Determinants of growth in non-farm proprietor densities in the US, 1990–2000

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Abstract The number of non-farm proprietorships in the US has expanded significantly in past decades, but this expansion has not occurred evenly over space. Regression analysis correcting for spatial autocorrelation reveals that proprietors respond rationally to economic incentives. Parameter estimates for variables measuring collateral, age, ethnic mix, government policy, female labor force participation, and natural amenities, each have the expected signs. A few options are available to policymakers for influencing growth in self-employment densities over time.

Keywords County-level · Non-farm proprietor employment density · Spatial effects

JEL Classifications L26 · J24

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1 Introduction

The perhaps most remarkable and least-studied labor market trend in recent decades has been the sharp rise in non-farm proprietor employment. The number of full- and part-time non-farm self-employed workers or proprietors tripled between 1969 and 2004 from 9.6 to 29.2 million. In comparison, the number of full- and part-time wage-and-salary workers grew by only 77%, or 60.1 million, from 78.8 million in 1969 to 138.8 million workers in 2004. The ratio of self- to wage-and-salary employment nearly doubled, from 0.12 to 0.21, over this period (Fig. 1).[1] In rural areas

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[1] The data are from the Regional Economic Information System, Bureau of Economic Analysis, US Department of Commerce, Washington, DC; ordering information for the compact disc is available at: http://www.bea.gov/bea/regional/docs/cd.asp. Nation-wide (rural and urban areas), the number of non-farm proprietorships increased from 12.3 to 27.8 million, with the share of proprietors in all jobs nationally rising by more than 50%, from 10.5% to 15.4%. In this study, "rural" and "non-metro" are used interchangeably, as are the terms proprietorship and self-employed. According to the Current Population Survey (2004 March Supplement), the proprietors work in these industries (ranked by order of importance): services, construction, retail, FIRE, manufacturing, transportation and public utilities, wholesale, and information (Low et al. 2005). Given the data limitations, we are largely unable to examine differences across scales of proprietorship operations, and this is one shortcoming of the analysis; in terms of sector detail, we control for construction, services, retail trade, and high-tech employment, and assume that these operate as intercept rather than slope shifters.

Fig. 1 Proprietor and wage-and-salary jobs, and ratio, 1969–2004
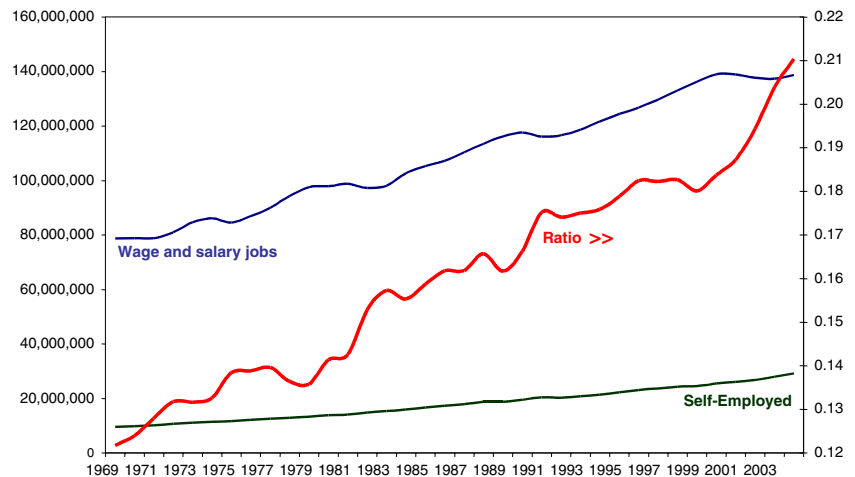
especially, this significant growth likely reflects job losses and downsizing of workforces in manufacturing and large firms, among other factors (Beyers 1996; Johnson 2000). Without this shift toward self-employment, the rural population decline documented by McGranahan and Beale (2002) and Goetz and Debertin (1996) for natural resource- and manufacturing-dependent communities would likely have been even greater—as would the attendant adjustment problems facing the population left behind.

This study identifies factors associated with net growth between 1990 and 2000 at the county-level in the ratio of non-farm proprietorships to all full- and part-time workers. We focus on these years to examine the phenomenon during the unprecedented economic expansion of the 1990s, and because of data availability. Proprietor numbers are calculated for each county by the Bureau of Economic Analysis (BEA) based on federal tax Form 1040 (Schedule C) for sole proprietorships and Form 1065 for partnerships data. These estimates include individuals who may be otherwise employed, but have additional income from self-employment, and they may include multiple filings by the same individual. While proprietors cannot be equated with entrepreneurs per se, they arguably have more in common with this group than with wage-and-salary workers, or workers who choose to remain unemployed after a lay-off.[2] Proprietors create new jobs for themselves, and often for others.

If the alternative to creating proprietorships is unemployment, then it is important for local and state decision-makers to know whether and how state- and county-level policies and socioeconomic characteristics foster or impede the net formation of proprietorships. This is especially true for those communities that have lost their manufacturing base, since these communities are unlikely to be able to recreate this base. For many of these counties, home-grown entrepreneurship or self-employment is the only viable source of economic growth and development available.

This study sheds new light on how county-level economic and social variables influence rates of self-employment growth, using a data set and measures that have not been employed previously in these kinds of studies. As one important innovation, we examine both individual- and community-level characteristics, uncovering the relative importance of each variable type, rather than relying on only one or the other. Perhaps more importantly, our study identifies specific policy levers available to public decision-makers to influence changes in self-employment shares over time. We find that the self-employed respond rationally to economic incentives, including the risk of self-employment—a factor that has not widely been considered explicitly or empirically in previous work. Our study also represents the first effort to explicitly

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[2] In particular, the degree of risk acceptance and creativeness or innovativeness likely distinguishes true entrepreneurs from

Footnote 2 continued
the self-employed, and so the analogy between the two types of individuals is not without problems. We draw on the entrepreneurship literature to generate maintained hypotheses for variables to include in the regression.

model county-level spillover effects leading to changes in self-employment rates, using relatively new spatial econometric techniques.

2 Conceptual framework

The empirical question investigated here is grounded in the theory of firm entry, growth and exit, which is well-developed in the industrial organization literature (e.g., Tirole 1988; Borjas 1986; Evans 1987a, b; Evans and Jovanovic 1989; Evans and Leighton 1989; Dunne et al. 1989; Dunne and Hughes 1994; Jovanovic 1982; Parker 1996). We draw on this literature to motivate the dynamic behavior of the self-employed or proprietor(ship)s as "firms." Fundamentally, the theory captures firm entry, growth, and exit behavior, which together lead to the net firm turnover dynamics that are of interest in this study. While most of this literature examines plant characteristics (e.g., Dunne et al. 1989; Dunne and Hughes 1994), we use county characteristics as proxies for the average characteristics of the population pool from which proprietors are drawn and to reflect the local market conditions in which they operate. We use these characteristics to draw stylized conclusions and recommendations in terms of what policy-makers can and cannot do to influence rates of proprietorship formation. This is consistent with Jovanovic (1982), who uses heterogeneity of individual proprietors over space to derive patterns of net firm growth and decline that are empirically tractable. Most studies of entrepreneurship posit a choice between two labor market states, namely wage employment or self-employment.

Consider a county with workforce normalized at one. Workers maximize expected utility of random income by choosing between wage employment of h hours at wage rate w and self-employment by producing output $q(l: \tau)$, where l is labor input and τ the individual's entrepreneurial ability (Cowling and Mitchell 1997).[3] Output is sold at price P, which

includes a stochastic component reflected in risk parameter η. This aspect of self-employment risk has received less attention in the literature (Parker 1996); we define this risk as being associated with self-employment relative to wage or salary employment net of non-pecuniary self-employment benefits (see also Hamilton 2000). Proprietors seeking to enter (start their own firm) incur costs vM, where v is per unit input price and M the quantity of inputs. Self-employment income is

$$\pi_i = P(\eta) \, q(l:\tau) - vM \qquad (1)$$

Defining $\omega = wh$, total income earned by a typical worker is $Y = \omega + \pi$, where time is allocated between the two types of income-earning activities (states) subject to a standard time constraint. We assume further that individuals maximize lifelong income by comparing the expected present value of ω to π. If

$$\int_t \left(\pi_i(t) - \omega_i(t) \right) \mathrm{d}t > 0, \qquad (2)$$

individuals choose to become self-employed rather than wage-and-salary workers.

3 Empirical model and data

Equation 2 may be written as an index function:

$$I_i = \pi_i(t) - \omega_i(t) = \beta \boldsymbol{x_i} + \varepsilon_i > 0 \qquad (3)$$

where $\boldsymbol{x}_i$ represents observable financial, managerial, and socioeconomic characteristics affecting π_i or ω_i, β is the parameter vector, and ε a disturbance term (see also Borjas 1986, Parker 1996). If $\pi_i(t) > \omega_i(\mathrm{t})$, a worker becomes self-employed, and a wage/salaried worker otherwise. The probability that the representative worker becomes self-employed is a function of the income differential between these choices: $\mathrm{Prob}_i(\pi_i(t) - \omega_i(t)) > 0$.

We introduce spatial heterogeneity through county average values that serve as proxies for the average characteristics of the potential pool from which proprietors are drawn. This in turn introduces variations in $\mathrm{Prob}_i(\pi_i(t) - \omega_i(t)) > 0$ and, therefore, variations in self-employment choices across workers. Define the total workforce in a county in year t as temp_t so that proprietor density is $\mathrm{prop}_{it}/\mathrm{temp}_{it}$. Our objective is to identify the determinants of changes in proprietorship density between 1990 (t–10) and 2000

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[3] This assumption may not fully explain the decisions of rural people. They may be willing to give up some level of income (wealth) to live in rural areas. In a spatial world, income maximizing individuals would simply move out of rural areas, but many choose not to. Researchers have suggested that because of lower opportunity costs, rural business owners are willing to accept lower rates of return. This possibility is embedded in our model as shift factor τ.

(t). In the above framework, this proprietorship density change is

$$\Delta\text{prop} = \text{prop}_t/\text{temp}_{it} - \text{prop}_{t-10}/\text{temp}_{t-10}$$
$$= f(\beta\boldsymbol{x}_i + \varepsilon_i) \tag{4}$$

Our primary interest in this study is to expand and investigate vector $\boldsymbol{x}$ in Eq. 4. To motivate the selection of regressors, we consult the large extant literature on innate individual and broader socioeconomic regional characteristics associated with entrepreneurial activity or firm "births." Previous work in this area has tended to focus either on the characteristics of individual entrepreneurs or on the local market conditions affecting entrepreneurship. In this study, we incorporate both sets of factors.

Of central interest are the shifters of the net proprietorship formation function. In addition to the relative returns from self-employment (π_i) and wage employment (ω_i), and self-employment risk (η_i), demographic (Ω_i), regional (Ψ_i), and government policy (Γ_i) characteristics are key determinants of changes in non-farm proprietor densities. These shifters include spatially varying cost factors that are associated with new business formation.

As noted above, risks associated with self-employment (η_i) have received less attention in the literature. Using the number of strikes as a measure of risk, Parker (1996) found that the proportion of time allocated by an individual to self-employment in the United Kingdom is inversely related to the riskiness of returns to self-employment and the degree of risk aversion. We use the coefficient of variation of the ratio of total self-employment income to wage-and-salary income in a county for a 10-year period (1986–1995) to measure self-employment risk. The coefficient of variation is hypothesized to be negatively associated with self-employment growth.

3.1 Demographic characteristics (Ω_i)

These are represented by average county-wide values, so that each county proxies for the average characteristic of the potential pool from which proprietors are drawn. Collateral in the form of wealth is an important determinant of a nascent entrepreneur's ability to start a new business, because it facilitates borrowing of capital (Evans and Jovanovic 1989; Bates and Dunham 1992; Bates 1993; Reynolds 1994; Robson 1998a, b;

Uusitalo 2001). Two related variables are the percentage of owner-occupied homes and median housing value in a county. Homeownership and higher housing values significantly improve a proprietor's ability to secure supplemental loan finance (Robson 1998a, b), since financial institutions in the US consider homes to be a major source of loan collateral.

Individuals with more education are more likely to become entrepreneurs (Goetz and Freshwater 2001; Evans and Leighton 1989; Bates 1993; Audretsch and Fritsch 1994; Malecki 1994; Bregger 1996; Robson 1998a). According to Bates (1993, p. 249), "[h]ighly educated and skilled potential entrepreneurs are particularly sensitive to the opportunity costs of self-employment because business ownership often entails sacrificing high-wage positions as employees." Self-employment rates increase with age (Evans and Leighton 1989; Bregger 1996, p. 7; Robson 1998a), reflecting both greater experience levels and potential age discrimination in the labor market.

In addition, ethnicity can affect entrepreneurial propensities in a locality. Various studies have investigated the relationship between ethnic diversity and economic development (Easterly and Levine 1997; Alesina et al. 1999; Alesina and La Ferrara 2000; Koellinegr and Minniti 2006; Minniti and Nardone 2006)). Easterly and Levine (1997) and Alesina et al. (1999) argue that ethnic diversity tends to increase polarization in a society and thus impede agreement about the provision of public goods, and create positive incentives for growth-reducing policies. Alesina and La Ferrara (2000) find that participation in associational activities is significantly lower in ethnically fragmented localities. Studies on social capital find ethnically fragmented societies to have less social capital (see Rupasingha et al. 2006) leading to less-trusting societies. Social interaction among local entrepreneurs represents an important venue for sustaining and enhancing local entrepreneurship. On the other hand, greater diversity in the form of a "melting pot" is argued to enhance economic wellbeing because it is associated with the presence of the creative class (Florida 2002). One can also argue that greater diversity leads to diversified consumer demand patterns leading to specialization among firms and niche markets.[4] In

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[4] We are grateful to an anonymous reviewer for this point.

addition, of course, ethnic background likely captures intrinsic cultural differences in attitudes toward entrepreneurship. We use the Alesina et al. ([1999]) measure of ethnic diversity to capture labor market discrimination with respect to race:

$$\text{ethnic} = 1 - \sum_i (\text{Race}_i)^2 \qquad (5)$$

where Race_i denotes the share of population self-identified as of race $i \in I = \{$White, Black, Asian and Pacific Islander, American Indian, and Other$\}$. This measure captures the odds that two individuals drawn at random from a county are of the same race.[5] The percentage of women in the total labor force is included because females are less likely than males to be self-employed.

3.2 Regional characteristics (Ψ_i)

Inclusion of per capita income in the model captures the possibility that a higher-income economy supports a relatively larger number of niche markets that entrepreneurs can supply (Robson [1998]a). In particular, if wealthy individuals prefer goods that are not mass-produced, opportunities arise for the self-employed to supply custom-made products and personal services (e.g., landscaping services). Per capita income also reflects aggregate demand in an economy (Robson [1998]b). We also incorporate the per capita income growth rate between 1985 and 1990 in order to control for economic activity in a county and county economic growth.[6] Even though proprietors likely have access to national credit markets to raise capital, following Malecki ([1994]), the amount of dollars deposited per capita in local banks is included in the model as a proxy for availability of seed capital.

Other regional characteristics affecting net proprietorship growth can be differentiated into those that can and cannot be influenced by local governments. Higher unemployment rates raise the odds of lay-offs and the relative returns to self-employment and, therefore, increase the share of proprietorships in all

jobs. The share of non-farm proprietors in 1990 is included in the regression to test for convergence in the proprietorship growth rate and to control for the relative size of the existing proprietor base in the county. We also include a vector of 1990 employment shares by industry to control for the growth dynamics of different sectors (Malecki [1994]; Armington and Acs [2002]). Robson ([1998]b) suggests that the rise in demand for the output of a sector that requires "low minimum efficient scales of operation" may stimulate growth in self-employment. We include shares of construction, service sector, and retail trade employment in the model to test for this possibility.

We also explore the effects of location-specific amenities on proprietorship growth, using McGranahan's ([1999]) measure. An indicator variable for the Appalachian Regional Commission (ARC) area is included to test for cumulative effects of federal economic development programs on proprietorship growth in the 1990s; stimulating entrepreneurship is an ARC priority. Last, a rural dummy variable (non-metro counties) was included to test for the possibility that rural/urban status of a county impacts proprietorship growth.

3.3 Policy characteristics (Γ_i)

Government policies affect the growth of proprietorships or self-employment, and wage-and-salary employment.[7] In particular, taxes, government spending, and labor laws can affect the growth of entrepreneurship in a locality in various ways. One hypothesis is that higher taxes stifle entrepreneurship and overall job growth by discouraging firms from locating in an area. Reducing taxes is thus viewed as an important stimulus for entrepreneurship growth and the question whether the impact of this variable is greater on self-employment than on wage-and-salary employment growth has to be answered empirically. On the other hand, higher taxes may lead to higher levels of self-employment because of the greater incentive to evade taxes; such evasion is easier with underreporting of self-employment income compared

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[5] To compare our results with those of previous studies, we also included shares of different ethnic groups in a separate regression. This is discussed in the results section.

[6] We thank a reviewer for this point.

[7] Again, we thank a reviewer for pointing out the significance of government policies in our study and directing us on where to find measures to incorporate in the empirical analysis.

to wage–salary income (see Blau 1987; Parker 1996; Robson 1998b). One can argue that in general, big government, minimum wage laws and higher, labor union rates discourage entrepreneurship activity in a locality. An alternative argument is that although these factors discourage wage-and-salary employment in general, they encourage self-employment because of lack of opportunities in formal employment sector.

We use the state-level *Economic Freedom of North America* (EFNA) index published by the Fraser Institute (www.freetheworld.com) to capture the effects of various government policies on self-employment growth. The EFNA is an attempt to measure the extent of the restrictions on economic freedom imposed by governments, and it rates economic freedom on a 10-point scale (higher values mean more economic freedom) for two indices. An all-government index captures the impact of restrictions on economic freedom by all levels of government (federal, state, and local). A sub-national index captures the impact of restrictions by state and local governments. It employs 10 components in three areas: (1) size of government (general consumption expenditures by government as a percentage of GDP, transfers and subsidies as a percentage of GDP, and social security payments as a percentage of GDP); (2) takings and discriminatory taxation (total government revenue from own source as a percentage of GDP, top marginal income tax rate and the income threshold at which it applies, indirect tax revenue as a percentage of GDP, and sales taxes collected as a percentage of GDP); and (3) labor market freedom (minimum wage legislation, government employment as a percentage of total state/provincial employment, and union density). We use these three measures as three separate variables in our model.

This leads to the specification of the following general model of net proprietorship or self-employment density growth (Δprop$_i$) in county i over time:

$$\Delta \text{prop}_i = f(\pi_i, \ \omega_i, \ \eta_i, \ \Omega_i, \ \Psi_i, \ \Gamma_i) = f\ (\mathbf{X}_i\beta + \varepsilon_i) \tag{6}$$

where all regressors (summarized in $\mathbf{X}$) were defined previously. Figure 2 shows county-level increases and decreases in self-employment shares or densities between 1990 and 2000 (variable dpropsh$_i$). While the overall pattern seems largely random, certain

county clusters emerge in which the density decreased, for example, in north-central Pennsylvania and central Vermont, as well as in southern Illinois and parts of the southern Great Plains states. This potential spatial clustering is explored below in greater detail.

4 Econometric issues

Equation 6 shows the change in county proprietorships relative to total employment from 1990 to 2000. In this formulation the regressors "explain" relative growth in proprietorships, or whether and how the mix of proprietors in total employment is changing relative to total employment.

As already noted, county-level aggregates are used to proxy for the characteristics of the pool of individuals from which entrepreneurs potentially emerge, and the local market conditions facing the self-employed. For example, a larger share of adults in a county with at least some college experience represents a larger pool of individuals with the requisite skills and knowledge to start their own businesses; consequently, this variable is hypothesized to positively affect proprietorship growth over time. The percent of owner-occupied housing and median housing value in each county are used to proxy for wealth and access to collateral. Median population age captures age-related effects, including the average amount of experience of workers.

Summary statistics for regressors used in the equations are reported in Table 1, along with the expected sign for each variable. The source for most of the data is either the Regional Economic Information System (Bureau of Economic Analysis) or the 1990 Population Census (Census Bureau); details are contained in the notes to Table 1 and in footnote 1.[8]

4.1 Spatial dependence

Figure 2 reveals that proprietorship growth potentially displays spatial patterns, suggesting that the growth is not independently distributed over space. A

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[8] Although most data are from publicly accessible sources, we will make the data set used in this study available for anyone who wishes to replicate or extend our results.

Fig. 2 Net change in proprietor jobs as a share of all jobs, non-farm, 1990–2000

Change in proprietorship rate
- -0.33 - 0
- 0 - 0.015
- 0.015 - 0.036
- 0.037 - 0.34
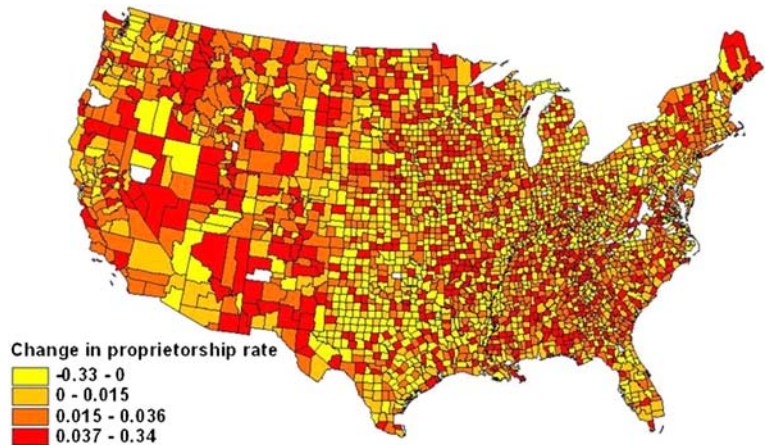
high concentration of proprietorship change occurs in Western and Midwestern counties, and Southeast and Northeast counties. The apparent clustering of proprietorship growth rates indicates that the data may not be randomly distributed. Such clustering of observations in space is known as spatial dependence.

Spatial dependence may follow either a substantive or a nuisance process (Anselin et al. 1996; Anselin 2000), or both. Substantive process refers to spatial interaction among neighboring observations that is due to some sort of underlying interaction mechanism, e.g., copycat behavior, spatial externalities, etc. In this study, proprietorship growth in a county may depend on that occurring in neighboring counties, after we account for other explanatory factors, because of growth-related spatial spillovers. This is typically modeled using a spatial lag model. In the case of a nuisance process, spatial dependence arises because of omitted spatially correlated variables, or because the spatial data may not capture fully the causes of proprietorship formation and the values of adjacent observations move together due to common or correlated unobservable variables. Thus, a random shock in county i not only affects the proprietorship growth in that county, but also the proprietorship growth in neighboring counties through the autocorrelated disturbance term (Rey and Montouri 1999). For example, a booming self-employment sector brought about by tourism expansion may stimulate growth in business services proprietorships in adjacent counties. Nuisance issues in the data, when left unaddressed, can cause

inefficient estimates and invalid hypothesis testing. In this article, we test and allow for both types of spatial dependence: proprietorship growth spillover effects and spatial dependence that operates through an autocorrelated disturbance term.

The spatial clustering of variables, and the possibility of omitted variables representing connectivity among neighboring localities, raise model misspecification concerns (Anselin 1988) and the possibility that OLS estimates are biased and inconsistent (LeSage 1999). Anselin (1988) reviews methods for addressing spatial interaction, and recent advances in applied spatial econometrics provide procedures for including spatial effects in empirical models even with large data sets (Pace and Barry 1997; LeSage 1999). The different types of spatial dependence require specification of different models: the substantive process requires the formulation of a *spatial lag* model, while the nuisance process requires estimation of a *spatial error* model (Anselin 2000). LeSage (1999) outlines several alternative specifications that can be used to correct for spatial dependence, including the spatial auto-regressive model (SAR) $S = \rho W(S) + \mathbf{X}\boldsymbol{\beta} + \varepsilon$, where $\varepsilon \sim N(0,\sigma^2 I_n)$ and S is an $n \times 1$ vector of the dependent variable, $\mathbf{X}$ represents an $n \times k$ matrix containing the determinants of proprietorship growth, W is a spatial weights matrix, scalar ρ is a spatial autoregressive parameter, and $\boldsymbol{\beta}$ denotes the k parameters to be estimated for $\mathbf{X}$. The other specification is the spatial error model (SEM): $S = \mathbf{X}\boldsymbol{\beta} + u$, $u = \lambda W u + \varepsilon$, $\varepsilon \sim N(0,\sigma^2 I_n)$, where λ is a scalar spatial error coefficient and the other variables were defined previously.

Table 1 Description of variables and summary statistics

Variable	Description	Expected effect	Mean	Std. dev.	Min.	Max.
Δprop_i	Change in proprietor share (see text, Eq. 4)[a]	na	0.019	0.038	–0.325	0.338
π_i	Proprietor earnings, $'000 per job, 1990[a]	+	13,750	3,824	2,333	66,650
ω_i	Wage-and-salary earnings, $'000 per job, 1990[a]	–	17,257	3,689	9,991	40,549
η_i	Coefficient of variation (see text for details)[a]	–	0.378	0.207	0.073	3.368
PCOWNOCC	Owner-occupied homes, % of total, 1990[b]	+	72.84	7.40	18	88
MEDHVALU	Median housing value (owner-occupied), $, 1990[b]	+	53,166	32,670	14,999	487,300
HISCH90	Persons with high school degree, % of adult, 1990[b]	+	0.344	0.061	0.135	0.526
COLLEGE	Some college or more, % of adults, 1990[b]	+	0.205	0.053	0.079	0.417
MDAGE	Median age of population, years, 1990[b]	+	34.43	3.59	20	55
ETHNIC	Ethnic fractionalization index (see text, Eq. 3)[b]	+	0.215	0.190	0.003	0.751
FLF90	Female labor force particip., % of total labor force[b]	±	0.443	0.027	0.271	0.571
PCINC90	Per capita income, $ per person, 1990[a]	±	14,853	3,403	5,266	44,436
DEPOPC	Bank deposits, $/capita, June 30, 1988[b]	+	16.22	6.72	0.000	73
UNEMPL	Unemployment rate, per cent, 1990[b]	+	6.10	2.64	0.500	37.200
SH90	Share of proprietors in 1990, % of total employmt[a]	+	0.167	0.053	0.011	0.556
CONS	Construction employment, % of total, 1990[a]	+	0.109	0.516	0.000	9
SERVICE	Service sector employment, % of total, 1990[a]	+	0.276	0.702	0.020	24
RTRADE	Retail trade sector employment, % of total, 1990[a]	–	0.185	1.42	0.017	77
PCHTEK90	High tech establishments per 10,000 people, 1990[e]	+	0.669	1.014	0.000	13
INCTAX93	Per capita state income tax, 1993[b]	+	383	222	0.000	895
AMNSCALE	McGranahan's amenity scale[c]	+	0.051	2.30	–6.400	11
RURAL	Non metropolitan counties, DV = 0,1 if Beale > 3[c]	+	0.771	0.420	0.000	1.000
ARCDUM	Appalachian Region, DV = 0,1 if yes[d]	±	0.130	0.337	0.000	1.000
GWTH8590	Per capita income growth rate between 1985–90[a]	+	0.253	0.085	–0.21	1.09
AREA1L	EFNA area 1 as explained in the text[f]	±	7.766	0.826	5.6	8.7
AREA2L	EFNA area 2 as explained in the text[f]	±	7.050	0.700	5.5	8.2
AREA3L	EFNA area 3 as explained in the text[f]	±	6.528	0.838	5.1	8.4

Sources: Authors' calculation using sources described in notes below:

[a] Bureau of Economic Analysis, REIS CD-ROM, 2000

[b] Census Department, CD-ROM, 1996

[c] U.S. Department of Agriculture

[d] TVA Rural Studies

[e] Bureau of the Census, County Business Patterns CD-ROM, 1990

[f] The Economic Freedom Network: www.freetheworld.com; note that higher values mean more economic freedom

If spatial dependence is suspected both in the form of a spatial lag and error term, a general spatial model (SAC) should be estimated (LeSage 1999). The SAC model nests both the spatial lag term and the spatial error structure: $S = \rho W(S) + \mathbf{X}\boldsymbol{\beta} + u$, where $u = \lambda W u + \varepsilon$ and $\varepsilon \sim N(0, \sigma^2 I_n)$. Diagnostic tests are available for detecting potential spatial dependence in the data (Anselin et al. 1996). LeSage (1999) proposes estimating the general spatial model on a particular data set in order to arrive at an appropriate spatial model; estimating the SAC model first can serve as a guide to selecting the appropriate spatial model. If both spatial parameters (ρ and λ) are positive and significant, the SAC model should be chosen; alternative, if only $\rho(\lambda)$ is positive and significant, then the SAR (the SEM) model is appropriate.

A more disaggregated view of spatial autocorrelation is provided by Local Indicators of Spatial

Fig. 3 LISA cluster map of
net proprietorship change,
1990–2000

LISA Cluster Map

Not Significant
High-High
Low-Low
Low-High
High-Low
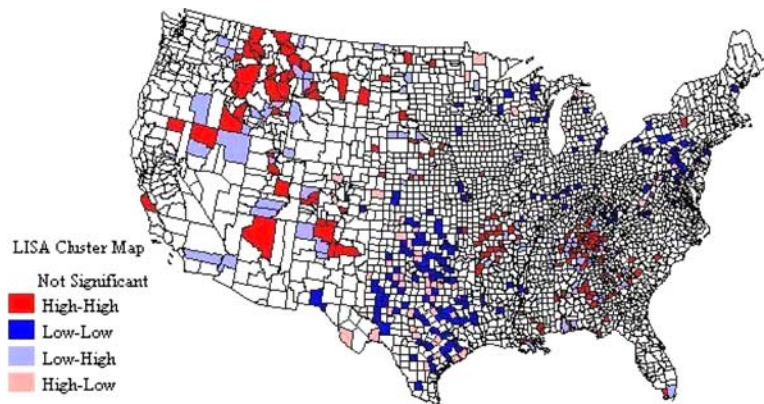
Association (LISA) cluster maps (Anselin 1995,
2004).[9] As illustrated in Fig. 3, these maps reveal
various combinations of high–high, low–high, high–
low, and low–low counties in terms of values of the
spatially clustered variable of interest. So-called
hotspot clusters of high proprietorship growth coun-
ties surrounded by high growth counties are evident
in the Southeastern US (e.g., Tennessee) and the
Intermountain West (e.g., Idaho). In contrast, *cold-
spots* of low–low county clusters appear in Texas,
Oklahoma, Pennsylvania, and Maryland. A limited
number of high-growth counties appearing next to
low-growth counties are also apparent. In general, the
map provides some evidence of the need to at least
test for the possibility of spatial dependence bias in
the dependent variable and regression model.

5 Results

In addition to specifying a first-order-contiguity
matrix, we tested different spatial weight matrices
based on alternative definitions of "nearest neigh-
bors" (see also Lesage 1999). Experimenting with
one to four nearest neighbors, we defined "nearest"
counties empirically and independently of contiguity.
The intuition here is that a noncontiguous county may
still be sufficiently "close" to exert an influence on
the county in question. Diagnostic (robust LM) tests

were performed separately to identify the extent of
the error vs. lag effects (Anselin et al. 1996) using
recently developed *GeoDa* software. The results
show that both forms of spatial effects are present
in the data.

The SAC model for all counties with three nearest
neighbors ($n = 3$) produced the best fit based on log
likelihood values for this data set, with both spatial
parameters showing statistical significance. Since
OLS is not appropriate for modeling changes in
proprietorship densities over the specified time
period, our inference is based on the SAC model
estimation, with results reported in Table 2.

The statistically significant spatial parameter esti-
mates have interesting implications. A positive and
significant spatial dependence in the dependent
variable (proprietorship growth rate) indicates that
proprietorship growth in a particular county is not
independent of proprietorship growth in surrounding
counties. Even though this result is econometrically
significant, it may not be significant in terms of
economic impact. For example, the value of the
spatial autocorrelation coefficient ($\rho = 0.027$) indi-
cates that if a county's neighbors' average rate grew
by 10%, it not only would be a very small change
(2.7%), but also that this growth would occur only
when all surrounding areas grow. Moreover, if a
county had five neighbors, and one grew by 10%,
then the average of the neighbors would be only 2.7%
higher, which would then result in only a 0.056%
increase in the home county.[10] The significant spatial
error coefficient reveals that a random shock in a
spatially significant omitted variable in surrounding

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[9] We use GeoDa software (available at www.geoda.uiuc.edu)
for LISA and diagnostic (robust LM) tests and Lesage's
(1999) Spatial Econometrics Toolbox for Matlab (available
at http://www.business.txstate.edu/users/jl47) spatial model
estimation.

[10] We are grateful to an anonymous reviewer for this point.

Table 2 General spatial model (SAC) estimates

Variable	Coefficient	Asymptotic t-statistic
Constant	0.0333	2.40
π_i (profits)	0.0003	2.19
ω_i (wages)	–0.0004	2.12
η_i (risks/CV)	–0.0098	4.40
PCOWNOCC	0.0003	5.44
MEDHVALU	0.0001	6.06
HISCH90	0.0212	1.81
COLLEGE	–0.0210	1.23
MDAGE	0.0010	6.16
ETHNIC	–0.0099	2.82
FLF90	–0.0537	2.64
PCINC90	–0.0151	5.81
DEPOPC	–0.0015	1.90
UNEMPL	–0.0017	3.69
UNEMPL^2	0.0001	3.17
SH90	–0.1312	11.79
CONSTRUC	0.0053	5.96
SERVICE	0.0020	3.29
RTRADE	–0.0013	4.01
PCHTEK90	0.0003	0.51
AMNSCALE	0.0010	3.82
RURAL	0.0047	3.67
ARCDUM	–0.0050	3.17
GWTH8590	0.0195	3.48
AREA1L	0.0020	1.97
AREA2L	–0.0020	1.85
AREA3L	–0.0012	1.46
ρ	0.0290	5.98
λ	0.0080	2.63
Adjusted R^2	0.15	
Log L	11,388.25	

Sample size: $N = 3{,}035$ US counties

counties of a particular county triggers a change in the proprietorship growth in that county.

Most of the explanatory variables are statistically significant and have expected signs. In particular, coefficient estimates for both proprietorship (π_i) and wage-and-salary (ω_i) earnings are statistically significant and have expected signs (Bradford and Osborne 1976). Thus, individuals choose among the two different employment types according to relative returns, *ceteris paribus*. One interpretation of high levels of π_i in a county in 1990 is the presence of

more proprietorship (profit) opportunities in the county. Also, higher levels of ω_i may have stifled subsequent employment growth and industry expansion in the county, thus also providing fewer opportunities for proprietors to start their own new businesses by supplying other local firms.

The effect of the risk factor (η_i) is negative, as expected, and highly significant, indicating that more stable income streams from self-employment relative to wage-and-salary employment contribute to self-employment growth. Both the percent of owner-occupied homes and median housing value are positive and highly significant, confirming the importance of personal collateral to secure loans. The number of dollars deposited in local banks depresses growth in relative self-employment rates over the time period considered, which is counter to expectations. The unemployment rate has an unexpected negative (and significant) sign. To test for the robustness of this result, a squared term for the unemployment rate was included. This yielded a U-shaped relationship with the minimum occurring at an unemployment rate of 12.9%. Only 50 out of the 3,035 counties had unemployment rates above this level, suggesting that higher unemployment raised the self-employment density in only 1.7% of counties.

The percent high school graduates variable is statistically significant at the 10% level, while the effect of higher college attainment rates is negative (and not significant in a two-tailed test). This is in contrast to previous literature that shows self-employment to be an increasing function of education (see Evans and Leighton 1989). A higher average age of the county population raises the self-employment density over time, possibly reflecting greater work experience of potential proprietors, but also labor market discrimination against older workers. Together, these results suggest that informal education (on-the-job training) is more important than formal education, at least in this context and given these data.

The ethnic diversity variable is negative and significant indicating that self-employment densities grew less rapidly between 1990 and 2000 in more ethnically diversified communities. This may be due to the generally negative relationship between ethnic diversity and economic development, and social capital, which also reduce growth of entrepreneurship

in a locality.[11] The negative and significant coefficient for female labor force participation confirms that self-employment is less pronounced among female workers.

The coefficient estimate for initial per capita income is negative and significant, suggesting that the ability to supply niche markets with goods does not appear to be a factor in proprietorship formation. An alternative interpretation of this result is that individuals are more likely to seek self-employment opportunities in periods of economic downturns because it is an "option of last resort," as often argued by small business administration (SBA) councilors. The positive sign and the significance level of previous economic growth (between 1985 and 1990) suggest that economic booms in the previous period lead to disproportionately larger growth in self-employment than wage-and-salary jobs. A negative and significant parameter estimate for the initial self-employment density implies convergence across counties in self-employment rates over time. Thus, counties with higher self-employment densities in 1990 experienced smaller increases in that density between 1990 and 2000, confirming Robson's (1998a) contention that a high existing rate of self-employment "reduces the prospective returns to self-employment and so acts to deter new entrants and perhaps precipitate exit by some incumbent firms" (p. 318).

Greater industry concentration in the construction and service sector is associated with more rapid growth in self-employment rates. Many construction workers are self-employed, and this trend appears to be increasing over time. Likewise, it has been argued that falling costs of information technology make it easier for service providers to start their own businesses. Greater employment concentration in retail trade has a statistically significant negative impact on self-employment growth. One explanation is that the growth of chain stores in this sector drives independent, small-scale operators out of business

and provides relatively more wage-and-salary jobs (e.g., as cashiers).

Counties with higher amenity levels experienced an increase in self-employment densities, suggesting that footloose entrepreneurs (entrepreneurs who move between localities in response to incentives) are attracted into these communities. This result is consistent with the compensating differentials literature, in that individuals become self-employed to have greater flexibility to consume local natural amenities. The coefficient for the rural indicator variable is positive and significant, indicating that self-employment densities are increasing over time in non-metro counties, presumably because of a strong desire of rural residents to remain in their communities even in the face of losses in wage-and-salary employment, and perhaps also because of the well-known culture of independence in rural areas.[12] This trend may accelerate with the spread of broadband into lower-cost rural communities.

To test whether a relationship exists between self-employment growth and economic freedom, we use three areas of the EFNA for 1990 in the model. As noted earlier, these three areas are size of government, takings and discriminatory taxation, and labor market freedom. Index of size of the government is positive and statistically significant indicating that less government spending on consumption activities, transfers, and social security promotes self-employment growth in a locality. The negative and significant (at less than 10% level) coefficient of index of takings and discriminatory taxation suggests that higher taxes lead individuals to switch to self-employment because of the greater incentive to evade taxes by underreporting self-employment income compared to wage-and-salary income, and (potentially) reduced wage-and-salary job growth resulting from the higher taxes. The effect of labor market freedom is negative, but only marginally significant. A possible explanation for the negative sign is that higher freedom of this type leads to more wage-and-salary employment. In terms of the regional federal

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[11] In a separate regression (not reported here), we also included the percent of the population that is Asian, Hispanic and African-American. Coefficient estimates were positive in each case, and statistically significant at the 5% level for Hispanics and at the 10% level for the other two groups (in a one-tailed test only); the other coefficient estimates were robust to this specification change.

[12] In a separate regression, we re-estimated the model for rural areas (rural–urban continuum codes 4–9) only. The results are remarkably robust in this case; the only exceptions are the following variables, which no longer differ statistically from zero when only the 2,339 rural counties are used: female labor force participation and the ARC dummy variable.

economic development program evaluated here, growth in self-employment densities is significantly lower in ARC counties, all else equal.

6 Summary and policy implications

This study identifies empirically the determinants of change in non-farm proprietorship densities in US counties over the period 1990–2000, using new variables and data that have not been used previously, and drawing on recent advances in spatial econometric analysis. In addition to obtaining new results, we provide new insight into the spatial dynamics of changes in self-employment densities at the county-level. In particular, we find clear evidence of spatial interaction in the self-employment growth rates over the sample period. The net creation of full- and part-time non-farm proprietorships does not occur randomly over space. Instead, the mix of individuals and the characteristics of the region in which they reside, systematically influence the formation of proprietorships over time, and there important spillover effects from one county to the next in terms of stimulating proprietorship growth. Further, in these kinds of studies, random shocks to spatially significant omitted variables in surrounding counties set off changes in proprietorship growth in the central county.

Proprietors respond rationally to relative earning opportunities in wage-and-salary versus self-employment, and the (income) risk of self-employment. This latter factor has not been empirically investigated previously in the literature, in the manner we have done here, to the best of our knowledge. The inverse relationship between the risk factor and self-employment growth suggests that a relatively stable income flow from self-employment relative to wage-and-salary employment is important to sustain its relative growth over time.

Age or experience of the potential proprietor population and education—but only up to a point—are associated with larger increases in proprietor densities, as are higher levels of wealth and collateral.[13] This is in contrast to the results of Lin et al.

(2000, for age), but confirms the findings of Evans and Leighton (1989), Robson (1998a), Uusitalo (2001), and Guesnier (1994) using different data sets (NLSY) or data from other countries (UK, Finland, and France). This also supports our contention that county-wide averages of individuals' characteristics can serve as appropriate alternatives to individual-level or micro data. In fact, we argue that there are advantages to using the county-wide averages for local economic conditions as we have done here, because all proprietors are affected equally by these average conditions.

Greater ethnic diversity is associated with smaller increases in proprietorship shares. Here we also employ a new measure that has not been previously used in this kind of study. In the context of the current immigration debate, this is an important—and relatively novel—finding because it is contrary to conventional wisdom (see also Mar 2005). Further, we find that higher shares of services and construction sector employment, higher female labor force participation, and higher levels of natural amenities were each associated with statistically significant greater changes in the share of proprietorship growth. In contrast, higher shares of retail employment were associated with smaller increases in self-employment rates over time, while the density of high-tech firms (as a future-oriented sector) had no effect statistically.

Another key innovation of this study is the use of the economic freedom index, measured at the state-level, to capture differences in public policies toward the labor markets. Greater economic freedom is associated with higher rates of self-employment or proprietorship formation, while greater taxation levels have the same effect, presumably because of the additional incentive to shirk from paying taxes. Previous work (e.g., Bartik 1989; Folster 2002) has been limited to more simple taxation measures, and they have been applied to other countries (Sweden). This adds an important dimension to the current debate surrounding what state and local governments can do to mitigate the labor market effects of globalization.

Some of our results point to policy options that have not been widely discussed previously. For example, tools for market-based means of pooling risk and thus reducing profit risks to individual proprietors could be explored. Also, the self-employed clearly and rationally respond to higher

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[13] More research on the effectiveness of alternative entrepreneurship or proprietorship promotion programs delivered through universities as a substitute for time-consuming experience of the potentially self-employed, is warranted.

returns to self-employment, so research-based outreach programs that raise their productivity are important for increasing the number of proprietorships. While more research is needed to identify the primary needs of the different types of self-employed, basic training in business skills, marketing, input procurement, securing venture capital, access to and the ability to use broadband for e-commerce are starting points.

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