature, it is well accepted that the share of the population with a given level of educational attainment is likely to be endogenous. Specifically, it is unclear whether highly educated individuals cause economic growth or whether regions with higher economic growth attract highly educated individuals. Results suggesting a positive relationship between education levels and economic growth are consistent with both possibilities. Several authors address whether more education leads to higher growth rates. Hammond and Thompson (2008), Berry and Glaeser (2005), Shapiro (2006), and Moretti (2004), among others, respond to this issue by using the number of colleges and universities in a local labor market to control for endogeneity. We use the college and high school attainment rates as one measure of human capital, but we also ensure the exogeneity of our measure of college attainment by including the number of colleges and universities and per capita local government education spending (see also Hammond and Thompson, 2004) in the LMAs.

The form of the regression for growth in proprietorship count is:

$$\begin{aligned}\Delta \ln(nonfarm\ proprietor's)_t \\ &= f(Regional\ control\ variables, including\ human\ capital)_{t-T} \\ &+ \ln(nonfarm\ proprietor's)_{t-T} + residual\end{aligned} \qquad (3)$$

The coefficient on the initial log nonfarm proprietorship count provides some information on agglomeration in proprietorship formation. Agglomeration effects result when there are gains to locating near other entrepreneurs. For example, financial institutions might be more attuned to the needs of

entrepreneurs when they make up a substantial portion of the customer base. A positive coefficient on this variable suggests that large regional economies with a larger number of proprietorships grow at a higher rate. A negative coefficient suggests slower growth in the number of proprietorships in larger regions.

This regression form (and associated data) allows us to explore determinants of growth in the number of proprietors during the 1970–2006 period, as well as for sub-periods defined around decades (1970–1980, 1980–1990, 1990–2000, and 2000–2006). This approach highlights the extent to which determinants change in relative importance during the 36-year period.

Finally, this approach allows us to investigate the degree to which determinants differ across metropolitan and nonmetropolitan labor markets. Hammond and Thompson (2008), Higgins et al. (2006), and Audretsch and Keilbach (2005) show that this form of heterogeneity may be an important consideration in the context of U.S. LMAs and counties.

2. Growth of the Proprietorship Share

We also consider how the determinants of proprietorship influence growth in the proprietorship share as well as the number of proprietorships. It is important to look at both proprietorship concepts because the regional characteristics that drive growth in the proprietorship number could differ from the characteristics that drive change in the proprietorship share. In particular, some regional characteristics may affect total employment growth, that is, growth in both proprietorship and wage-and-salary employment. These characteristics would be associated with higher regional growth in the number of proprietorships but not necessarily the proprietorship share of total employment. Factors that affect the proprietorship share are those with a disproportionately large effect on proprietors relative to wage-and-salary employment.

The form of our regression is:

$$\begin{aligned}\Delta \ln(&nonfarm\ proprietor's\ share)_t \\ &= f(Regional\ control\ variables, including\ human\ capital)_{t-T} \\ &+ \ln\ (nonfarm\ proprietor's\ share)_{t-T} + residual\end{aligned} \qquad (4)$$

This specification allows us to explore the drivers of growth in entrepreneurship concentration (or proprietor shares) during the 1970–2006 period, by decade, and for metropolitan and nonmetropolitan regions. The coefficient on the initial log nonfarm proprietors' share provides some information of the evolution of distribution dynamics. A positive coefficient on this variable suggests that regions with initially high proprietor shares tend to grow faster than those with initially low shares, which may reflect

divergence in the regional distribution, relative to long-run determinants. A negative coefficient suggests that regions with low proprietor shares grow faster than regions with high shares, which suggests that the distribution may display catch-up in entrepreneurship concentration, again relative to long-run determinants.

3. Growth of Self-Employment by Sub-Group

Our research to this point allows us to identify differences in how factors affect proprietorship numbers and shares across metropolitan and nonmetropolitan regions and across time periods. Further examination of the other factors affecting self-employment numbers and shares for sub-groups is possible by dividing self-employment into categories based on gender, age, and industry. This disaggregation is not possible with data from BEA's Regional Economic Information System, so we exploit the Public Use Microdata Sample (PUMS) data from the 2000 Census and the 2006 American Community Survey that is available on IPUMS.

We use the 5 percent sample data from PUMS, because this maximizes the regional disaggregation available in the data. For the 5 percent sample, estimates are published for 2,057 mutually exclusive and exhaustive regions in the United States, called Public Use Microdata Areas (PUMAs). These regions must have a minimum population size of 100,000 residents (in 2000) and do not necessarily reflect local LMAs. Since PUMAs may be redefined for each Census, we cannot track reasonably defined regions from 1970 to 2000.[12] However, PUMA regions are consistent from 2000 on.

Using the PUMS data, we compute regional concentrations of the self-employed by gender, by age group, and by industry. For the industry groupings we focus on the relatively high-tech professional and business services and the health care industries (defined using available three-digit NAICS codes),[13] since Audretsch and Keilbach (2005) find that the research and development, as well as knowledge-intensive, entrepreneurship activities have a bigger impact on regional growth. Thus, it is important to understand the regional determinants of these types of entrepreneurship.

Our regression approach is similar for these data, but since PUMAs do not reflect local LMAs we control for "spatial spillovers" using spatial econometric techniques (Anselin, 1988; Cliff and Ord, 1981). PUMAs may be either aggregations of counties or they may be parts of counties. In order to conform to our regional characteristic data (same as the previous section), we sum PUMAs to the county level, where

[12] PUMS data is available for consistent PUMS regions for the 1980, 1990, and 2000 samples. However, since PUMAs are often redefined over time, these consistent regions range from states to portions of cities. Thus, consistent PUMAs are not appropriate for our purposes.

[13] More information on industry classification using NAICS codes can be found on the Census website: http://www.census.gov/eos/www/naics/.

necessary. Likewise, where necessary we aggregate our regional characteristic data to match multi-county PUMAs. Once this has been accomplished we are left with 942 PUMA-county aggregates. These may be as small as counties, but are often multi-county aggregates.

In contrast to the previous section, our PUMA-county regions do not conform to LMAs. This makes it is important to account for spatial spillovers across regions. These spillovers may be caused by commuting connections across regions, which imply that growth shocks to one county may be transmitted to other regions nearby and cause the residual variance in an ordinary least squares regression to be nonspherical. To correct for this, we use a model of spatial relationship developed by Anselin (1988): the "spatial error model." As Anselin (1988) points out, accounting for spatial relationships using the spatial error model improves the efficiency of resulting hypothesis tests. This model has been estimated in a variety of contexts, including US state income convergence by Garrett et al. (2007) and Rey and Montouri (1999).

We estimate a spatial error model of the following form:

$$\gamma = X\beta + \mu \qquad (5)$$

$$\mu = \lambda W\mu + \epsilon \qquad (6)$$

Where *y* is an Nx1 vector containing the dependent variable, in our case self-employment (or self-employment share) growth rates for our N regions. The vector (β, kx1) contains the estimated coefficients. The matrix *X* (which is Nxk) contains our variables of interest (which are the same as in the previous section), as well as a full set of state binary variables (excluding Alabama in order to avoid perfect collinearity with the constant term).

The matrix *W* is an NxN row standardized spatial weight matrix (the rows sum to one). We choose to model spatial relationships using first-order contiguity, which identifies contiguous neighbors. This approach also was utilized by Goetz and Rupasingha (2009). The term ε is an Nx1 vector of errors, and λ is a parameter to be estimated that shows the degree of spatial dependence among the error terms. The parameter λ may be either positive or negative, depending on the spatial relationship among shocks to growth.

Use of ordinary least squares on equations 1 and 2 is not appropriate since the spatial error term is non-spherical. However, if ε is homoskedastic and jointly normally distributed, the model given by equations 1 and 2 can be estimated via maximum likelihood estimation (Anselin, 1988).

4. Regression Results

In the preceding section, we found that there has been little reduction in the dispersion of self-employment shares during the 1970–2006 period, but that individual regions sometimes "catch up" and "fall back" depending on the initial self-employment share. These results suggest that growth in self-employment depends on the characteristics of individual regions. Thus, self-employment trends do not follow a prescribed path and may instead be a function of the underlying conditions in each region. In particular, the socio-economic characteristics of a region (education, demographics, industry mix, amenities) may influence the overall rate of growth of self-employment.

A. Proprietorship Growth by Metropolitan/Nonmetropolitan Region and Decade: 1970–2006

In this section, we examine how economic and demographic factors influence the growth of entrepreneurship in U.S. LMAs. We examine growth in the number of proprietorships as well as growth in proprietors' share of total employment. As noted above, we regress our dependent variable on determinants of entrepreneurship identified in the literature, including demographics (gender, race, and age), industry structure (measured by employment shares), income, the unemployment rate, amenities (measures developed by the USDA Economic Research Service for climate, proximity to water, and topography), military employment share, wealth, and human capital. In conducting this part of the analysis we are able to address two of the three research hypotheses. First, we are able to examine if higher levels of human capital are associated with faster growth in entrepreneurs (measured by the increase in proprietorships) and entrepreneurship share (measured by the increase in proprietorship share) across time periods and across U.S. regions, as well as metropolitan and nonmetropolitan regions. Second, we examine whether the contribution of human capital (or education) varies across time periods, and between metropolitan and nonmetropolitan regions.

1. Descriptive Statistics

Summary statistics for proprietorship trends, human capital, and other regional characteristics are provided in Table 4. We list values for growth in proprietorship count and share for the 1970–2006 period for all LMAs, metropolitan LMAs, and nonmetropolitan LMAs. For human capital and other regional characteristics, we provide initial values for 1970. For brevity, we do not present data on proprietorship trends or regional characteristics by decade. (Decade-by-decade trends in proprietorship were presented earlier in this report.) A more complete description for all variables is provided in the data appendix.

Table 4

Summary Statistics

	All LMA		Metro LMA		NonMetro LMA	
Variable	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**
Growth in Proprietorship Share (1970-2006)	32.2%	24.3%	44.7%	19.8%	25.2%	23.8%
Growth in Proprietorship Count (1970-2006)	96.2%	46.3%	119.4%	37.3%	83.5%	45.8%
Percent College Graduates (1970)	8.2%	3.1%	9.9%	2.9%	7.2%	2.7%
Local Education Spending Share of Income (1977)	5.4%	1.5%	4.7%	1.0%	5.7%	1.6%
University Count	2.7	7.0	7.0	10.6	0.6	0.9
Personal Income Per Capita (1970)	$3,341	$660	$3,639	$591	$3,177	$639
Unemployment Rate (1970)	4.6%	2.0%	4.5%	1.4%	4.7%	2.3%
Dividend, Interest, and Rent Income Per Capita (1970)	$465	$187	$488	$179	$453	$190
Percent Military Employment (1970)	3.7%	5.6%	4.7%	6.6%	3.1%	4.8%
Percent Female (1970)	49.2%	130.5%	48.9%	113.5%	49.3%	137.1%
Percent White (1970)	90.7%	12.8%	88.9%	10.8%	91.7%	13.7%
Percent Age 0-19 (1970)	38.4%	3.5%	38.6%	2.8%	38.3%	3.9%
Percent Age 20-44 (1970)	29.0%	3.6%	31.6%	2.7%	27.6%	3.3%
Percent Age 45-64 (1970)	21.0%	2.6%	19.9%	2.0%	21.6%	2.5%
Percent Age 65 or more (1970)	11.6%	3.5%	9.9%	2.6%	12.5%	3.5%
Ruggedness	9.3	6.1	8.6	6.1	9.7	6.1
July Humidity	53.2	15.5	57.8	14.7	50.7	15.4
Number of Sunny Days in January	154.3	34.7	152.0	35.5	155.6	35.7
Access to Water	4.5%	9.9%	6.4%	9.5%	3.5%	10.0%
Mean January Temperature	31.8	12.6	35.7	12.5	29.6	12.2
Mean July Temperature	75.4	5.7	76.2	5.2	74.9	5.8
Percent Agr Service, Forestry, and Fishery Jobs (1970)	1.2%	1.2%	0.8%	0.9%	1.5%	1.3%
Percent Mining Jobs (1970)	2.3%	4.5%	1.2%	2.4%	2.9%	5.3%
Percent Construction Jobs (1970)	5.5%	2.5%	5.4%	1.2%	5.6%	3.0%
Percent Manufacturing Jobs (1970)	18.0%	11.8%	21.5%	10.6%	16.1%	11.9%
Percent Transportation and Utilities Jobs (1970)	5.2%	2.0%	5.2%	1.5%	5.2%	2.2%
Percent Wholesale Trade Jobs (1970)	3.4%	1.5%	4.1%	1.6%	3.0%	1.4%
Percent Retail Trade Jobs (1970)	18.1%	4.0%	19.6%	4.5%	19.1%	4.3%
Percent Finance, Insurance and Real Estate Jobs (1970)	5.7%	1.9%	6.1%	1.9%	5.5%	1.9%
Percent Services Jobs (1970)	19.0%	3.9%	19.0%	3.6%	19.1%	4.1%
Percent Government Jobs (1970)	21.6%	8.4%	20.6%	8.9%	22.1%	8.1%
Percent Small Nonmetropolitan Labor Market Area	17.0%	37.6%	0.0%	0.0%	26.4%	44.1%
Percent Mid-Size Nonmetropolitan Labor Market Area	33.0%	47.0%	0.0%	0.0%	51.1%	50.0%
Percent Large Nonmetropolitan Labor Market Area	14.5%	35.3%	0.0%	0.0%	22.5%	4.2%
Small Metropolitan Labor Market Area	16.8%	37.4%	47.3%	50.0%	0.0%	0.0%
Mid-Size Metropolitan Labor Market Area	11.9%	32.4%	33.6%	47.3%	0.0%	0.0%
Large Metropolitan Labor Market Area	6.8%	25.2%	19.1%	39.4%	0.0%	0.0%

Source: Authors' calculation.

Data on the number and share of proprietorships come from the Regional Economic Information System (U.S. Bureau of Economic Analysis). This data source includes proprietor employment and wage-and-salary employment for all counties. Proprietorship share is proprietor employment divided by total nonfarm employment (which is the sum of proprietor and wage-and-salary employment, including public sector employment). County totals are aggregated into data for multi-county LMAs. There was a rapid expansion in the number of proprietorships in the United States during the 1970–2006 period, as would be expected given the rapid increase in population and labor force participation during the period. Using the unweighted mean across the 722 LMAs, the number of proprietorships nearly doubled, rising by 96.2 percent from 1970 to 2006. The rate of growth was more rapid in metropolitan labor markets, but that was partly due to more rapid population growth in metropolitan areas. Both proprietorships and wage-and-salary employment were growing more quickly in metropolitan areas. Proprietorships also grew as a share of total employment, indicating a movement towards proprietor employment rather than wage-and-salary employment, particularly in metropolitan areas.

Education (human capital) variables are included in order to examine if LMAs with a more educated workforce had more rapid growth in proprietorship count and proprietorship share. Due to endogeneity concerns, we measure human capital in regions using the initial level of education, specifically, the college graduation rate in each LMA. Among the education variables, the "percent college graduate" is the share of persons age 25 or older who hold a college degree. This data is from the 1970, 1980, 1990, and 2000 Census of Population. In some specifications, we utilize alternative measures of educational attainment, following Hammond and Thompson (2004). These measures were local education spending (primarily on primary and secondary education) and number of universities (for the number of four-year colleges and universities in an LMA). Local education spending as a share of income is based on spending data from the 1977, 1982, 1987, and 1992 Census of Governments, and personal income data from the Regional Economic Information System. Data on university counts is from the National Center for Education Statistics. All data is available for counties and is summed for multi-county LMAs. As would be expected, the average number of four-year colleges and universities and the percentage of college graduates is higher in metropolitan LMAs. But, local government spending on education as a share of income is higher in nonmetropolitan areas.

Other control variables in Table 4 reflect the underlying economic conditions or demographic characteristics of the LMAs that can influence growth in the proprietorship rate. The unemployment rate variable reflects the flexibility of the workforce in finding employment. LMAs with chronically high unemployment rates may have a less resourceful labor force that is also less likely to engage in entrepreneurship. Conversely, the unemployed might be more likely to become self-employed as they have few wage-and-salary employment opportunities. Unemployment rate data for counties are from the

Census of Population in 1970, 1980, 1990, and 2000 (these Census surveys were not taken during a recession period so unemployment rates reflect long-term rather than cyclical unemployment). As noted earlier, we only report the value for 1970 in the interest of brevity. Unemployment rates are slightly higher in nonmetropolitan areas and also are much more variable, as indicated by the larger standard deviation.

A variable measuring wealth was included in the analysis to reflect the role of capital in entrepreneurship. Capital markets are national and global in scope, but information is an important component of entrepreneurial finance. A wealthier local population, who would also have greater information about would-be entrepreneurs within their own community, could be an important source of financing for self-employed individuals. Information on wealth is not available at the county level, but a partial measure—dividend, interest, and rent income—is available for counties from BEA's Regional Economic Information System. That data source also has population estimates for each county and year. We utilized this data to calculate dividend, interest, and rent income per capita. Dividend, interest, and rent income per capita was slightly higher for metropolitan LMAs than for nonmetropolitan LMAs.

Military employment is another potential indicator of entrepreneurship (Moutray, 2007). Retiring career service members, i.e., veterans, often look to live in the community where they were based. These middle-aged veterans also have a pension, health coverage and areas of professional expertise that may suit them for a career as a proprietor. We utilize a variable for military employment's share of total non-farm employment in each LMA. Military and non-farm employment data for counties were also available from the Regional Economic Information System. We summed county data to LMA totals and then divided by total employment to calculate the percent military employment for each LMA. The percent military employment is on average higher in metropolitan LMAs, given that military bases tend to be located in urban areas (Table 4). Standard deviations were large relative to means because many counties do not have military bases and have only limited employment associated with military reserve programs.

Among demographic variables, we include a variable for percent white, percent female, and percent in four broad age categories for children and teens (less than 20), younger working age (20–44), older working age (45-64) and potential retirement age (65 and older). There was no *a priori* expectation about how these demographic characteristics would influence growth in the proprietorship count or share, but there was an expectation that business formation could differ among demographic groups. All data were taken from the 1970, 1980, 1990, and 2000 Census of Population. The population in each demographic group was divided by total population to calculate shares. A larger share of the population was white in the nonmetropolitan LMAs. Nonmetropolitan LMAs also had an older population (Table 4).

We utilize natural amenity variables because previous research indicates that local economies in areas with higher amenity levels grow faster than areas with lower levels (McGranahan, 1999). This growth could include faster growth in the number of proprietorships. Further, if proprietors are more mobile than wage-and-salary workers and can move more easily to high-growth areas, then LMAs with greater amenities also would have faster growth in their proprietorship share. Further, among amenity variables, natural amenity variables are especially appealing because these are predetermined and not subject to endogeneity bias. Faster growth in the proprietorship number and share was expected in LMAs with more natural amenities. LMAs with a more rugged typography, less July humidity, more sunny hours in January, greater access to water, a higher mean January temperature and a lower mean July temperature were all expected to have higher growth in their proprietorship number and share. Natural amenity values were similar in metropolitan and nonmetropolitan LMAs, except that metropolitan LMAs had higher temperatures in January and greater access to water (Table 4).

Table 4 also includes data on industrial structure which can also influence growth in the proprietorship share. In particular, proprietorships are more common in industries such as construction or services. We controlled for industry structure through a series of variables indicating the share of LMA employment in one of nine private sector industries. Non-military government employment was the omitted category and serves as the reference point (i.e., the effects of all other industries should be interpreted as relative to the non-military government sector). Employment shares for each period were gathered for 1970, 1980, 1990, and 2000 from the Regional Economic Information System. Missing values for employment in industries within counties were estimated following Hammond and Thompson (2004). Metropolitan LMAs had higher shares of employment in manufacturing and wholesale trade, while nonmetropolitan areas had higher shares of mining and government employment (Table 4).

Categorical variables for metropolitan size also were included to capture the influence of agglomeration on growth in proprietorship counts and share. Proprietorships would be expected to grow more rapidly in larger urban areas if agglomeration encourages entrepreneurship. However, the relationship between agglomeration and entrepreneurship may be non-linear, so that it is preferable to classify LMAs into categories based on population size and urban orientation rather than include a continuous variable.

We classify LMAs into six agglomeration categories designed to provide a size and urban orientation typology for both nonmetropolitan and metropolitan economic regions. The six categories are: small, mid-size, and large metropolitan LMAs; and small, mid-size, and large nonmetropolitan LMAs. Note that among nonmetropolitan LMAs, mid-size regions were most common, while among

metropolitan LMAs, small regions were most common. These variables are included as a series of zero-one variables with small nonmetropolitan areas serving as the omitted category.[14]

2. Number of Proprietorships

We begin our multivariate analysis by examining factors that influence the growth in the number of proprietorships within LMAs. This initial analysis focuses on results pooled for all 722 LMAs in the contiguous U.S. states. Factors influencing the rate of growth in the number of proprietorships from 1970 through 2006 vary by decade (Table 5).

The analysis provides consistent support for the hypothesis that education is positively related to growth in the number of proprietorships. For the 1970–2006 period, a larger initial share of college graduates in an LMA led to higher subsequent growth in the number of proprietorships. The coefficient on the college attainment variable also was positive in all individual decades. It was statistically significant only in the 1980s and 1990s. These results show a correlation between increasing educational attainment and higher growth in the number of proprietorships.

Results suggest lower growth in the number of proprietorships in higher income regions, but the initial size of the economy, as measured by the proprietorship count, had an inconsistent influence. Over the entire 1970–2006 period, the initial number of proprietorships had no impact on subsequent growth in the number of proprietorships. Therefore, over the full period, there was no evidence that agglomeration economies encouraged a higher rate of growth in entrepreneurs. However, late in the period, in both the 1980s and 2000s, there was a positive relationship between the initial count of proprietorships and growth in the number of proprietors. Agglomeration may have become an increasingly important component of entrepreneurship in the last few decades.

[14] Another potential control variable would be variations in technology use across LMAs. As we do not have reliable measures of technology use, these effects are captured in the error term, reducing the precision of the estimates but not affecting the other parameter estimates as long as the other controls are uncorrelated with technology use.

Table 5

Factors Influencing Growth in Number of Proprietorships

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	-1.6988	0.1818	-1.3553	2.5954 *	0.6497
ln (Proprietorship Number$_{t-1}$)	-0.0272	-0.0073	0.0195 *	0.0014	0.0146 **
ln(percent college graduates$_{t-1}$)	0.0445 ***	0.0084	0.0100 *	0.0201 ***	0.0028
ln (Per capita income$_{t-1}$)	-1.3287 ***	-0.5080 ***	-0.1626 ***	-0.2716 ***	-0.2158 ***
ln (Unemployment Rate$_{t-1}$)	0.0072	0.0057	-0.0489 ***	-0.0425 **	-0.0543 ***
ln (DIR per capita$_{t-1}$)	0.5162 ***	0.2675 ***	-0.0747 *	0.0441	0.0989 ***
ln (Percent Military Jobs$_{t-1}$)	-0.0167	-0.0012	-0.0155 *	0.0212 **	-0.0148 ***
ln (Percent female$_{t-1}$)	1.0003	0.2022	0.1389	0.0246	-0.4818 **
ln (Percent white$_{t-1}$)	0.2928 ***	0.1960 ***	0.1205 **	0.0148	-0.1276 ***
ln (Percent age 20 to 44$_{t-1}$)	0.6998 ***	0.3040 ***	0.4816 ***	-0.0758	0.1674 **
ln (Percent age 45 to 64$_{t-1}$)	0.0664	-0.1349	0.2451 ***	0.0341	0.1480 **
ln (Percent age 65 and over$_{t-1}$)	-0.3543 ***	-0.0722	-0.0642	-0.1336 **	-0.0946 ***
ln (Ruggedness)	0.0055	-0.0091	0.0008	0.0056	-0.0001
ln (July Humidity)	-0.2261 ***	-0.1152 ***	-0.1188 ***	-0.0794 ***	0.0335 **
ln (Sunny hours in January)	0.3144 ***	0.1263 ***	-0.0016	0.0921 ***	0.0041
ln (Access to water)	0.0637 ***	0.0269 ***	0.0127 ***	0.0112 ***	0.0133 ***
ln (Mean January temperature)	0.2506 ***	0.1186 ***	0.0484 **	0.0283 *	-0.0161
ln (Mean July temperature)	-1.7002 ***	-0.8416 ***	-0.1163	-0.2619 **	0.0732
ln (Percent agriculture jobs$_{t-1}$)	-0.0366 *	-0.0087	0.0038	-0.0089	-0.0132 **
ln (Percent mining jobs$_{t-1}$)	-0.0022	0.0037 **	-0.0010	-0.0041 **	-0.0045 ***
ln (Percent construction jobs$_{t-1}$)	0.2657 ***	0.1131 ***	0.0484 **	0.1161 ***	0.0548 ***
ln (Percent manufacturing jobs$_{t-1}$)	0.0511 **	0.0166 *	-0.0148	0.0399 ***	-0.0129 *
ln (Percent transportation & utility jobs$_{t-1}$)	-0.1115 ***	0.0107	-0.0510 ***	-0.0166	-0.0193 *
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0609 **	-0.0371 ***	-0.0653 ***	-0.0384 **	0.0011
ln (Percent retail trade jobs$_{t-1}$)	-0.4294 ***	-0.2793 ***	-0.1239 **	0.1731 ***	0.0660 **
ln (Percent FIRE jobs$_{t-1}$)	0.1170 **	0.0168	0.0296	0.0528 **	-0.0344 **
ln (Percent service jobs$_{t-1}$)	0.2017 ***	0.1026 ***	0.0498	-0.0038	-0.0368
Mid-size nonmetropolitan labor market area	-0.0162	0.0172	-0.0006	-0.0044	-0.0314 ***
Large nonmetropolitan labor market area	-0.0382	0.0165	-0.0347 *	-0.0094	-0.0330 **
Small metropolitan labor market area	-0.0489	0.0120	-0.0249	-0.0325 *	-0.0233 *
Mid-size metropolitan labor market area	-0.0005	0.0259	-0.0272	0.0075	0.0012
Large metropolitan labor market area	0.0811 ***	0.0192 **	0.0321 ***	0.0033	-0.0012
N	722	722	722	722	722
Adjusted R-square	0.593	0.543	0.41	0.270	0.328

*** = significant at 1% level, **=significant at 5%, *=significant at 10%

Note: For a description of the variables see Section 8, Data Appendix.

Source: Authors' calculation.

Initial wealth in the region, as measured by dividend, interest, and rent income per capita, was associated with faster growth in the number of proprietors over the 1970–2006 period, but the greatest influence appeared to occur early in the period. Among demographic variables, LMAs with a higher share of white residents demonstrated faster growth in the number of proprietorships in the 1970s and 1980s,

but by the 2000s these regions experienced slower growth in proprietorship counts. LMAs with a larger initial share of population aged 20 to 44 had higher growth in the number of proprietorships. However, this result may simply reflect that regions with higher population and employment growth in the period before 1970 (and a large young population as a result) also had higher growth in population and employment during the 1970–2006 period. Results regarding the proprietorship rate presented in Tables 9 through 12 may shed more insight on the impact of age distribution on proprietorship formation.

There was a consistent positive relationship between natural amenities and growth in the number of proprietorships. The number of proprietorships grew more in regions with more temperate weather, sunnier Januaries, and better access to water. The magnitude of coefficients, however, tended to decline over time. That is, the coefficients on the climate variables were lower in more recent time periods.

Industry mix and region size variables also influenced the rate of growth but there were few consistent patterns. The largest urban LMAs experienced higher growth in the number of proprietorships than small nonmetropolitan areas (and it appears, all other metro and nonmetro LMAs) up until around 1990, but this phenomenon was not evident in the 1990s or 2000s. Regions with a higher share of initial construction employment consistently experienced higher growth in the number of proprietorships, but this again may simply reflect continuity of growth in regions over the decades.

The 722 LMAs included in our regressions in Table 5 include a diverse set of regional economies ranging from small nonmetropolitan LMAs with just a few thousand in population to large metropolitan areas encompassing portions of the New York Metropolitan Area. An F-Test for constant coefficients across LMA types rejected pooling of the data across metropolitan and nonmetropolitan LMAs at the 1 percent significance level. This result suggests that factors affect metropolitan and nonmetropolitan areas in different ways. Therefore, in Tables 6 and 7 below, we break the sample into metropolitan and nonmetropolitan LMAs to see whether the same factors influence self-employment trends in both sets of regions. Recall that there were 256 metropolitan LMAs and 466 nonmetropolitan LMAs.

Results in Table 6 pertain to a regression using data from the 256 metropolitan LMAs. Results are quite similar to what was found for all LMAs in Table 5. The regional characteristics associated with faster growth in the number of proprietorships are the same: lower initial per capita income, higher wealth, and a large share of population aged 20 to 44. The same is true for the regression results using data from the 466 nonmetropolitan LMAs (Table 7). The same regional characteristics are related to growth.

Table 6
Factors Influencing Growth in Number of Proprietorships
In Metropolitan Labor Market Areas

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	-3.8607	-1.2437	-0.9608	-0.3664	1.1693
ln (Proprietorship Number$_{t-1}$)	-0.0462	-0.0243	0.0159	-0.0003	0.0064
ln(percent college graduates$_{t-1}$)	-0.0017	0.0099	0.1174 **	-0.0671	0.0236
ln (Per capita income$_{t-1}$)	-1.6862 ***	-0.4470 ***	-0.2871 *	-0.5899 ***	-0.1467
ln (Unemployment Rate$_{t-1}$)	-0.2159 ***	0.0133	-0.1139 ***	-0.1107 ***	-0.1064 ***
ln (DIR per capita$_{t-1}$)	0.5580 ***	0.2842 ***	-0.1360	0.2428 ***	0.0518
ln (Percent Military Jobs$_{t-1}$)	-0.0622 **	-0.0263 **	-0.0174	-0.0095	-0.0201 ***
ln (Percent female$_{t-1}$)	0.6061	0.3174	-0.0250	0.3449	-0.9816 **
ln (Percent white$_{t-1}$)	0.4211 **	0.1606 *	0.1111	-0.0381	-0.0597
ln (Percent age 20 to 44$_{t-1}$)	0.8476 *	0.2027	0.7052 ***	-0.0075	0.1807
ln (Percent age 45 to 64$_{t-1}$)	0.0455	-0.3961 ***	0.5474 ***	0.1104	0.0542
ln (Percent age 65 and over$_{t-1}$)	-0.3725 **	0.0358	-0.0761	-0.3093 ***	0.0139
ln (Ruggedness)	0.0208	0.0110	0.0099	0.0100	-0.0024
ln (July Humidity)	-0.2801 ***	-0.0843 **	-0.0995 **	-0.0610 *	-0.0063
ln (Sunny hours in January)	0.2584 ***	0.1456 ***	0.0639	0.0757 **	-0.0098
ln (Access to water)	0.0558 ***	0.0141 **	0.0203 ***	0.0036	0.0127 ***
ln (Mean January temperature)	0.1840 **	0.1335 ***	0.0532	0.0791 ***	-0.0359 *
ln (Mean July temperature)	-0.8145	-0.4583 **	-0.3382	-0.1353	0.4376 ***
ln (Percent agriculture jobs$_{t-1}$)	0.0172	-0.0049	0.0164	-0.0054	-0.0382 ***
ln (Percent mining jobs$_{t-1}$)	-0.0575 ***	-0.0097	-0.0045	-0.0304 ***	-0.0298 ***
ln (Percent construction jobs$_{t-1}$)	0.2920 ***	0.1611 ***	0.0705 *	0.0245	0.1349 ***
ln (Percent manufacturing jobs$_{t-1}$)	-0.1064 **	-0.0663 ***	-0.0277	-0.0158	-0.0456 ***
ln (Percent transportation & utility jobs$_{t-1}$)	-0.0239	-0.0174	-0.0245	0.0624 **	-0.0123
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0587	0.0308	-0.0859 **	-0.0566 *	-0.0162
ln (Percent retail trade jobs$_{t-1}$)	-0.6624 ***	-0.2442 **	0.1542	0.0334	0.0087
ln (Percent FIRE jobs$_{t-1}$)	0.1093	-0.0380	-0.0278	0.0031	-0.0634 **
ln (Percent service jobs$_{t-1}$)	0.4095 ***	0.1095 *	0.0129	0.1272 *	-0.0509
Mid-size metropolitan labor market area	-0.0021	0.0073	-0.0095	0.0315 **	0.0126
Large metropolitan labor market area	0.1605 ***	0.0355 **	0.0519 ***	0.0154	0.0145
N	256	256	256	256	256
Adjusted R-square	0.612	0.617	0.396	0.356	0.422

*** = significant at 1% level, **=significant at 5%, *=significant at 10%
Note: For a description of the variables see Section 8, Data Appendix.
Source: Authors' calculation.

The influence of initial educational attainment on proprietorship growth appeared to be stronger in nonmetropolitan areas. In nonmetropolitan areas, the coefficient on the initial education variables was positive and statistically significant during the 1970–2006 period. The coefficient was positive in all decades and was statistically significant during the 1990s. In metropolitan areas, the sign of the coefficient on initial education varied from period to period and was rarely statistically significant. A higher share of college graduates was consistently associated with higher growth in the number of proprietorships only in nonmetropolitan areas.

Table 7
Factors Influencing Growth in Number of Proprietorships
In Nonmetropolitan Labor Market Areas

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	2.3929	2.3002	-1.3272	4.0968 **	0.2921
ln (Proprietorship Number$_{t-1}$)	-0.0168	0.0011	0.0160	-0.0085	0.0135
ln(percent college graduates$_{t-1}$)	0.0370 ***	0.0062	0.0077	0.0179 ***	0.0022
ln (Per capita income$_{t-1}$)	-1.1423 ***	-0.4011 ***	-0.1170 *	-0.1954 **	-0.1940 ***
ln (Unemployment Rate$_{t-1}$)	0.0076	0.0043	-0.0475 **	-0.0310	-0.0499 ***
ln (DIR per capita$_{t-1}$)	0.4579 ***	0.2158 ***	-0.0810	0.0025	0.0957 ***
ln (Percent Military Jobs$_{t-1}$)	-0.0124	-0.0011	-0.0183	0.0291 **	-0.0085
ln (Percent female$_{t-1}$)	0.6237	-0.2037	0.2387	-0.1745	-0.2829
ln (Percent white$_{t-1}$)	0.2708 **	0.1836 ***	0.0906	0.0279	-0.1487 ***
ln (Percent age 20 to 44$_{t-1}$)	0.5215 *	0.2900 **	0.3990 **	-0.0858	0.1210
ln (Percent age 45 to 64$_{t-1}$)	0.0779	-0.0266	0.2008	0.0069	0.1519 **
ln (Percent age 65 and over$_{t-1}$)	-0.3193 **	-0.1042 *	-0.0592	-0.0739	-0.1127 ***
ln (Ruggedness)	0.0202	-0.0017	-0.0013	0.0127	0.0095
ln (July Humidity)	-0.2239 ***	-0.1076 ***	-0.1333 ***	-0.0924 ***	0.0389 *
ln (Sunny hours in January)	0.2754 ***	0.0938 **	-0.0711	0.0988 **	0.0046
ln (Access to water)	0.0544 ***	0.0243 ***	0.0061	0.0123 **	0.0127 ***
ln (Mean January temperature)	0.2446 ***	0.0934 ***	0.0336	0.0170	-0.0094
ln (Mean July temperature)	-2.2113 ***	-0.9626 ***	-0.0212	-0.4045 **	0.0105
ln (Percent agriculture jobs$_{t-1}$)	-0.0517 **	-0.0136	-0.0072	-0.0072	-0.0079
ln (Percent mining jobs$_{t-1}$)	-0.0008	0.0035 *	-0.0009	-0.0028	-0.0033 **
ln (Percent construction jobs$_{t-1}$)	0.2292 ***	0.0941 ***	0.0411	0.1297 ***	0.0522 ***
ln (Percent manufacturing jobs$_{t-1}$)	0.0698 ***	0.0245 **	-0.0072	0.0436 ***	-0.0054
ln (Percent transportation & utility jobs$_{t-1}$)	-0.1641 ***	-0.0066	-0.0562 **	-0.0406 *	-0.0201
ln (Percent retail trade jobs$_{t-1}$)	-0.3046 ***	-0.2137 ***	-0.1449 **	0.2093 ***	0.0759 **
ln (Percent FIRE jobs$_{t-1}$)	0.0364	-0.0144	0.0500	0.0310	-0.0438 *
ln (Percent service jobs$_{t-1}$)	0.1191	0.0687 *	0.0417	-0.0439	-0.0376
Mid-size nonmetropolitan labor market area	0.0697	0.0324	0.0259	0.0118	-0.0340 **
Large nonmetropolitan labor market area	0.1360 *	0.0494	0.0223	0.0209	-0.0364 *
N	466	466	466	466	466
Adjusted R-square	0.547	0.521	0.291	0.285	0.267

*** = significant at 1% level, **=significant at 5%, *=significant at 10%
Note: For a description of the variables see Section 8, Data Appendix.
Source: Authors' calculation.

A key difference between metropolitan and nonmetropolitan areas was found in the influence of the initial unemployment rate. We did not find a strong negative relationship between initial unemployment rate and growth in the number proprietorships among nonmetropolitan LMAs. In metropolitan LMAs, there was a negative and statistically significant value for the coefficient on initial unemployment rate for the entire 1970–2006 period, and for most individual decades. In nonmetropolitan LMAs, there was no consistent relationship between initial unemployment and subsequent growth in

number of proprietorships. There was a negative and statistically significant relationship in two decades, the 1980s and 2000s, but the magnitude of the coefficients remained less than half as large as in metropolitan areas. High unemployment rates in a regional economy, after controlling for factors such as education, wealth, and industry mix, can be indicative of less flexible, less adaptive workforce, or of a region with persistent challenges in terms of job growth. Both regional characteristics would be expected to retard growth in regions, including growth in the number of proprietorships. This relationship is evident only within metropolitan LMAs.

Industrial structure also had a differing influence on the regional growth rate for the number of proprietorships, particularly for manufacturing. A higher percentage of manufacturing employment was associated with lower growth in the number of proprietorships in metropolitan LMAs, but higher growth in nonmetropolitan LMAs. This difference may reflect the diffusion of the manufacturing sector within the United States as manufacturing activity has been moving away from large metropolitan areas and toward nonmetropolitan areas. Initial manufacturing employment would therefore be negative for growth in metropolitan and positive in nonmetropolitan areas.

Due to concerns about endogeneity, we used initial educational attainment as a measure of college attainment in our analysis in Table 5 through 7. In Table 8, we utilize another set of measures of human capital within LMAs, number of colleges and universities and local government education spending as a share of income (Hammond and Thompson, 2004). Results are presented in Table 8 for all LMAs. Generally speaking, coefficient estimates for most variables in the regression model are unchanged, or change very little. But, we find different results for the new education variables. In particular, we identify a negative relationship between local government spending on education, which is significantly different from zero in the 1970s and 1990s, and growth in the number of proprietorships. For the 36-year period, we find a positive, but insignificant correlation between universities and proprietorship growth. However, the coefficient on universities (which is negative and significant during the 1970s) becomes positive and significant by the 2000–2006 period. This suggests that human capital may be becoming a more important determinant of growth in the number of proprietorships over time.

For metropolitan areas during the 2000–2006 period (presented in Appendix Table A.1) we find that local government spending is significantly (and positively) correlated with proprietorship growth, while the presence of universities is not significant, but positive. For nonmetropolitan regions, the results differ markedly. We find that local government education spending is not significant, but we also find that universities are positive and significant for this most recent period. Overall, the results suggest that different forces may be at work in metropolitan and nonmetropolitan regions. For instance, it is possible that top students from nonmetropolitan areas tend to locate in metropolitan areas to expand their

Table 8

Alternative Education Instrument Variables and Other Factors Influencing Growth in Number of Proprietorships

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	-0.6484	0.7840	-1.0865	3.3854 **	0.5372
ln (Proprietorship Number$_{t-1}$)	-0.0305	0.0002	0.0171	0.0023	0.0111
ln (Local educ spending$_{t-1}$)	-0.0904	-0.0994 ***	-0.0238	-0.1266 ***	-0.0018
ln(University Count$_{-1}$)	0.0000	-0.0017 ***	0.0004	0.0001	0.0011 ***
ln (Per capita income$_{t-1}$)	-1.3286 ***	-0.5401 ***	-0.1618 ***	-0.2984 ***	-0.2069 ***
ln (Unemployment Rate$_{t-1}$)	0.0073	0.0053	-0.0473 ***	-0.0348 *	-0.0547 ***
ln (DIR per capita$_{t-1}$)	0.5291 ***	0.2701 ***	-0.0708	0.0443	0.0973 ***
ln (Percent Military Jobs$_{t-1}$)	-0.0164	-0.0040	-0.0157 *	0.0136	-0.0152 ***
ln (Percent female$_{t-1}$)	0.9525	0.1733	0.1314	0.0883	-0.4263 **
ln (Percent white$_{t-1}$)	0.2635 **	0.1924 ***	0.1150 **	-0.0033	-0.1253 ***
ln (Percent age 20 to 44$_{t-1}$)	0.6798 ***	0.2758 **	0.4573 ***	-0.2395 *	0.1337 *
ln (Percent age 45 to 64$_{t-1}$)	-0.0402	-0.2222 **	0.2330 **	-0.0439	0.1635 ***
ln (Percent age 65 and over$_{t-1}$)	-0.3431 ***	-0.0725	-0.0740	-0.1661 ***	-0.1053 ***
ln (Ruggedness)	0.0093	-0.0073	0.0008	0.0052	-0.0001
ln (July Humidity)	-0.2296 ***	-0.1138 ***	-0.1204 ***	-0.0801 ***	0.0307 *
ln (Sunny hours in January)	0.3181 ***	0.1347 ***	0.0002	0.0998 ***	0.0042
ln (Access to water)	0.0627 ***	0.0245 ***	0.0126 ***	0.0100 **	0.0144 ***
ln (Mean January temperature)	0.2509 ***	0.1152 ***	0.0487 **	0.0230	-0.0154
ln (Mean July temperature)	-1.8439 ***	-0.9619 ***	-0.1501	-0.3802 ***	0.0854
ln (Percent agriculture jobs$_{t-1}$)	-0.0314	-0.0023	0.0049	-0.0017	-0.0116 *
ln (Percent mining jobs$_{t-1}$)	-0.0025	0.0027	-0.0008	-0.0036 **	-0.0044 ***
ln (Percent construction jobs$_{t-1}$)	0.2562 ***	0.1052 ***	0.0497 **	0.1081 ***	0.0582 ***
ln (Percent manufacturing jobs$_{t-1}$)	0.0485 **	0.0105	-0.0154	0.0294 ***	-0.0131 *
ln (Percent transportation & utility jobs$_{t-1}$)	-0.1183 ***	0.0106	-0.0534 ***	-0.0203	-0.0193 *
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0636 **	-0.0391 ***	-0.0651 ***	-0.0420 ***	0.0016
ln (Percent retail trade jobs$_{t-1}$)	-0.3953 ***	-0.2604 ***	-0.1152 **	0.1831 ***	0.0647 **
ln (Percent FIRE jobs$_{t-1}$)	0.1134 **	0.0041	0.0293	0.0445 *	-0.0313 *
ln (Percent service jobs$_{t-1}$)	0.2012 ***	0.1038 ***	0.0471	-0.0264	-0.0461 *
Mid-size nonmetropolitan labor market area	-0.0193	0.0182	-0.0019	-0.0088	-0.0326 ***
Large nonmetropolitan labor market area	-0.0407	0.0182	-0.0358 *	-0.0127	-0.0355 ***
Small metropolitan labor market area	-0.0512	0.0163	-0.0268	-0.0336 *	-0.0286 **
Mid-size metropolitan labor market area	-0.0044	0.0268	-0.0293	0.0010	-0.0027
Large metropolitan labor market area	0.0880 ***	0.0243 **	0.0326 ***	0.0062	-0.0022
N	722	722	722	722	722
Adjusted R-square	0.586	0.554	0.407	0.277	0.328

*** = significant at 1% level, **=significant at 5%, *=significant at 10%

Note: For a description of the variables see Section 8, Data Appendix.

Source: Authors' calculation.

employment options after completing high school or college. Thus, additional education spending in these areas might improve student outcomes but do little positive for local economic growth. That is, the social benefits from higher quality education do not necessarily accrue to the region where the spending occurred as workers migrate to more metropolitan areas for increased employment opportunities, a

phenomenon sometimes referred to as "brain drain." For brevity, these results are presented in the Appendix in Tables A.1 and A.2. Once again, an F-Test for constant coefficients across LMA types rejected pooling of the data across metropolitan and nonmetropolitan LMAs at the 1 percent significance level. This result suggests that factors affect metropolitan and nonmetropolitan areas in different ways.

3. Proprietorship Share

We have examined factors that influence the growth in number of proprietorships within LMAs. But, these same factors also could be critical for growth in wage-and-salary employment. A separate question is, What factors are particularly beneficial to entrepreneurship, that is, would raise the share of self-employment in the workforce? This can be measured by examining factors that contribute to the growth of the proprietorship share. The proprietorship share increases if the number of proprietorships grows at a higher rate than the rate of wage-and-salary employment. The proprietorship share also increases if a factor decreases wage-and-salary employment at a greater rate than it decreases the proprietorship rate. Thus, for factors that have a positive effect on employment growth, we are looking to identify those that have a disproportionately large effect on proprietors and for factors with a negative effect we are looking for factors with less of an impact on proprietors.

We now examine how factors such as education, per capita income, unemployment rate, wealth, demographic characteristics, and industry mix influence the growth in the share of proprietorships. In the analysis, we substitute the initial *share* of proprietorships for the initial *number* of proprietorships. The coefficient on this variable shows whether LMAs with a lower initial share of proprietorships tend to have higher or lower growth in proprietor shares. Recall that analysis earlier in the report found that LMAs with lower initial proprietorship shares tended to "catch up" to other LMAs through higher growth in proprietorship shares in the subsequent period. We now examine whether this trend holds after accounting for educational attainment and other factors that may influence growth in proprietorship shares.

As before, our initial analysis focuses on pooled results for all 722 LMAs in the contiguous U.S. states. Many factors influence the growth in proprietorship share for the full period from 1970 through 2006, and for the four component decades (Table 9). In Tables 10 and 11, the model is rerun for metropolitan and then nonmetropolitan LMAs. We again substitute the local education spending and university count measures for the initial human capital measure—percent college graduates (Table 12).

Results for educational attainment differed significantly from those in Table 5. We found variation over time in the influence of educational attainment on growth in the proprietorship share (Table 9). For the entire 1970–2006 period, the coefficient on the initial college attainment variable was close to

zero and was not statistically significant. In the individual decades, the coefficient on initial college attainment was negative during the 1970s, but positive and significant during the 1990s, and then insignificant during the 2000–2006 period. This is very different than the results displayed in Table 5, where we found a consistent positive relationship between initial college attainment and subsequent growth in the number of proprietorships. These results may suggest that educational attainment is a critical factor in spurring job growth, including growth in proprietorships, but that education may not generate stronger growth in the number of proprietorships than in the number of wage-and-salary jobs.

Results indicate a strong negative relationship between the initial proprietorship share and subsequent growth in proprietorship share. Such a negative relationship is sometimes interpreted as evidence of convergence—i.e., an increase in similarity of rates across all regions (Table 9). However, it also could simply indicate reversion to the mean within a stable distribution. That is, regions can move past one another upward or downward within the distribution but the total variation in proprietorship share distribution changes little. In other words, there could be intra-distributional mobility but no convergence. In this scenario, a negative coefficient on the initial proprietors share is not evidence of convergence among the regions. Rather, regions that happen to experience a drop in entrepreneurship share in the initial year are likely to exhibit a higher growth in the share in later years. Similarly, regions that happened to exhibit a higher share of proprietors in the initial year would have a lower growth in the share in a later year. In this scenario, regions that are above the mean tend to have downward movements and regions below the mean tend to have upward movements creating a negative relationship between previous period share.

Coefficients are estimated for our other control variables (Table 9). We anticipate that coefficient estimates for many variables will change from what was found for growth in the number of proprietorships. This is because we are now examining what factors cause proprietorships to grow relative to wage-and-salary employment, rather than examining what factors cause higher regional employment growth in general, as measured by growth in the number of proprietorships.

However, results in Table 9 for growth in the proprietorship share are quite similar to what was found in Table 5 for growth in the number of proprietorships. Generally, the same variables that contributed to growth in the number of proprietorships also contributed to growth in the proprietorship share. However, the magnitude of that contribution was typically smaller and less consistent. Coefficient values had the same sign but were substantially smaller and more often were not statistically significant. The results seem to suggest that both proprietorship and wage-and-salary employment were sensitive to these growth determinants, but that proprietorships were more sensitive. Thus, factors such as initial wealth, natural amenities, and selected demographic characteristics of LMAs encouraged growth in all

Table 9
Factors Influencing Growth in Proprietorship Share

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	1.1390	1.1419	0.9710	2.8229 **	0.7630
ln (Proprietor Share$_{t-1}$)	-0.6311 ***	-0.3015 ***	-0.3186 ***	-0.2032 ***	-0.1542 ***
ln(percent college graduates$_{t-1}$)	0.0047	-0.0071 *	0.0019	0.0084 **	-0.0014
ln (Per capita income$_{t-1}$)	-0.1933 ***	0.0211	0.0040	-0.0528	-0.0647
ln (Unemployment Rate$_{t-1}$)	-0.0087 **	0.0028	-0.0825 ***	-0.0177	-0.0450 ***
ln (DIR per capita$_{t-1}$)	0.1295 ***	0.0677 **	-0.0637 *	-0.0031	0.0264
ln (Percent Military Jobs$_{t-1}$)	0.0247 **	0.0246 ***	-0.0126 *	0.0262 ***	-0.0136 ***
ln (Percent female$_{t-1}$)	-0.0198	-0.1551	0.4114	-0.2949	-0.2447
ln (Percent white$_{t-1}$)	0.1746 ***	0.1949 ***	0.1374 ***	0.0201	-0.1081 ***
ln (Percent age 20 to 44$_{t-1}$)	-0.0166	-0.0258	0.0118	-0.0613	0.1103 *
ln (Percent age 45 to 64$_{t-1}$)	0.4409 ***	-0.0631	0.0856	0.2610 ***	0.2235 ***
ln (Percent age 65 and over$_{t-1}$)	-0.1304 ***	0.0928 ***	0.0188	-0.0068	-0.0218
ln (Ruggedness)	-0.0012	-0.0083	0.0075	0.0041	-0.0062
ln (July Humidity)	-0.0088	-0.0154	-0.0993 ***	-0.0399 **	0.0351 ***
ln (Sunny days in January)	0.0632 **	0.0074	-0.0558 **	0.0794 ***	0.0003
ln (Access to water)	0.0028	0.0029	0.0033	0.0042	0.0060 ***
ln (Mean January temperature)	0.0540 ***	0.0502 ***	0.0228	0.0217 *	-0.0094
ln (Mean July temperature)	-0.4697 ***	-0.2988 ***	-0.2031 *	-0.4226 ***	-0.0679
ln (Percent agriculture jobs$_{t-1}$)	0.0060	0.0032	0.0092	0.0188 **	-0.0073
ln (Percent mining jobs$_{t-1}$)	0.0008	-0.0038 ***	0.0047 ***	0.0018	-0.0030 ***
ln (Percent construction jobs$_{t-1}$)	0.0509 ***	0.0462 ***	0.0371 **	-0.0060	0.0158
ln (Percent manufacturing jobs$_{t-1}$)	0.0083	0.0076	-0.0302 ***	0.0044	0.0082
ln (Percent transportation & utility jobs$_{t-1}$)	-0.0509 ***	-0.0300 **	0.0135	-0.0175	-0.0197 **
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0410 ***	-0.0377 ***	-0.0154	-0.0380 ***	-0.0002
ln (Percent retail trade jobs$_{t-1}$)	-0.1205 **	-0.1094 ***	-0.1343 ***	-0.0180	0.0196
ln (Percent FIRE jobs$_{t-1}$)	-0.0050	0.0115	0.0109	0.0227	-0.0157
ln (Percent service jobs$_{t-1}$)	-0.0183	-0.0186	-0.0275	-0.0518 *	-0.0165
Mid-size nonmetropolitan labor market area	-0.0812 ***	-0.0233 **	-0.0206	-0.0055	-0.0406 ***
Large nonmetropolitan labor market area	-0.0889 ***	-0.0031	-0.0405 **	-0.0143	-0.0456 ***
Small metropolitan labor market area	-0.0833 ***	-0.0060	-0.0289 *	-0.0291 **	-0.0395 ***
Mid-size metropolitan labor market area	-0.0651 ***	0.0045	-0.0435 **	-0.0126	-0.0224 *
Large metropolitan labor market area	-0.0217 **	-0.0164 ***	-0.0004	-0.0020	-0.0043
N	722	722	722	722	722
Adjusted R-square	0.593	0.543	0.41	0.270	0.328

*** = significant at 1% level, **=significant at 5%, *=significant at 10%
Note: For a description of the variables see Section 8, Data Appendix.
Source: Authors' calculation.

employment, but had the largest impact on the growth of both the number of proprietorships and the proprietorship share.

To give some specific examples, LMAs with a higher initial per capita income had lower growth in proprietorship share, just as these regions had lower growth in the number of proprietorships. But, the

size of the effect was much more muted. The magnitude of the coefficient on initial per capita income was significantly lower in the proprietorship share results in Table 9 than it was in Table 5. Further, the coefficient was only statistically significant in the equation for growth over the entire 1970–2006 span. Similarly, coefficients on the initial wealth variable had a much smaller magnitude in Table 9 than in Table 5. Coefficients on the natural amenity variables also were less often significant in the results for growth in proprietorship share in Table 9 than in Table 5.

In addition to the education variables discussed above, the biggest difference between the results for growth in the number of proprietorships and the proprietorship share was found for the military employment. A higher initial share of military employment had a positive influence on growth in the proprietorship share for the 1970–2006 period and in the 1970s and 1990s. This is consistent with the expectation that military personnel would have a proclivity towards entrepreneurship. By contrast, the variable had a neutral or negative influence on the growth in the number of proprietorships in most decades as seen in Table 5. These results suggest that regions with greater military employment may have slower growth in the amount of wages and salary employment but an average level of growth in proprietorships. As a result, there is average growth in the number of proprietorships but faster growth in the share of proprietorships in regions with a higher share of military employment. Finally, there was a negative relationship between military share and growth in entrepreneurship share in the 1980s and 2000s. This could be related to the military buildups that occurred during these decades.

Regressions were estimated for the model of growth in the proprietorship share using 256 metropolitan LMAs (Table 10) and 466 nonmetropolitan LMAs (Table 11). Again, an F-test rejected pooling of the data at the 1 percent significance level. Results are largely consistent between metropolitan and nonmetropolitan LMAs. However, the educational attainment variable, initial percent college graduates, is more consistently positive in the metropolitan LMAs. Its coefficient is frequently not significant but it is positive and statistically significant during the decade of the 1980s. The coefficient on percent college graduates is just as large for the full 1970–2006 period as it was during the 1980s, but that coefficient estimate is not statistically different than zero at the 10 percent confidence level.

For nonmetropolitan LMAs, the coefficient on educational attainment is close to zero and not statistically significant in the equation for the 1970–2006 period. The coefficient is negative and statistically significant during the 1970s and positive and statistically significant during the 1990s. But, all coefficient estimates are much smaller than the estimates for metropolitan LMAs in Table 10. Generally speaking, we found more evidence that educational attainment contributes to growth in the proprietorship share in metropolitan areas. Interestingly, this result is the mirror image of what was found for growth in the number of proprietorships. We found a strong positive relationship between initial education and

Table 10
Factors Influencing Growth in Proprietorship Share in Metropolitan Labor Market Areas
In Metropolitan Labor Market Areas

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	4.5275 *	3.4899 **	1.3309	3.1793 *	3.8462 **
ln (Proprietorship Share$_{t-1}$)	-0.4745 ***	-0.2365 ***	-0.2587 ***	-0.1537 ***	-0.1455 ***
ln(percent college graduates$_{t-1}$)	0.0673	-0.0084	0.0776 *	-0.0144	0.0368
ln (Per capita income$_{t-1}$)	-0.3756 ***	-0.0474	0.1165	0.0042	0.0652
ln (Unemployment Rate$_{t-1}$)	-0.0523	0.0392 *	-0.0982 ***	0.0083	-0.0678 **
ln (DIR per capita$_{t-1}$)	0.1683 *	0.0896	-0.1367 *	0.0044	-0.0787 *
ln (Percent Military Jobs$_{t-1}$)	0.0242 **	0.0175 **	-0.0008	0.0105	-0.0064
ln (Percent female$_{t-1}$)	-1.1964 **	-0.9659 **	0.3578	-0.1602	-0.9242 **
ln (Percent white$_{t-1}$)	0.1886 **	0.1523 **	0.0754	-0.0122	-0.0615
ln (Percent age 20 to 44$_{t-1}$)	0.1128	0.1275	0.1485	-0.2682 *	-0.0069
ln (Percent age 45 to 64$_{t-1}$)	0.3905 **	-0.2359 **	0.2734 **	0.0895	0.1454 *
ln (Percent age 65 and over$_{t-1}$)	-0.2384 ***	0.1293 ***	0.0033	-0.1345 **	-0.0061
ln (Ruggedness)	-0.0242 **	-0.0056	-0.0061	0.0083	-0.0129 **
ln (July Humidity)	-0.0084	-0.0009	-0.0884 ***	0.0230	0.0167
ln (Sunny days in January)	0.0518	0.0545 **	-0.0045	0.0613 **	-0.0067
ln (Access to water)	0.0126 **	0.0017	0.0065	-0.0052	0.0061 *
ln (Mean January temperature)	0.0350	0.0576 ***	0.0293	0.0594 ***	-0.0164
ln (Mean July temperature)	-0.4699 **	-0.2710 *	-0.5265 ***	-0.4243 ***	0.0546
ln (Percent agriculture jobs$_{t-1}$)	-0.0093	-0.0217 **	0.0104	0.0091	-0.0315 ***
ln (Percent mining jobs$_{t-1}$)	0.0168 **	-0.0043	0.0331 ***	-0.0100 *	-0.0098 **
ln (Percent construction jobs$_{t-1}$)	-0.0467	-0.0051	0.0299	0.0310	0.0555 **
ln (Percent manufacturing jobs$_{t-1}$)	0.0469 **	-0.0073	0.0063	-0.0124	0.0237 *
ln (Percent transportation & utility jobs$_{t-1}$)	0.0268	-0.0156	-0.0078	0.0258	-0.0223
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0919 ***	-0.0227	-0.0167	-0.0516 **	-0.0265
ln (Percent retail trade jobs$_{t-1}$)	-0.4253 ***	-0.1235 *	0.0207	-0.0479	-0.0244
ln (Percent FIRE jobs$_{t-1}$)	0.0045	0.0094	-0.0731 *	-0.0358	-0.0178
ln (Percent service jobs$_{t-1}$)	0.0911	0.0166	-0.0366	0.0525	0.0292
Mid-size metropolitan labor market area	-0.0209	0.0080	-0.0220 *	0.0042	-0.0025
Large metropolitan labor market area	0.0233 *	-0.0128	0.0136	0.0041	0.0057
N	256	256	256	256	256
Adjusted R-square	0.743	0.450	0.509	0.338	0.608

*** = significant at 1% level, **=significant at 5%, *=significant at 10%
Note: For a description of the variables see Section 8, Data Appendix.
Source: Authors' calculation.

growth in the number of proprietorships in nonmetropolitan areas, but less so in metropolitan areas (Tables 6 and 7). Taken together, our results suggest that initial education has a similar positive impact on growth in both proprietorships and wage-and-salary employment in nonmetropolitan areas but in metropolitan areas initial education may have a larger influence on proprietorship growth than on growth in wage-and-salary employment. We again re-estimated the all LMA model using the two alternative measures for human capital: 1) local government spending on education and 2) the number of colleges

and universities (Table 12). We again found weaker support for the importance of education to proprietorship growth when using these instrumental variables. Similar estimates are reported for metropolitan and nonmetropolitan LMAs in Appendix Tables A.3 and A.4.

Table 11
Factors Influencing Growth in Proprietorship Share
In Nonmetropolitan Labor Market Areas

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	0.6754	0.0806	1.5617	3.0881 **	0.0623
ln (Proprietorship Share$_{t-1}$)	-0.7027 ***	-0.3273 ***	-0.3952 ***	-0.2321 ***	-0.1340 ***
ln(percent college graduates$_{t-1}$)	0.0011	-0.0081 *	0.0001	0.0074 *	-0.0021
ln (Per capita income$_{t-1}$)	-0.1750 **	0.0529	-0.0397	-0.0210	-0.0761
ln (Unemployment Rate$_{t-1}$)	-0.0069	0.0019	-0.0693 ***	-0.0170	-0.0310 **
ln (DIR per capita$_{t-1}$)	0.1167 **	0.0590	-0.0544	-0.0315	0.0456
ln (Percent Military Jobs$_{t-1}$)	0.0370 **	0.0205 *	-0.0204 *	0.0310 ***	-0.0139 *
ln (Percent female$_{t-1}$)	0.3087	0.1649	0.2772	-0.4281	-0.1110
ln (Percent white$_{t-1}$)	0.1844 ***	0.2092 ***	0.1537 ***	0.0256	-0.1129 ***
ln (Percent age 20 to 44$_{t-1}$)	-0.0597	-0.1006	0.0702	0.0441	0.1126
ln (Percent age 45 to 64$_{t-1}$)	0.4549 ***	-0.0191	0.0230	0.2805 ***	0.2079 ***
ln (Percent age 65 and over$_{t-1}$)	-0.0581	0.0857 *	0.0841	0.0745	-0.0037
ln (Ruggedness)	0.0032	-0.0100	0.0087	0.0079	-0.0028
ln (July Humidity)	-0.0281	-0.0024	-0.1105 ***	-0.0706 ***	0.0394 **
ln (Sunny days in January)	0.0893 **	-0.0090	-0.0706 **	0.0911 ***	0.0167
ln (Access to water)	0.0024	0.0041	0.0005	0.0051	0.0067 **
ln (Mean January temperature)	0.0684 ***	0.0514 ***	0.0153	0.0084	-0.0019
ln (Mean July temperature)	-0.6265 ***	-0.3085 **	-0.1498	-0.4592 ***	-0.1109
ln (Percent agriculture jobs$_{t-1}$)	0.0210	0.0120	0.0182 *	0.0215 **	-0.0003
ln (Percent mining jobs$_{t-1}$)	0.0003	-0.0035 **	0.0030 **	0.0018	-0.0027 **
ln (Percent construction jobs$_{t-1}$)	0.0566 **	0.0517 ***	0.0344 *	-0.0184	0.0173
ln (Percent manufacturing jobs$_{t-1}$)	0.0110	0.0090	-0.0385 ***	0.0028	0.0075
ln (Percent transportation & utility jobs$_{t-1}$)	-0.0653 ***	-0.0390 ***	0.0189	-0.0275 *	-0.0164
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0376 **	-0.0482 ***	-0.0184	-0.0452 ***	0.0048
ln (Percent retail trade jobs$_{t-1}$)	-0.0645	-0.0842 **	-0.1514 ***	-0.0171	0.0276
ln (Percent FIRE jobs$_{t-1}$)	-0.0046	-0.0060	0.0620 **	0.0412	-0.0390 **
ln (Percent service jobs$_{t-1}$)	-0.0199	-0.0255	-0.0376	-0.0866 **	-0.0223
Mid-size nonmetropolitan labor market area	-0.0925 ***	-0.0312 *	-0.0269	-0.0050	-0.0388 ***
Large nonmetropolitan labor market area	-0.1191 ***	-0.0200	-0.0559 **	-0.0175	-0.0420 ***
N	466	466	466	466	466
Adjusted R-square	0.592	0.562	0.383	0.218	0.353

*** = significant at 1% level, **=significant at 5%, *=significant at 10%
Note: For a description of the variables see Section 8, Data Appendix.
Source: Authors' calculation.

Table 12

Alternative Education Instrument Variables and Other Factors Influencing Growth in Proprietorship Share

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	1.1180	1.2140	0.8212	3.0790 ***	0.6482
ln (Proprietorship Share$_{t-1}$)	-0.6388 ***	-0.2984 ***	-0.3200 ***	-0.2018 ***	-0.1532 ***
ln (Local educ spending$_{t-1}$)	0.0287	-0.0318	0.0396 *	-0.0323 *	-0.0128
ln(University Count$_{-1}$)	-0.0006	-0.0003	-0.0003	-0.0003	0.0004
ln (Per capita income$_{t-1}$)	-0.1900 ***	0.0121	0.0103	-0.0602	-0.0686
ln (Unemployment Rate$_{t-1}$)	-0.0086 **	0.0027	-0.0846 ***	-0.0161	-0.0447 ***
ln (DIR per capita$_{t-1}$)	0.1293 ***	0.0655 **	-0.0608 *	-0.0026	0.0248
ln (Percent Military Jobs$_{t-1}$)	0.0253 ***	0.0234 ***	-0.0102	0.0248 ***	-0.0147 ***
ln (Percent female$_{t-1}$)	-0.0394	-0.1508	0.3632	-0.2995	-0.1883
ln (Percent white$_{t-1}$)	0.1668 ***	0.2027 ***	0.1428 ***	0.0123	-0.1066 ***
ln (Percent age 20 to 44$_{t-1}$)	0.0476	-0.0620	0.0736	-0.0805	0.0748
ln (Percent age 45 to 64$_{t-1}$)	0.4354 ***	-0.0719	0.0821	0.2289 ***	0.2235 ***
ln (Percent age 65 and over$_{t-1}$)	-0.1044 **	0.0792 **	0.0396	-0.0082	-0.0293
ln (Ruggedness)	-0.0014	-0.0080	0.0084	0.0042	-0.0067
ln (July Humidity)	-0.0100	-0.0127	-0.0967 ***	-0.0403 **	0.0346 ***
ln (Sunny days in January)	0.0581 *	0.0127	-0.0601 **	0.0810 ***	0.0017
ln (Access to water)	0.0027	0.0026	0.0035	0.0035	0.0063 ***
ln (Mean January temperature)	0.0537 ***	0.0493 ***	0.0240	0.0210 *	-0.0098
ln (Mean July temperature)	-0.4632 ***	-0.3189 ***	-0.1627	-0.4612 ***	-0.0646
ln (Percent agriculture jobs$_{t-1}$)	0.0045	0.0049	0.0065	0.0199 **	-0.0072
ln (Percent mining jobs$_{t-1}$)	0.0009	-0.0040 ***	0.0046 ***	0.0020	-0.0030 ***
ln (Percent construction jobs$_{t-1}$)	0.0525 ***	0.0445 ***	0.0373 **	-0.0082	0.0162
ln (Percent manufacturing jobs$_{t-1}$)	0.0092	0.0063	-0.0271 ***	0.0026	0.0072
ln (Percent transportation & utility jobs$_{t-1}$)	-0.0512 ***	-0.0285 **	0.0124	-0.0189	-0.0189 **
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0405 ***	-0.0374 ***	-0.0151	-0.0386 ***	-0.0004
ln (Percent retail trade jobs$_{t-1}$)	-0.1217 **	-0.1085 ***	-0.1419 ***	-0.0139	0.0196
ln (Percent FIRE jobs$_{t-1}$)	0.0002	0.0069	0.0152	0.0193	-0.0169
ln (Percent service jobs$_{t-1}$)	-0.0122	-0.0211	-0.0195	-0.0514 *	-0.0236
Mid-size nonmetropolitan labor market area	-0.0802 ***	-0.0225 *	-0.0206	-0.0063	-0.0411 ***
Large nonmetropolitan labor market area	-0.0869 ***	-0.0034	-0.0401 **	-0.0142	-0.0472 ***
Small metropolitan labor market area	-0.0797 ***	-0.0067	-0.0277 *	-0.0278 **	-0.0418 ***
Mid-size metropolitan labor market area	-0.0616 ***	0.0030	-0.0414 **	-0.0130	-0.0246 *
Large metropolitan labor market area	-0.0203 **	-0.0149 **	0.0007	0.0000	-0.0051
N	722	722	722	722	722
Adjusted R-square	0.672	0.505	0.405	0.215	0.445

*** = significant at 1% level, **=significant at 5%, *=significant at 10%

Note: For a description of the variables see Section 8, Data Appendix.

Source: Authors' calculation.

4. Summary

There were several patterns that emerged from the large set of regression results presented in Tables 5 through 12. We found a consistent positive relationship between wealth and growth in the number of proprietorships and the proprietorship share within LMAs, and a negative relationship between the initial unemployment rate and the number and share of proprietorships. Natural amenities were found to have a positive influence on growth in proprietorship counts and share.

In terms of the first hypothesis, we also found support for the expectation that higher levels of education are associated with faster growth in the number of self-employed. However, we find somewhat less evidence that human capital contributes to growth in the entrepreneurship share. This suggests that human capital contributes to growth in both the number of proprietorships and to wage-and-salary employment.

In terms of the second research question, we also found that human capital has different impacts across decades. In particular, we found that the coefficients on human capital differed in magnitude and significance over time, with significant positive impacts often found during the 1990s. We also found evidence that human capital contributes more to growth in the number of entrepreneurs in nonmetropolitan regions than in metropolitan regions. However, our evidence suggests that human capital contributes more to growth in the proprietorship share in metropolitan regions than in nonmetropolitan regions.

Results were less clear, however, when using alternative measures for human capital in the proprietorships regressions. Instruments such as local spending on education and the presence of universities within an LMA showed a substantial variation in impact across time periods and across metropolitan/nonmetropolitan regions. We note that the impact of universities on growth in both the number and share of proprietorships was positive and significant in the most recent period, and that this impact was most prevalent in nonmetropolitan regions.

Our analysis so far has focused on differences across metropolitan and nonmetropolitan regions, using Bureau of Economic Analysis data source that reported on the number of proprietorships. However, we are also interested in self-employment growth within subgroups defined along other dimensions, including gender, age group, and industry. In the next Section, we address these issues by calculating the number of self-employed and the self-employment share with data from the Public Use Micro Sample (PUMS) from the Census Bureau. This data, available for the 2000–2006 period, allows us to estimate separate regressions by gender, age, and industry.

B. Self-Employment Growth by Gender, Age Group, and Industry: 2000–2006

We now turn to an analysis of factors that affect self-employment growth by gender, age, and industry. In this section, we examine the determinants of growth of self-employment shares (and number of self-employed) across regions during the 2000–2006 period. Measures of self-employment levels and shares by category were constructed by aggregating microdata from PUMS.

1. Descriptive Statistics

The measure of self-employment represents those who report that their primary job is working for themselves and includes incorporated and unincorporated nonfarm self-employed. The PUMS data allow us to disaggregate self-employment by gender, age group, and industry. We present results for growth in all regions for both the total number of self-employed and the self-employment share. In addition, we analyze these measures of self-employment by subgroups based on gender, age (20–44 and 45–64), and industry (professional and business services, and health care sectors).[15] We regress these dependent variables on measures of educational attainment, income and wealth, labor market performance, military presence, demographic characteristics, natural amenities, industry employment mix, and a metropolitan indicator.[16] With the exception of the metropolitan indicator, these are the same determinants examined in the previous section.

Descriptive statistics were calculated for our dependent variables, as well as initial period values for self-employment and the self-employment share (Tables 13 and 14). The means (and standard deviations) are unweighted averages across our 942 regions. We find strong growth in self-employment during the 2000–2006 period, with self-employment rising an average of 12.4 percent across our regions. Self-employment growth was slightly stronger for women than for men, but much stronger for residents age 45-64 (at 24.2 percent) than for residents age 20–44 (at 2.1 percent). In addition, we find much stronger self-employment growth in professional and business services than for health care during the period.

Growth in self-employment share during the period is much lower on average, which reflects the growth in wage-and-salary jobs during the 2000–2006 period. Overall, growth in the self-employment share averaged 3.7 percent. Again, we find higher growth for women than for men, higher growth for the

[15] In defining our age and industry categories we encountered problems with regions having zero self-employed in the 65 and older age group and in finer industry divisions. Zeros present problems for our spatial econometric strategy so we focus on the age groups generally associated with the working age population and two relatively high tech industries that did not result in zero self-employed for multiple regions.

[16] The metropolitan indicator is a dummy variable that takes a value of one if any county in the Public Use Micro Sample (PUMS) region is classified as metropolitan if the PUMS contained at least one county in an MSA.

45-64 age group, and much higher growth in professional and business services. Keep in mind that the self-employment share for men is calculated by dividing male self-employment by male total employment in a given period. Other shares are computed similarly.

Table 13
Summary Statistics For Dependent Variables In PUMS Regressions
(Unweighted Averages Across Regions)

	Mean	Std. Dev.
Growth in self-employment (2000-06)	12.42%	20.29%
Male	12.24%	22.25%
Female	13.86%	29.85%
Age 20-44	2.07%	28.32%
Age 45-64	24.16%	27.55%
Prof. & business services	25.22%	51.91%
Health care	1.71%	56.39%
Growth in self-employment share (2000-06)	3.74%	16.39%
Male	3.45%	19.15%
Female	5.43%	26.73%
Age 20-44	0.06%	25.61%
Age 45-64	2.53%	20.42%
Prof. & business services	2.63%	38.39%
Health care	-15.29%	45.37%
Self-employment (2000)	13,906	25,619
Male	9,157	16,733
Female	4,749	8,931
Age 20-44	6,432	12,428
Age 45-64	6,090	10,918
Prof. & business services	2,568	5,897
Health care	1,350	2,491
Self-employment share (2000)	10.55%	2.64%
Male	15.20%	4.05%
Female	6.57%	1.81%
Age 20-44	8.24%	2.09%
Age 45-64	14.12%	3.55%
Prof. & business services	23.15%	6.84%
Health care	8.74%	2.91%

Growth is calculated as the total percent change from 2000 to 2006.
Authors' calculation.

Table 14
Summary Statistics For Independent Variables In PUMS Regressions
(Data Is For Year 2000 Unless Otherwise Noted)

Variable	Mean	Std.Dev.
Local educ. spending share, 1992	9.52%	19.36%
University count	1.37	1.97
Percent college graduates	20.18%	8.50%
Per capita income	$25,944	$6,919
Unemployment rate	5.79%	2.00%
DIR per capita	$4,813	$1,923
Percent military Jobs	1.51%	3.19%
Percent female	50.77%	1.13%
Percent white	82.04%	14.65%
Percent age 20 to 44	35.53%	3.55%
Percent age 45 to 64	22.62%	2.09%
Percent age 65 and over	13.28%	3.44%
Ruggedness	8.74	6.42
July humidity (1941-70)	58.81	13.93
Sunny days in January (1941-70)	148.38	34.36
Access to water	6.87	12.48
Mean January temperature (1941-70)	34.88	11.78
Mean July temperature (1941-70)	75.81	5.21
Percent agriculture jobs	1.55%	1.64%
Percent mining jobs	0.84%	1.77%
Percent construction jobs	6.37%	1.77%
Percent manufacturing jobs	13.99%	7.53%
Percent transportation & utility jobs	4.56%	1.88%
Percent wholesale trade jobs	3.85%	1.46%
Percent retail trade jobs	17.92%	2.50%
Percent fin., ins., and R.E. jobs	6.49%	2.22%
Percent service jobs	28.23%	5.60%
Percent government jobs	16.19%	6.25%
MSA Indicator (Contains MSA county=1)	0.17	0.37

Authors' calculation.

2. Spatial Regression Results for Number and Share of Self-Employed: Total and by Sub-Group

We present summary results for growth from 2000 to 2006 in the number of self-employed and the self-employment share in Table 15. The results suggest that regions with higher concentrations of

highly educated residents generate faster growth in the number of self-employed than regions with lower levels of human capital. The coefficient remains positive in the self-employment share regression, but is no longer significant at conventional levels (at the 1, 5, or 10 percent level). This implies that human capital contributes both to faster growth in the number of self-employed and in the number of wage-and-salary earners, but does not particularly favor self-employment growth. This result is similar in spirit to the findings of Low, Henderson, and Weiler (2005), namely that college attainment is positively correlated with growth in number of self-employed but not growth in the self-employment share.

We find little impact for income, unemployment, wealth, and the prevalence of military jobs on either growth in the number or share of self-employed. Demographic characteristics have little impact on growth in the share, but for self-employment growth, the results suggest that regions with high proportions of their population under age 20 tend to have more growth in the number of self-employed. More specifically, the coefficients on the three age categories included are negative, indicating slower growth relative to the excluded reference category, birth to age 19.

Natural amenities matter both for growth in the number and share of self-employed. Cooler, less humid regions generate a higher rate of self-employment growth. Industry employment mix also matters, with regions with larger shares of construction jobs generating higher growth in both the number and share of self-employed. Higher proportions of jobs in FIRE industries and services are also associated with more growth in the number of self-employed, while larger shares of wholesale trade jobs have the opposite effect.[17] Finally, the metropolitan indicator is not significantly related to growth in the number or share of self-employed. It is important not to place too much emphasis on this result, since a region may be identified as metropolitan even though only one county is part of a metropolitan area.

Finally, we find a negative and significant coefficient on λ, which measures the extent to which changes to employment growth in neighboring regions affect growth in the reference region. This result suggests that "spatial spillovers" matter for both growth in the number and share of self-employed in our regions. The negative coefficient suggests that when neighboring regions experience a negative shock to self-employment growth—measured in terms of number or share—the reference region tends to grow more. This uneven pattern of spatial influence may be related to the spatial characteristics of the PUMA regions, which do not conform to LMAs. In addition, these PUMA regions may be part of an LMA or they may contain multiple LMAs. This characteristic of the region data is likely to generate a complex pattern of spatial spillovers.

[17] FIRE = finance, insurance, and real estate.

Table 15
PUMS Regression Results For All Self-Employed

	Growth rate from 2000-2006			
	Self-employment		Self-employment share	
Constant	0.6369	0.4436	2.3287 **	2.2144 **
ln (Self-employment$_{t-1}$)	0.0131	0.0100	--	--
ln (Self-employment share$_{t-1}$)	--	--	-0.1746 ***	-0.1776 ***
ln (Local educ. spending share$_{t-1}$)	0.0012	--	0.0033	--
ln (University count$_{t-1}$)	-0.0010	--	-0.0004	--
ln (Percent college graduates$_{t-1}$)	--	0.0757 *	--	0.0305
ln (Per capita income$_{t-1}$)	0.0771	0.0844	-0.0403	-0.0382
ln (Unemployment Rate$_{t-1}$)	-0.0357	-0.0334	-0.0218	-0.0199
ln (DIR per capita$_{t-1}$)	-0.0537	-0.1123 *	0.0639	0.0422
ln (Percent military jobs$_{t-1}$)	-0.0037	-0.0026	0.0070	0.0075
ln (Percent female$_{t-1}$)	0.2921	-0.0043	0.3743	0.2320
ln (Percent white$_{t-1}$)	0.0305	0.0304	-0.0222	-0.0222
ln (Percent age 20 to 44$_{t-1}$)	-0.2297 **	-0.3471 ***	-0.0225	-0.0838
ln (Percent age 45 to 64$_{t-1}$)	-0.4130 ***	-0.4105 ***	-0.1338	-0.1356
ln (Percent age 65 and over$_{t-1}$)	-0.1338 **	-0.1047 *	-0.0066	0.0014
ln (Ruggedness)	0.0184 **	0.0168 *	0.0243 ***	0.0244 ***
ln (July humidity)	-0.1586 ***	-0.1585 ***	-0.1175 ***	-0.1160 ***
ln (Sunny days in January)	0.0417	0.0499	0.0450	0.0442
ln (Access to water)	0.0029	0.0034	0.0028	0.0030
ln (Mean January temperature)	0.0544	0.0680	0.0807 *	0.0851 *
ln (Mean July temperature)	-0.2124	-0.1908	-0.5733 ***	-0.5648 ***
ln (Percent agriculture jobs$_{t-1}$)	-0.0039	-0.0055	-0.0127	-0.0128
ln (Percent mining jobs$_{t-1}$)	-0.0056	-0.0044	-0.0048	-0.0043
ln (Percent construction jobs$_{t-1}$)	0.1338 ***	0.1355 ***	0.0543 **	0.0542 **
ln (Percent manufacturing jobs$_{t-1}$)	0.0180	0.0246	0.0094	0.0128
ln (Percent trans. & utility jobs$_{t-1}$)	0.0164	0.0244	0.0105	0.0135
ln (Percent whlsl. trade jobs$_{t-1}$)	-0.0419 **	-0.0426 **	-0.0180	-0.0166
ln (Percent retail trade jobs$_{t-1}$)	0.0578	0.0517	0.0024	0.0002
ln (Percent FIRE jobs$_{t-1}$)	0.0737 **	0.0747 **	0.0340	0.0346
ln (Percent service jobs$_{t-1}$)	0.1184 **	0.1060 **	0.0753	0.0729
MSA indicator (MSA county=1)	0.0211	0.0202	0.0179	0.0173
λ	-0.1280 ***	-0.1260 ***	-0.1200 ***	-0.1229 ***
State fixed effects	Yes	Yes	Yes	Yes
N	942	942	942	942
Adjusted R-square	0.210	0.213	0.100	0.100
Akaike Information Criterion	-3.525	-3.528	-3.640	-3.642
Schwarts Criterion	-3.334	-3.339	-3.448	-3.454
Log-Likelihood	725.156	726.365	780.480	780.326

*, **, *** indicate significance (two-tailed) at the 10%, 5%, and 1% levels, respectively
Authors' calculation.

Summarizing our results by gender, the results from a spatial Chow test suggest that the determinants of growth in the self-employment share differ across men and women, although we do not find significant differences for the growth in the number of self-employed (Table 16).[18] This suggests overall that men and women generally respond in somewhat similar ways to these determinants.

We find that the share of the population with a bachelor's degree or better is positively correlated with growth in the number of male self-employed, although again not for the share. We find no significant correlation with our measures of human capital and female self-employment growth (either in the number or share of self-employed).

We also find differences with respect to income from dividends, interest, and rent, which is positively correlated with growth in the female self-employment share, but the coefficient is not significant for males. Demographics matter for self-employment growth for both men and women, with regions with younger populations (under age 20) generating more growth in self-employment numbers for men and women. Natural amenities also continue to matter, with cooler and more rugged regions again generating higher growth in the share of self-employed for men and women.

In addition, growth in self-employment shares for women rise more in regions with larger concentrations of construction jobs, while regions with larger shares of manufacturing, finance, and service jobs generate higher growth in the self-employment share for men. Larger concentrations of construction jobs also increase the number of self-employed for men and women, while retail, FIRE, and service jobs increase the number of men who are self-employed. Higher proportions of jobs in the wholesale trade sector decrease the number of men in self-employment.

The results for construction jobs are especially interesting. A higher share of employment in construction often indicates a faster growing regional economy, since there is a greater need for new homes, apartments, and commercial/industrial buildings. Under this interpretation, we find that faster growing regions (with a higher share of construction employment) have faster growth in both the number and share of female self-employed. This indicates that self-employment becomes increasingly prominent among female workers in faster growing regions. But, this is not the case among male workers. We do not find that faster growing regions have faster growth in the share of male self-employed.

[18] The spatial Chow test examines the null of equal coefficients across groups (men and women).

Table 16
PUMS Regression Results By Gender

	Self-employment growth rate 2000-2006				Self-employment share growth rate 2000-2006			
	Female		Male		Female		Male	
Constant	3.0364 **	2.8223 **	-0.5082	-0.7230 **	4.1148 **	3.9809 **	1.1288	1.0074
ln (Self-employment$_{t-1}$)	-0.0178	-0.0178	0.0087	0.0075	--	--	--	--
ln (Self-employment share$_{t-1}$)	--	--	--	--	-0.4920 ***	-0.4957 ***	-0.1955 ***	-0.1942 ***
ln (Local educ. spending$_{t-1}$)	0.0036	--	0.0023	--	0.0002	--	0.0034	--
ln (University count$_{t-1}$)	-0.0008	--	-0.0006	--	-0.0006	--	-0.0002	--
ln (Percent college graduates$_{t-1}$)	--	0.0703	--	0.1012 **	--	0.0517	--	0.0512
ln (Per capita income$_{t-1}$)	0.1018	0.1081	0.0828	0.0903	-0.1794	-0.1785	-0.0571	-0.0518
ln (Unemployment rate$_{t-1}$)	-0.0489	-0.0455	-0.0299	-0.0238	-0.0061	-0.0044	-0.0267	-0.0224
ln (DIR per capita$_{t-1}$)	-0.0359	-0.0892	-0.0533	-0.1283 *	0.2401 ***	0.2022 **	0.0718	0.0347
ln (Percent military jobs$_{t-1}$)	0.0060	0.0069	-0.0057	-0.0046	0.0082	0.0086	0.0028	0.0036
ln (Percent female$_{t-1}$)	0.4467	0.1646	0.1784	-0.1775	0.7352	0.5459	-0.1516	-0.3366
ln (Percent white$_{t-1}$)	0.0744	0.0748	0.0068	0.0081	0.0511	0.0518	-0.0585	-0.0582
ln (Percent age 20 to 44$_{t-1}$)	-0.1134	-0.2301	-0.3156 ***	-0.4553 ***	-0.0439	-0.1208	-0.1809	-0.2563 *
ln (Percent age 45 to 64$_{t-1}$)	-0.4881 ***	-0.4910 ***	-0.4079 ***	-0.4090 ***	0.0786	0.0840	-0.2098 *	-0.2154 **
ln (Percent age 65 and over$_{t-1}$)	-0.0627	-0.0381	-0.1779 ***	-0.1358 **	-0.0270	-0.0068	-0.0488	-0.0294
ln (Ruggedness)	0.0231	0.0223	0.0171 *	0.0153	0.0331 **	0.0319 **	0.0223 **	0.0220 **
ln (July humidity)	-0.2136 ***	-0.2122 ***	-0.1310 ***	-0.1299 ***	-0.1466 **	-0.1468 **	-0.1053 **	-0.1033 **
ln (Sunny days in January)	0.0096	0.0137	0.0686	0.0796	-0.0040	0.0027	0.0885	0.0907
ln (Access to water)	0.0100	0.0103	0.0010	0.0014	0.0104	0.0106	-0.0001	0.0000
ln (Mean January temperature)	0.1250	0.1356	0.0329	0.0479	0.1624 **	0.1708 **	0.0552	0.0615
ln (Mean July temperature)	-0.6105 *	-0.5907 *	-0.0240	-0.0003	-1.0545 ***	-1.0424 ***	-0.4474 ***	-0.4345 ***
ln (Percent agriculture jobs$_{t-1}$)	0.0064	0.0049	-0.0102	-0.0126	0.0111	0.0101	-0.0144	-0.0155
ln (Percent mining jobs$_{t-1}$)	-0.0102	-0.0092	-0.0034	-0.0018	-0.0093	-0.0085	0.0002	0.0009
ln (Percent construction jobs$_{t-1}$)	0.1843 ***	0.1854 ***	0.1092 ***	0.1115 ***	0.0883 **	0.0893 **	0.0339	0.0344
ln (Percent manufacturing jobs$_{t-1}$)	0.0044	0.0112	0.0280	0.0370 **	-0.0345	-0.0307	0.0297 *	0.0353 *
ln (Percent transportation & utility jobs$_{t-1}$)	0.0476	0.0545 *	0.0101	0.0195	0.0225	0.0272	0.0072	0.0118
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0095	-0.0094	-0.0506 **	-0.0510 **	0.0072	0.0057	-0.0261	-0.0248
ln (Percent retail trade jobs$_{t-1}$)	-0.0575	-0.0621	0.1231 **	0.1162 **	-0.1177	-0.1212	0.0829	0.0801
ln (Percent fin., ins., and R.E. jobs$_{t-1}$)	0.0609	0.0608	0.0946 ***	0.0923 ***	0.0175	0.0169	0.0620 *	0.0604 *
ln (Percent service jobs$_{t-1}$)	0.1042	0.0942	0.1290 **	0.1138 **	0.0223	0.0117	0.1012 *	0.0966 *
MSA indicator (Contains MSA county=1)	0.0480	0.0464	0.0122	0.0112	0.0300	0.0290	0.0165	0.0160
λ	-0.1190 ***	-0.1240 ***	-0.1330 ***	-0.1370 ***	-0.0860 ***	-0.0920 ***	-0.1480 ***	-0.1440 ***
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	942	942	942	942	942	942	942	942
Adjusted R-square	0.067	0.069	0.204	0.208	0.073	0.074	0.114	0.115
Akaike Information Criterion	-2.571	-2.575	-3.356	-3.365	-2.665	-2.669	-3.394	-3.396
Schwarts Criterion	-2.380	-2.387	-3.165	-3.177	-2.473	-2.481	-3.203	-3.208
Log-Likelihood	277.057	277.367	646.893	649.100	321.860	322.131	663.900	664.188

*, **, *** indicate significance (two-tailed) at the 10%, 5%, and 1% levels, respectively
Authors' calculation.

To summarize our results by age group, we find evidence of significant differences in the influence of our growth determinants across age groups, for growth in both the number and share of self-employed (Table 17). We find that the share of the population with a bachelor's degree or better is positively and significantly correlated with both growth in the number and share of self-employed for residents aged 45-64. We do not find significant correlations between our human capital measures and either measure of self-employment growth (number or share) for residents aged 20-44.

In contrast, we find that regions with higher levels of per capita income tend to have lower rates of self-employment share growth for the younger age group (20–44), although regions with higher levels of income from dividends, interest, and rent tended to generate relatively higher growth in the self-employment share. Results are opposite for the number of self-employed in the 45-65 age group; increases in per capita income increase the number of self-employed, while increases in income from dividends, interest, and rent reduce growth in the number of self-employed for this group.

Regions with high shares of female residents tended to generate higher growth in the self-employment share for the 20–44 age group, but lower growth in the 45-64 age group. In addition, the 45-64 age group tended to post the highest growth in the self-employment share in those regions with larger shares of the population in the 65 and older age group, but lower shares in the 20–44 age group.

Natural amenities tend to matter in the usual way, with cooler climates and more rugged topography related to higher growth in the self-employment share for both age groups. In addition, regions with large shares of construction jobs tend to be associated with strong growth in the self-employment share for the younger age group, while regions with larger shares in finance, insurance, and real estate tend to generate stronger growth in the older age group.

The industrial structure of regions has little impact on self-employment growth or growth in self-employment shares among regions. Coefficients on construction employment variables, however, are in most cases positive and significant. As noted earlier, a higher share of employment in construction often indicates a faster growing regional economy. Under this interpretation, we find that faster growing regions (with a higher share of construction employment) have faster growth in both the number and share of self-employed among younger workers age 25 to 44. This indicates that self-employment becomes increasingly prominent among younger workers in rapidly growing regions. But, this is not the case for older workers age 45 to 64. We do not find that faster growing regions have faster growth in the share of self-employment among workers age 45 to 64.

Table 17
PUMS Regression Results By Age Group

	Self-employment growth rate 2000-2006				Self-employment Share growth rate 2000-2006			
	Age 20-44		Age 45-64		Age 20-44		Age 45-64	
Constant	1.9441	1.9282	-0.5105	-0.8933 *	3.9595 ***	3.9844 ***	0.8261	0.6214
ln (Self-employment$_{t-1}$)	0.0060	0.0023	-0.0120	-0.0109	--	--	--	--
ln (Self-employment share$_{t-1}$)	--	--	--	--	-0.2990 ***	-0.2986 ***	-0.3929 ***	-0.3878 ***
ln (Local educ. spending$_{t-1}$)	-0.0022	--	0.0066	--	0.0002	--	0.0020	--
ln (University count$_{t-1}$)	-0.0010	--	-0.0006	--	-0.0006	--	0.0000	--
ln (Percent college graduates$_{t-1}$)	--	-0.0313	--	0.1795 ***	--	-0.0652	--	0.1272 ***
ln (Per capita income$_{t-1}$)	-0.1545	-0.1533	0.3713 ***	0.3838 ***	-0.3117 **	-0.3148 **	0.0496	0.0605
ln (Unemployment rate$_{t-1}$)	-0.0871	-0.0940 *	-0.0054	0.0078	-0.0842	-0.0916 *	0.0265	0.0365
ln (DIR per capita$_{t-1}$)	-0.0473	-0.0304	-0.1168 *	-0.2476 ***	0.1129	0.1575 *	0.0902	-0.0040
ln (Percent military jobs$_{t-1}$)	-0.0255 *	-0.0256 *	0.0047	0.0068	-0.0096	-0.0100	-0.0029	-0.0017
ln (Percent female$_{t-1}$)	0.7991 *	0.8441 *	-0.2667	-0.8825 **	0.8167 *	0.9764 **	-0.6545	-1.0424 **
ln (Percent white$_{t-1}$)	0.0486	0.0462	-0.0694	-0.0664	-0.0020	-0.0047	-0.0309	-0.0284
ln (Percent age 20 to 44$_{t-1}$)	-0.0395	-0.0241	-0.2156	-0.4617 ***	0.0305	0.0849	-0.1290	-0.2785 *
ln (Percent age 45 to 64$_{t-1}$)	-0.3997 **	-0.3934 **	-0.5089 ***	-0.5169 ***	-0.0242	-0.0214	-0.0975	-0.1019
ln (Percent age 65 and over$_{t-1}$)	-0.1140	-0.1322	-0.0622	0.0118	-0.0562	-0.0909	0.0520	0.1105 *
ln (Ruggedness)	0.0190	0.0191	0.0141	0.0117	0.0240 *	0.0254 *	0.0242 **	0.0219 **
ln (July humidity)	-0.2333 ***	-0.2356 ***	-0.1363 **	-0.1327 **	-0.1879 ***	-0.1889 ***	-0.1026 **	-0.1013 **
ln (Sunny days in January)	0.1390	0.1359	-0.0241	-0.0082	0.1513 *	0.1398 *	-0.0009	0.0153
ln (Access to water)	0.0011	0.0015	0.0048	0.0052	0.0022	0.0023	0.0032	0.0034
ln (Mean January temperature)	0.1063	0.1068	0.0153	0.0380	0.1422 *	0.1348 *	0.0670	0.0828
ln (Mean July temperature)	-0.3508	-0.3499	-0.0290	0.0127	-0.8974 ***	-0.9034 ***	-0.4521 ***	-0.4233 ***
ln (Percent agriculture jobs$_{t-1}$)	-0.0073	-0.0062	0.0039	-0.0001	-0.0151	-0.0131	0.0226	0.0190
ln (Percent mining jobs$_{t-1}$)	-0.0118	-0.0121	-0.0018	0.0009	-0.0059	-0.0069	-0.0013	0.0004
ln (Percent construction jobs$_{t-1}$)	0.1710 ***	0.1706 ***	0.1050 ***	0.1081 ***	0.0912 **	0.0887 **	0.0382	0.0416
ln (Percent manufacturing jobs$_{t-1}$)	0.0160	0.0127	0.0282	0.0451 **	-0.0007	-0.0062	0.0002	0.0117
ln (Percent transportation & utility jobs$_{t-1}$)	0.0539 *	0.0529 *	-0.0045	0.0115	0.0508 *	0.0457	-0.0237	-0.0126
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0715 **	-0.0726 **	-0.0232	-0.0230	-0.0284	-0.0282	-0.0154	-0.0165
ln (Percent retail trade jobs$_{t-1}$)	0.0421	0.0424	0.1001	0.0894	-0.0310	-0.0271	0.0364	0.0289
ln (Percent fin., ins., and R.E. jobs$_{t-1}$)	0.0726	0.0788	0.0937 **	0.0878 **	0.0389	0.0440	0.0737 **	0.0677 **
ln (Percent service jobs$_{t-1}$)	0.1250	0.1268	0.0763	0.0522	0.0978	0.1064	-0.0005	-0.0186
MSA indicator (Contains MSA county=1)	0.0686 **	0.0683 **	0.0068	0.0046	0.0540 *	0.0535 *	0.0167	0.0158
λ	-0.1160 ***	-0.1170 ***	-0.0850 ***	-0.0880 ***	-0.1370 ***	-0.1390 ***	-0.0950 ***	-0.1020 ***
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	942	942	942	942	942	942	942	942
Adjusted R-square	0.127	0.128	0.146	0.156	0.062	0.064	0.121	0.128
Akaike Information Criterion	-2.556	-2.558	-3.041	-3.053	-2.650	-2.654	-3.263	-3.274
Schwarts Criterion	-2.365	-2.370	-2.849	-2.864	-2.458	-2.466	-3.071	-3.086
Log-Likelihood	269.831	269.713	497.758	502.433	313.832	314.280	603.399	606.815

*, **, *** indicate significance (two-tailed) at the 10%, 5%, and 1% levels, respectively
Authors' calculation.

The two sectors studied—professional and business services, and health care industries—were chosen because they are usually categorized as high-technology sectors, they extensively utilize high levels of human capital, and a sufficient number of individuals participate in these sectors at the regional level to generate results using spatial econometric techniques (Table 18). We find significant differences in the influence of our independent variables on the number of self-employed (and growth in the self-employment share) across industries.

Our results suggest that human capital contributes to self-employment growth for both sectors (we find significant correlations for all of our measures in at least one regression in Table 18). In terms of self-employment share growth, we find that universities contribute positively to gains in the health care sector. Overall, as expected, human capital appears to play a role in the growth and relative development of self-employment in these sectors.

We also find that income from dividends, interest, and wealth contributes to self-employment share growth for both sectors, while the share of military jobs is positively associated with growth in the self-employment share in health care. Demographics also tend to matter, with relatively young regions posting stronger share growth. Natural amenities also tend to matter, with relatively rugged and cool regions generating strong share growth. For professional and business services, regions with large shares of mining and finance, insurance, and real estate (FIRE) jobs tended to generate the strongest share growth.

Table 18
PUMS Regression Results By Industry

	Self-employment growth rate 2000-2006				Self-employment share growth rate 2000-2006			
	Prof. & bus. services		Health care		Prof. & bus. services		Health care	
Constant	3.3118 ***	3.2037 ***	-1.8914	-1.2512	5.2189 **	5.5019 ***	-3.2732	-2.4120
ln (Self-employment$_{t-1}$)	-0.1336 ***	-0.1066 ***	-0.1314 ***	-0.1013 **	--	--	--	--
ln (Self-employment share$_{t-1}$)	--	--	--	--	-0.5203 ***	-0.5210 ***	-0.4525 ***	-0.4429 ***
ln (Local educ. spending$_{t-1}$)	0.0224 **	--	0.0143	--	0.0067	--	0.0039	--
ln (University count$_{t-1}$)	0.0025	--	0.0120 **	--	0.0024	--	0.0112 **	--
ln (Percent college graduates$_{t-1}$)	--	0.0066	--	0.2878 *	--	-0.0624	--	0.2344
ln (Per capita income$_{t-1}$)	0.3766	0.3521	0.4384	0.4332	-0.1654	-0.1634	0.0491	0.0682
ln (Unemployment rate$_{t-1}$)	0.0673	0.0812	0.0748	0.1439	0.1178	0.1267	0.0757	0.1421
ln (DIR per capita$_{t-1}$)	-0.0740	-0.0649	0.0229	-0.1389	0.2593 **	0.3167 **	0.4146 *	0.2855
ln (Percent military jobs$_{t-1}$)	0.0227	0.0229	0.0786 **	0.0776 **	0.0109	0.0109	0.0796 **	0.0804 **
ln (Percent female$_{t-1}$)	-0.2962	-0.3304	-0.6308	-0.9649	-0.7130	-0.4307	-0.8863	-0.9607
ln (Percent white$_{t-1}$)	0.0381	0.0444	-0.0475	-0.0221	0.0213	0.0226	-0.0201	0.0012
ln (Percent age 20 to 44$_{t-1}$)	-0.0064	-0.0558	-0.2235	-0.2705	-0.3111	-0.1975	-0.2886	-0.2353
ln (Percent age 45 to 64$_{t-1}$)	-0.8862 ***	-0.9296 ***	-0.8135 *	-0.8840 **	-0.4374 *	-0.4656 *	-0.5451	-0.6257 *
ln (Percent age 65 and over$_{t-1}$)	0.0538	0.0487	-0.0246	0.1684	0.1090	0.0863	-0.1497	0.0289
ln (Ruggedness)	0.0014	0.0054	0.0820 **	0.0806 **	-0.0256	-0.0216	0.0842 **	0.0829 **
ln (July humidity)	-0.1508	-0.1365	-0.0613	-0.0437	-0.1440	-0.1370	-0.0229	-0.0063
ln (Sunny days in January)	0.0187	-0.0094	-0.3424	-0.2945	0.0132	-0.0011	-0.3611 *	-0.3059
ln (Access to water)	0.0164	0.0144	0.0277	0.0242	0.0072	0.0066	0.0177	0.0153
ln (Mean January temperature)	-0.1025	-0.1299	0.0362	0.0307	-0.1017	-0.1178	-0.0043	-0.0005
ln (Mean July temperature)	-0.2939	-0.3020	0.9866 **	0.9210 ***	-1.1135 **	-1.1429 **	0.6600	0.6048
ln (Percent agriculture jobs$_{t-1}$)	-0.0141	-0.0122	-0.0006	-0.0101	0.0184	0.0201	0.0157	0.0046
ln (Percent mining jobs$_{t-1}$)	0.0140	0.0144	0.0156	0.0194	0.0347 ***	0.0337 ***	0.0053	0.0078
ln (Percent construction jobs$_{t-1}$)	0.2230 ***	0.2126 ***	0.3070 ***	0.3208 ***	0.0153	0.0134	0.1619	0.1784
ln (Percent manufacturing jobs$_{t-1}$)	0.0552	0.0628	0.0608	0.0911	0.0287	0.0278	0.0349	0.0615
ln (Percent transportation & utility jobs$_{t-1}$)	0.0755	0.0686	0.1077	0.1177	-0.0323	-0.0392	0.0623	0.0739
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0325	-0.0234	0.1461 *	0.1581 **	-0.0086	0.0008	0.1003	0.1148
ln (Percent retail trade jobs$_{t-1}$)	0.0131	0.0272	0.1789	0.1718	-0.0015	0.0035	0.2044	0.1916
ln (Percent fin., ins., and R.E. jobs$_{t-1}$)	0.3214 ***	0.3022 ***	0.1521	0.0923	0.1896 ***	0.1869 ***	0.0660	0.0228
ln (Percent service jobs$_{t-1}$)	0.2466 *	0.2522 *	0.5103 **	0.5028 **	0.0249	0.0545	0.2557	0.2701
MSA indicator (Contains MSA county=1)	0.1042 **	0.1013 **	0.0088	0.0178	0.0672	0.0703	-0.0411	-0.0283
λ	-0.2480 ***	-0.2510 ***	-0.1170 ***	-0.1200 ***	-0.1320 ***	-0.1399 ***	-0.1140 ***	-0.1250 ***
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	942	942	942	942	942	942	942	942
Adjusted R-square	0.097	0.093	0.069	0.065	0.109	0.110	0.089	0.087
Akaike Information Criterion	-1.593	-1.590	-0.698	-0.696	-1.824	-1.825	-0.789	-0.787
Schwarts Criterion	-1.402	-1.402	-0.507	-0.508	-1.632	-1.637	-0.597	-0.599
Log-Likelihood	-187.449	-190.278	-605.403	-607.657	-75.528	-76.145	-562.776	-564.944

*, **, *** indicate significance (two-tailed) at the 10%, 5%, and 1% levels, respectively
Authors' calculation.

3. Summary

Our analysis in this section shows that self-employment growth when measured in terms of either the number of self-employed or the self-employment rate was strong during the 2000–2006 period, outpacing wage-and-salary employment growth. We also note that self-employment growth, when analyzed on these two dimensions, was stronger for women than for men, that growth in the 45-64 age group outpaced growth in the 20–44 age group, and that growth was much higher in professional and business services than in health care.

Our regression results suggest a positive role for human capital accumulation in stimulating the growth in regional self-employment, particularly for the self-employed aged 45-64, and for the self-employed in the health care sector, which provides evidence on hypothesis three. Specifically, we find evidence that higher levels of human capital in a local labor market are associated with higher growth in entrepreneurship numbers and shares for these groups during the 2000–2006 period.

We find that our indicator of local wealth has a significant positive impact on self-employment growth (both the number and rate), for women, and for both professional and business services and health care industries. We also find that the local demographic mix matters for local self-employment growth, with regions with high concentrations of the population in the under 20 age group tending to generate strong self-employment growth.[19] In addition, we find that natural amenities matter, with regions that had more rugged topography and cooler temperatures tending to generate more self-employment growth.

Finally, we find that the industry mix of the local area matters for self-employment growth, but that this influence varies with the demographic population being examined. For example, we find that regions with large shares of construction employment tended to generate strong self-employment growth for those in the 20–44 age group and women, but had no significant influence on self-employment growth for men or for people in the 45-64 age group.

[19] This can be deduced from the tables as the under–20 age group serves as the reference category meaning that the results for other age groups should be interpreted relative to the under–20 group. The coefficients for the other groups are negative, indicating slower growth relative to regions with higher shares of their population in the under–20 group.

5. Conclusion

The variation among regions in the growth of entrepreneurship, measured by the number of proprietors or self-employed and entrepreneurship concentration, measured by the self-employment or proprietor share, has important implications for regional development. As Audretsch and Keilbach (2005), Shrestha et al. (2007), and Camp (2005) have suggested, entrepreneurs play a crucial role in facilitating "knowledge spillovers" in local economies. Further, Acs and Armington (2005) have found that the more entrepreneurial regions exhibit faster economic growth.

This report examined the trends, variation, and determinants of growth in entrepreneurship and entrepreneurship concentration in the United States from a broad perspective. We examined self-employment and proprietorship trends over the 1970–2006 period. We explored the determinants of entrepreneurship concentration in metropolitan and nonmetropolitan LMAs throughout this 36-year period. We also examined the determinants of entrepreneurship in specific demographic and industry groups during the current decade.

We had three specific research hypotheses: 1) that higher levels of human capital in a local labor market are likely to be associated with faster growth in entrepreneurship numbers and shares over time and in both metropolitan and nonmetropolitan regions, 2) that the impact of human capital on growth in entrepreneurship numbers and shares differs over time and across metropolitan and nonmetropolitan regions, and 3) that higher levels of human capital in local LMAs are associated with higher growth in the proportion of entrepreneurs within specific gender, age, and high-technology industry subgroups in LMAs during the 2000–2006 period.

We find persistent differences in the entrepreneurial shares of employment among U.S. regions. There is evidence of substantial change (growth or decline) in entrepreneurship concentration in individual regions over time, but only limited evidence of convergence of shares among regions. These findings suggest that growth in entrepreneurship in regions is not determined by forces toward convergence, but instead is related, more directly, to the specific characteristics of regions.

Beyond these trend results, there were also a number of specific findings. In particular, using data on proprietorships published by BEA, our results suggest that nonfarm proprietorship shares and share growth differed significantly across Census regions and across metropolitan and nonmetropolitan region types during the past 36 years. We find relatively high proprietorship shares in the West Census region and relatively low shares in the Midwest. In addition, we find much higher proprietorship shares in nonmetropolitan regions than in metropolitan regions. We also find large differences in the growth of proprietorship shares across Census regions and across metropolitan and nonmetropolitan regions. We

note particularly strong growth in the Northeast Census region and much stronger growth in metropolitan regions than in nonmetropolitan regions.

We find some evidence of convergence in the proprietorship share across metropolitan and nonmetropolitan regions, as strong metropolitan growth has caused the gap with nonmetropolitan regions to close during the period. In addition, we find little evidence of within-distribution convergence for all regions, metropolitan regions, or nonmetropolitan regions, based on the standard deviation of the distribution. In other words, there is little reduction in the dispersion of proprietorship shares across regions during the period. However, we also find that regions that begin with relatively low proprietorship shares tend to have higher growth than regions that begin with larger shares. This suggests that regions tend to "catch up" and "fall back" depending on the initial level of their proprietorship share.

Our multivariate regression results suggest support for the first hypothesis, namely that higher levels of human capital are associated with faster growth in the number of proprietors. However, we find somewhat less evidence that human capital contributes to growth in the proprietorship share. This suggests that human capital contributes to growth in both the number of proprietorships and to wage-and-salary employment. This result held when we used percentage of the population with a bachelor's degree or higher as the measure of human capital.

Our multivariate regression results also suggest a consistent positive relationship between wealth and growth in number of proprietorships within LMAs, and a negative relationship between the initial unemployment rate and the number of proprietorships. Natural amenities were found to have a positive influence on growth in both the number and share of proprietorships.

We also found a positive correlation between human capital and the growth in the number and share of proprietorships in nearly every decade, depending on whether the particular regression focused on all LMAs, metropolitan LMAs, and nonmetropolitan LMAs. We find some evidence that human capital may have mattered more during the 1990s (particularly for nonmetropolitan regions). These results provide support for our second research hypothesis.

Results were less clear, however, when an alternative set of measures for human capital was incorporated into the proprietorships regressions. Measures such as local spending on education and the presence of universities within an LMA showed a large amount of variation in impact across time periods and across metropolitan/nonmetropolitan regions. We note that the impact of universities on growth in proprietorships was positive and significant in the most recent period, and that this impact was most prevalent in nonmetropolitan regions.

In addition to results disaggregated by decade and by metropolitan/nonmetropolitan status, we were interested in self-employment growth within specific subgroups defined by gender, age group, and

industry. We addressed these issues by generating self-employment number and share data using the Public Use Micro Sample (PUMS) from the U.S. Census Bureau. We focused on 942 PUMS-county regions in the contiguous U.S. states. This data, available for the 2000–2006 period, allowed us to estimate separate regressions by gender, age, and industry.

The PUMS data suggest that self-employment growth in terms of both number and share of self-employment, was strong during the 2000–2006 period, outpacing wage-and-salary employment growth. We also note that self-employment growth was stronger for women than for men, that growth in the 45-64 age group outpaced growth in the 20–44 age group, and that growth was much higher in professional and business services than for the health care sector.

Our spatial regression results suggest a positive role for human capital accumulation in stimulating the growth in regional self-employment, particularly for the self-employed aged 45-64, and for the self-employed in health care, which provides some support for research hypothesis three. As with the regressions using BEA data, we find variation in the results, depending on how we measure human capital.

We find that our indicator of local wealth has a significant positive impact on growth in the number of self-employed, particularly for the younger self-employed (age 20–44), for women, and for both professional and business services and health care industries. We also find that the local demographic mix matters for local growth in the number of self-employed, with regions with high proportions of the population under age 20 tending to generate strong growth in the number of self-employed. In addition, we find that natural amenities matter, with regions that had more rugged topography and cooler temperatures tending to generate more self-employment growth.

Finally, we find that the industry mix of the local area matters for self-employment growth, but that these influences vary with the demographic population being examined. For example, we find that regions with large shares of construction employment tended to be associated with strong self-employment growth for the 20–44 age group and for women, but had no significant influence on self-employment growth for men or for the 45-64 age group.

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7. Appendix

Table A.1

Alternative Education Instrument Variables and Other Factors Influencing Growth in Number of Proprietorships In Metropolitan Labor Market Areas

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	-3.4818	-0.7902	-0.6073	0.4082	1.4717
ln (Proprietorship Number$_{t-1}$)	-0.0255	-0.0020	0.0151	0.0141	0.0062
ln (Local educ spending$_{t-1}$)	-0.2061 **	-0.1508 ***	-0.0128	-0.1824 ***	0.0911 ***
ln(University Count$_{-1}$)	-0.0041	-0.0051 ***	0.0023	-0.0016	-0.0007
ln (Per capita income$_{t-1}$)	-1.7976 ***	-0.5463 ***	-0.3386 **	-0.5827 ***	-0.1390
ln (Unemployment Rate$_{t-1}$)	-0.2070 ***	0.0177	-0.1357 ***	-0.0841 **	-0.1258 ***
ln (DIR per capita$_{t-1}$)	0.5869 ***	0.3216 ***	-0.0860	0.1378 *	0.1024 *
ln (Percent Military Jobs$_{t-1}$)	-0.0664 **	-0.0285 ***	-0.0189	-0.0203 **	-0.0169 **
ln (Percent female$_{t-1}$)	0.5127	0.2102	-0.2150	0.6499	-1.3339 ***
ln (Percent white$_{t-1}$)	0.4466 **	0.1641 *	0.1218	-0.0490	-0.0875
ln (Percent age 20 to 44$_{t-1}$)	0.6570	0.0773	0.8610 ***	-0.3941 *	0.3849 **
ln (Percent age 45 to 64$_{t-1}$)	-0.0397	-0.4954 ***	0.5405 ***	0.0556	0.0802
ln (Percent age 65 and over$_{t-1}$)	-0.4378 ***	-0.0097	-0.1142	-0.3352 ***	0.0415
ln (Ruggedness)	0.0177	0.0096	0.0121	0.0081	-0.0004
ln (July Humidity)	-0.3069 ***	-0.1065 ***	-0.1018 **	-0.0531	-0.0169
ln (Sunny hours in January)	0.2480 ***	0.1314 ***	0.0646	0.0851 **	-0.0231
ln (Access to water)	0.0526 ***	0.0108 *	0.0217 ***	0.0027	0.0121 ***
ln (Mean January temperature)	0.1793 **	0.1269 ***	0.0531	0.0620 **	-0.0329
ln (Mean July temperature)	-0.7911	-0.4307 **	-0.3693	-0.2333	0.4979 ***
ln (Percent agriculture jobs$_{t-1}$)	0.0280	0.0017	0.0168	0.0043	-0.0397 ***
ln (Percent mining jobs$_{t-1}$)	-0.0625 ***	-0.0147 **	-0.0040	-0.0338 ***	-0.0285 ***
ln (Percent construction jobs$_{t-1}$)	0.2541 ***	0.1314 ***	0.0665	0.0255	0.1381 ***
ln (Percent manufacturing jobs$_{t-1}$)	-0.1176 **	-0.0739 ***	-0.0457 *	-0.0273	-0.0390 **
ln (Percent transportation & utility jobs$_{t-1}$)	-0.0042	0.0015	-0.0447	0.0692 **	-0.0139
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0769	0.0134	-0.0936 **	-0.0780 **	-0.0173
ln (Percent retail trade jobs$_{t-1}$)	-0.5916 **	-0.1886 **	0.1409	0.0808	0.0325
ln (Percent FIRE jobs$_{t-1}$)	0.0728	-0.0660	-0.0106	0.0078	-0.0661 **
ln (Percent service jobs$_{t-1}$)	0.3626 ***	0.0845	0.0276	0.0642	-0.0334
Mid-size metropolitan labor market area	-0.0020	0.0105	-0.0116	0.0234 *	0.0181 *
Large metropolitan labor market area	0.1554 ***	0.0293 **	0.0555 ***	0.0131	0.0151
N	256	256	256	256	256
Adjusted R-square	0.621	0.658	0.386	0.409	0.443

*** = significant at 1% level, **=significant at 5%, *=significant at 10%

Note: For a description of the variables see Section 8, Data Appendix.

Source: Authors' calculation.

Table A.2

Alternative Education Instrument Variables and Other Factors Influencing Growth in Number of Proprietorships In Non-Metropolitan Labor Market Areas

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	3.7142	2.6514	-1.1159	4.8012 **	0.0912
ln (Proprietorship Number$_{t-1}$)	-0.0302	0.0046	0.0132	-0.0122	0.0086
ln (Local educ spending$_{t-1}$)	-0.1833 ***	-0.0659 **	-0.0084	-0.1031 ***	-0.0232
ln(University Count$_{-1}$)	0.0003	-0.0013 *	0.0002	0.0004	0.0012 ***
ln (Per capita income$_{t-1}$)	-1.1235 ***	-0.4135 ***	-0.1096	-0.2112 **	-0.1975 ***
ln (Unemployment Rate$_{t-1}$)	0.0072	0.0039	-0.0466 **	-0.0219	-0.0495 ***
ln (DIR per capita$_{t-1}$)	0.4638 ***	0.2154 ***	-0.0778	0.0113	0.0939 ***
ln (Percent Military Jobs$_{t-1}$)	-0.0182	-0.0046	-0.0178	0.0219	-0.0114
ln (Percent female$_{t-1}$)	0.7206	-0.1957	0.2244	-0.1174	-0.1592
ln (Percent white$_{t-1}$)	0.2437 *	0.1697 ***	0.0878	0.0080	-0.1462 ***
ln (Percent age 20 to 44$_{t-1}$)	0.2790	0.2722 *	0.3840 **	-0.2318	0.0420
ln (Percent age 45 to 64$_{t-1}$)	-0.1010	-0.1079	0.1855	-0.0505	0.1607 **
ln (Percent age 65 and over$_{t-1}$)	-0.3375 **	-0.0905	-0.0611	-0.1039	-0.1331 ***
ln (Ruggedness)	0.0281	0.0013	-0.0009	0.0139	0.0082
ln (July Humidity)	-0.2460 ***	-0.1144 ***	-0.1332 ***	-0.0919 ***	0.0359 *
ln (Sunny hours in January)	0.2752 ***	0.0923 **	-0.0720	0.1056 ***	0.0043
ln (Access to water)	0.0529 ***	0.0221 ***	0.0062	0.0111 **	0.0141 ***
ln (Mean January temperature)	0.2507 ***	0.0911 ***	0.0343	0.0139	-0.0096
ln (Mean July temperature)	-2.3372 ***	-1.0160 ***	-0.0363	-0.5220 ***	0.0274
ln (Percent agriculture jobs$_{t-1}$)	-0.0454 *	-0.0109	-0.0071	-0.0030	-0.0057
ln (Percent mining jobs$_{t-1}$)	-0.0007	0.0030	-0.0007	-0.0021	-0.0030 **
ln (Percent construction jobs$_{t-1}$)	0.2142 ***	0.0889 ***	0.0425	0.1259 ***	0.0590 ***
ln (Percent manufacturing jobs$_{t-1}$)	0.0685 ***	0.0208 *	-0.0066	0.0369 ***	-0.0068
ln (Percent transportation & utility jobs$_{t-1}$)	-0.1570 ***	-0.0021	-0.0580 **	-0.0423 **	-0.0189
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0628 *	-0.0459 ***	-0.0629 ***	-0.0351 *	0.0095
ln (Percent retail trade jobs$_{t-1}$)	-0.2750 **	-0.2095 ***	-0.1397 **	0.2172 ***	0.0782 **
ln (Percent FIRE jobs$_{t-1}$)	0.0163	-0.0243	0.0507	0.0225	-0.0442 *
ln (Percent service jobs$_{t-1}$)	0.1127	0.0717 **	0.0403	-0.0656	-0.0525 *
Mid-size nonmetropolitan labor market area	0.0783	0.0374 *	0.0259	0.0125	-0.0346 **
Large nonmetropolitan labor market area	0.1537 **	0.0583 *	0.0237	0.0265	-0.0382 *
	(0.0699)	(0.0313)	(0.0348)	(0.0311)	(0.0210)
N	466	466	466	466	466
Adjusted R-square	0.545	0.527	0.287	0.283	0.279

*** = significant at 1% level, **=significant at 5%, *=significant at 10%

Note: For a description of the variables see Section 8, Data Appendix.

Source: Authors' calculation.

Table A.3

Alternative Education Instrument Variables and Other Factors Influencing Growth in Proprietorship Share In Metropolitan Labor Market Areas

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	5.0808 **	3.6841 **	1.1319	3.3966 *	3.8429 **
ln (Proprietorship Share$_{t-1}$)	-0.4817 ***	-0.2430 ***	-0.2447 ***	-0.1562 ***	-0.1338 ***
ln (Local educ spending$_{t-1}$)	-0.0114	-0.0858 ***	0.0529	-0.0544 **	0.0525 **
ln(University Count$_{-1}$)	-0.0013	-0.0018 *	0.0027 **	-0.0014	0.0006
ln (Per capita income$_{t-1}$)	-0.4086 ***	-0.0763	0.0899	0.0082	0.0626
ln (Unemployment Rate$_{t-1}$)	-0.0561 *	0.0458 **	-0.1060 ***	0.0186	-0.0813 ***
ln (DIR per capita$_{t-1}$)	0.2154 ***	0.0957 *	-0.0921	-0.0195	-0.0342
ln (Percent Military Jobs$_{t-1}$)	0.0239 **	0.0157 **	0.0008	0.0070	-0.0055
ln (Percent female$_{t-1}$)	-1.3804 **	-1.0118 ***	0.2119	-0.1086	-1.1346 ***
ln (Percent white$_{t-1}$)	0.1654 *	0.1633 ***	0.0863	-0.0239	-0.0736
ln (Percent age 20 to 44$_{t-1}$)	0.2362	0.0492	0.3128 *	-0.3338 **	0.1268
ln (Percent age 45 to 64$_{t-1}$)	0.3224 **	-0.2613 ***	0.2959 **	0.0601	0.1611 **
ln (Percent age 65 and over$_{t-1}$)	-0.2351 ***	0.1045 **	-0.0129	-0.1348 **	-0.0037
ln (Ruggedness)	-0.0209 *	-0.0063	-0.0034	0.0083	-0.0118 **
ln (July Humidity)	-0.0140	-0.0101	-0.0779 ***	0.0227	0.0095
ln (Sunny hours in January)	0.0429	0.0532 **	-0.0037	0.0639 ***	-0.0145
ln (Access to water)	0.0128 **	0.0012	0.0076	-0.0051	0.0057 *
ln (Mean January temperature)	0.0281	0.0567 ***	0.0287	0.0552 ***	-0.0148
ln (Mean July temperature)	-0.4633 **	-0.2565 *	-0.5098 ***	-0.4492 ***	0.0995
ln (Percent agriculture jobs$_{t-1}$)	-0.0091	-0.0173	0.0035	0.0118	-0.0327 ***
ln (Percent mining jobs$_{t-1}$)	0.0160 **	-0.0061	0.0334 ***	-0.0112 **	-0.0090 **
ln (Percent construction jobs$_{t-1}$)	-0.0485	-0.0259	0.0438	0.0278	0.0531 **
ln (Percent manufacturing jobs$_{t-1}$)	0.0410 *	-0.0084	-0.0030	-0.0134	0.0237 *
ln (Percent transportation & utility jobs$_{t-1}$)	0.0253	-0.0078	-0.0224	0.0261	-0.0259
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0941 ***	-0.0263	-0.0189	-0.0538 **	-0.0301 *
ln (Percent retail trade jobs$_{t-1}$)	-0.4204 ***	-0.0898	-0.0211	-0.0287	-0.0171
ln (Percent FIRE jobs$_{t-1}$)	0.0090	-0.0010	-0.0568	-0.0351	-0.0198
ln (Percent service jobs$_{t-1}$)	0.1093 *	-0.0042	-0.0226	0.0467	0.0356
Mid-size metropolitan labor market area	-0.0208	0.0077	-0.0222 *	0.0028	0.0003
Large metropolitan labor market area	0.0253 *	-0.0111	0.0143	0.0055	0.0065
N	256	256	256	256	256
Adjusted R-square	0.741	0.480	0.513	0.353	0.611

*** = significant at 1% level, **=significant at 5%, *=significant at 10%

Note: For a description of the variables see Section 8, Data Appendix.

Source: Authors' calculation.

Table A.4

Alternative Education Instrument Variables and Other Factors Influencing Growth in Proprietorship Share In Non-Metropolitan Labor Market Areas

Variable	1970-2006	1970-1980	1980-1990	1990-2000	2000-2006
Constant	0.7994	0.0137	1.3222	3.3077 **	-0.1789
ln (Proprietorship Share$_{t-1}$)	-0.7056 ***	-0.3199 ***	-0.3936 ***	-0.2293 ***	-0.1315 ***
ln (Local educ spending$_{t-1}$)	-0.0336	-0.0642 ***	0.0712 ***	-0.0180	-0.0387 *
ln(University Count$_{-1}$)	-0.0004	0.0000	-0.0006	-0.0001	0.0004
ln (Per capita income$_{t-1}$)	-0.1803 **	0.0428	-0.0577	-0.0219	-0.0966 *
ln (Unemployment Rate$_{t-1}$)	-0.0071	0.0015	-0.0708 ***	-0.0165	-0.0296 **
ln (DIR per capita$_{t-1}$)	0.1163 **	0.0599	-0.0446	-0.0303	0.0461
ln (Percent Military Jobs$_{t-1}$)	0.0351 **	0.0165	-0.0133	0.0307 ***	-0.0181 **
ln (Percent female$_{t-1}$)	0.3278	0.2352	0.1832	-0.4439	0.0136
ln (Percent white$_{t-1}$)	0.1822 ***	0.2199 ***	0.1635 ***	0.0164	-0.1122 ***
ln (Percent age 20 to 44$_{t-1}$)	-0.0862	-0.2217 *	0.2133	0.0378	0.0327
ln (Percent age 45 to 64$_{t-1}$)	0.4232 ***	-0.0414	0.0483	0.2581 ***	0.1951 ***
ln (Percent age 65 and over$_{t-1}$)	-0.0585	0.0459	0.1140 **	0.0771	-0.0204
ln (Ruggedness)	0.0044	-0.0087	0.0081	0.0086	-0.0044
ln (July Humidity)	-0.0308	-0.0058	-0.1074 ***	-0.0717 ***	0.0403 **
ln (Sunny hours in January)	0.0897 **	-0.0042	-0.0727 **	0.0918 ***	0.0198
ln (Access to water)	0.0017	0.0040	0.0005	0.0044	0.0068 **
ln (Mean January temperature)	0.0680 ***	0.0525 ***	0.0183	0.0080	-0.0036
ln (Mean July temperature)	-0.6441 ***	-0.2937 **	-0.1247	-0.4929 ***	-0.1057
ln (Percent agriculture jobs$_{t-1}$)	0.0225 *	0.0139	0.0133	0.0215 **	0.0001
ln (Percent mining jobs$_{t-1}$)	0.0002	-0.0037 **	0.0029 *	0.0019	-0.0025 **
ln (Percent construction jobs$_{t-1}$)	0.0544 **	0.0481 ***	0.0367 *	-0.0196	0.0192
ln (Percent manufacturing jobs$_{t-1}$)	0.0097	0.0070	-0.0312 ***	0.0023	0.0049
ln (Percent transportation & utility jobs$_{t-1}$)	-0.0624 ***	-0.0318 **	0.0153	-0.0288 *	-0.0140
ln (Percent wholesale trade jobs$_{t-1}$)	-0.0367 **	-0.0468 ***	-0.0167	-0.0450 ***	0.0036
ln (Percent retail trade jobs$_{t-1}$)	-0.0626	-0.0883 **	-0.1640 ***	-0.0136	0.0297
ln (Percent FIRE jobs$_{t-1}$)	-0.0082	-0.0170	0.0684 **	0.0381	-0.0453 **
ln (Percent service jobs$_{t-1}$)	-0.0190	-0.0291	-0.0226	-0.0870 **	-0.0339
Mid-size nonmetropolitan labor market area	-0.0906 ***	-0.0314 *	-0.0226	-0.0044	-0.0390 ***
Large nonmetropolitan labor market area	-0.1159 ***	-0.0210	-0.0498 **	-0.0151	-0.0434 ***
N	466	466	466	466	466
Adjusted R-square	0.593	0.465	0.394	0.212	0.358

*** = significant at 1% level, **=significant at 5%, *=significant at 10%

Note: For a description of the variables see Section 8, Data Appendix.

Source: Authors' calculation.

8. Data Appendix

Proprietorships

Calculation of the number of proprietorships and the proprietorship share were based on county employment data from the Regional Economic Information System of the U.S. Department of Commerce Bureau of Economic Analysis. Data was gathered on non-farm proprietor employment and non-farm wage-and-salary employment in each county in 1970, 1980, 1990, 2000, and 2006. The rate of growth in the number of proprietorships was calculated for 1970 to 2006, and for each decade. The proprietorship share in any year was the number of non-farm proprietors divided by total non-farm employment. Total non-farm employment was non-farm proprietors plus non-farm wage-and-salary employment. County values were aggregated into values for multi-county LMAs.

College Graduation Rate

The college graduation rate is the percentage of the population age 25+ with a college degree or higher in 1970, 1980, 1990, and 2000. These data were gathered from the Census of Population for 1970, 1980, 1990, and 2000 by county. County data was aggregated to LMAs.

Local Government Education Spending

Local government education spending is total local government spending as a share of personal income. Data on local government education spending for each county were taken from the 1977, 1982, 1987, and 1992 Census of Government. Data on personal income for each county in 1977, 1982, 1987, and 1992 were taken from the *Regional Economic Information System* data base of the U.S. Department of Commerce. County data was then aggregated to LMAs.

Four-year Colleges and Universities

The number of four-year colleges or universities in 1980 for counties in each LMA was downloaded from the National Center for Education Statistics website (http//nces.ed.gov/ipedspas/). Institutions were initially geo-located by ZIP codes, which are then assigned to counties using a ZIP-to-county correspondence purchased from zipinfo.com. County totals were aggregated to get counts of universities for each LMA.

Unemployment Rate

The unemployment rate is the percentage of the population that indicated that they were in the labor force but unemployed when responding to the U.S. Census. The county unemployment rate was taken from the 1970, 1980, 1990, and 2000 Census. County data was aggregated to LMAs.

Dividend, Interest, and Rent Income Per Capita

Dividend, interest, and rent income data and population data is available for each year from 1969 to 2007 from the *Regional Economic Information System* of the U.S. Department of Commerce. Population and dividend, interest, and rent income data was gathered for each county in the contiguous U.S. states for the years 1970, 1980, 1990, and 2000. County data was summed to LMA totals. LMA dividend, interest, and rent was divided by total population to yield the per capita value.

Percent Military Employment

The percent military employment is military employment divided by total non-farm employment. Both data is available for all U.S. counties in *Regional Economic Information System* of the U.S. Department of Commerce. County data was gathered for 1970, 1980, 1990, and 2000 and summed to LMA totals. Military employment is then divided by total non-farm employment to calculate the percent military employment.

Percent Female

The percent female is the total number of females in an LMA divided by the total population. Data on total and female population in each county was available from the 1970, 1980, 1990, and 2000 Census of Population. County totals were summed to LMAs.

Percent White

The percent white is the total white population of an LMA divided by the total population. Data on total and white population in each county was available from the 1970, 1980, 1990, and 2000 Census of Population. While the racial choices varied from census to census, we choose percent white as the only variable. The percent white likely dropped in the 2000 Census in part because of the inclusion of the two or more races option for respondents. County totals were summed to LMAs.

Age Categories

The percent of the population under age 20 is the total number of persons within that age range in an LMA divided by the total population. Data on total and population and population by age group in each county was available from the 1970, 1980, 1990, and 2000 Census of Population. County totals were summed to LMAs. A similar approach was used to calculate the percentage of the population that was age 20-44, 45-64, and 65 or older.

Temperature, Humidity, Sunny Days and Water Surface Area

The mean July temperature and water access variables in each LMA were developed by the U.S. Department of Agriculture, Economic Research Services, fully described in McGranahan (1999). Temperature data were annual averages for 1941 through 1970. Humidity in July is the average daily humidity during that month over that time period. The measure sunny hours in January is the average number of hours in that month. Water area is measured as water area as a percent of total county area. County data were aggregated into LMAs based on shares of surface area.

Topography(Ruggedness)

The topography scale is from McGranahan (1999), who mapped topographic information from The National Atlas of the United States of America 1970 to U.S. counties. The land surface code scale (1 through 21) runs from 1 (plains) to 21 (high mountains). Land surface codes by county are aggregated to labor market regions using county shares of surface area.

Industrial Structure

Industrial structure is captured based on the share of LMA employment in each of 9 major non-farm industry groups (with the 10^{th} industry, government, the omitted industry). Given our interest in industrial structure in the year 2000 and earlier, we focus on the Standard Industrial Classification structure, rather than the NAICS structure current in use. The nine industries are: agriculture, forestry, and fisheries; mining; construction; manufacturing; transportation and utilities; wholesale trade; retail trade; finance, insurance, and real estate; and services. The percent of employment in manufacturing would be total manufacturing employment in the LMA divided by total non-farm employment in the LMA. A similar approach would be used for other industries. Industry employment data is available for all U.S. counties in *Regional Economic Information System* of the U.S. Department of Commerce. County data was gathered for 1970, 1980, 1990, and 2000 and summed to LMA totals. Missing values for employment in industries in counties, when this occurred, were estimated following Hammond and Thompson (2004).

LMA Size and Urban Orientation Code

LMAs are classified into 6 categories based on population and urban orientation. LMAs are classified based on the county classification of the largest county in each LMA. The codes are designed for ERS regions by (Tolbert and Sizer, 1996). Small metropolitan areas are those with less than 250,000 residents in 1990. Mid-size metropolitan areas are those with at least 250,000 but less than 1.0 million residents. Large metropolitan areas are those with more than 1.0 million residents. Small nonmetropolitan regions are those with less than 5,000 residents in 1990. Mid-size nonmetropolitan regions are those with at least 5,000 residents but less than 20,000 residents. Large nonmetropolitan areas are those with at least 20,000 residents.

9. Glossary of Key Terms

Agglomeration Effects – The effects that occur when a large number of entrepreneurs are located in the same region. Positive agglomeration effects could result from positive knowledge spillovers or better entrepreneurial services (e.g. technological, financial) in areas with large concentration of entrepreneurs.

Convergence – Occurs when values of the variable of interest become more similar over time. For example if region 1 has a self-employment share of 10 percent and region 2 has a self-employment share of 30 percent, any change that reduces the difference from 20 percentage points represents convergence. This could occur if the share in region 1 grows at a higher rate that the share in region 2 or if the share in region 2 declines by more than the share in region 1.

Entrepreneurship capital – The capacity of individuals to start new firms including legal, institutional, and social factors.

Entrepreneurial Counts – The number of entrepreneurs in a region.

Entrepreneurial Shares – The ratio of entrepreneurs and the total number of employed, also referred to as entrepreneurial concentration.

Human Capital – The cumulative skills and knowledge used in work activities (labor used to produce economic output). These skills and knowledge sets are acquired through education and work experience.

Knowledge spillovers – Ideas and knowledge added to the market by entrepreneurs (sometimes generated in large firms that decide not to pursue them) that potentially benefit all firms in the community.