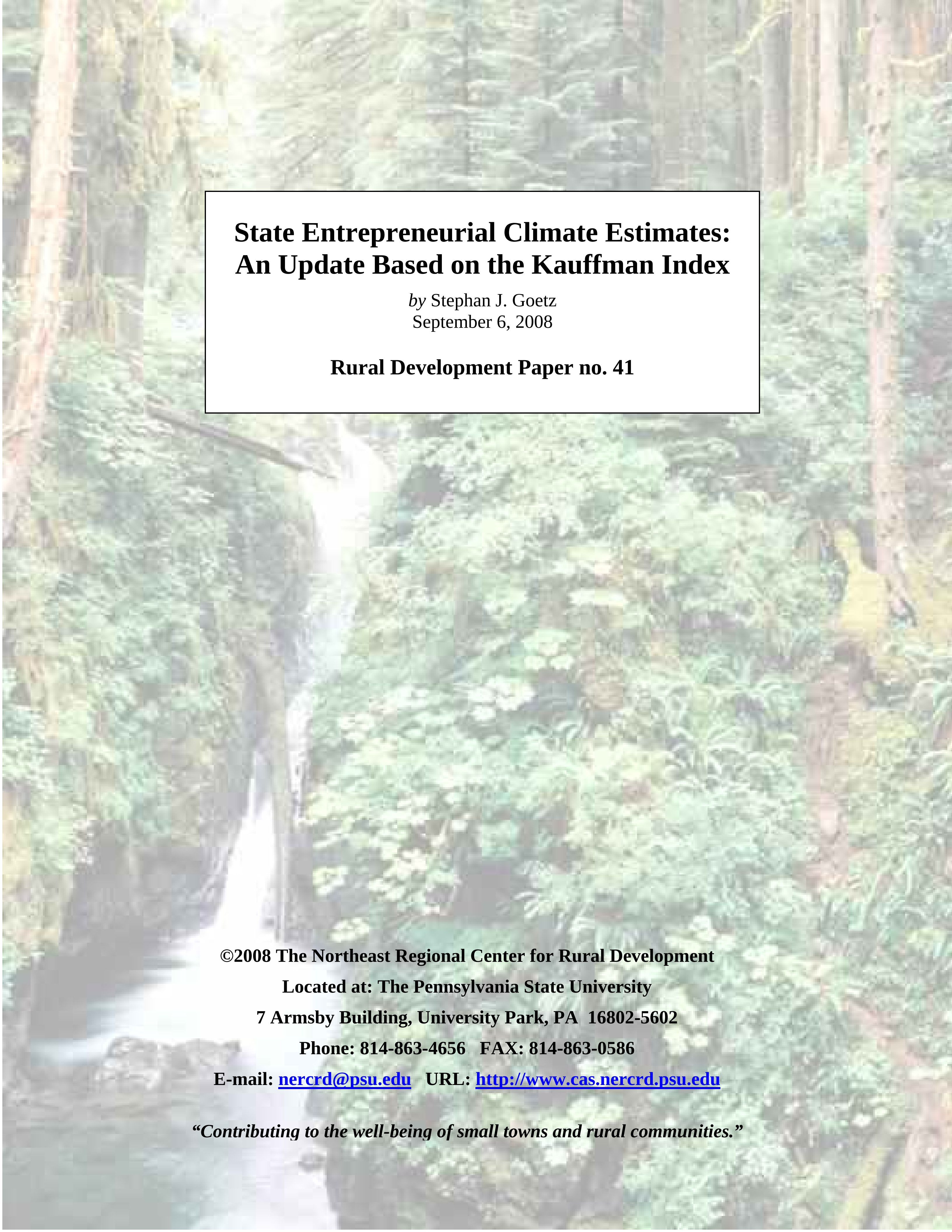

State Entrepreneurial Climate Estimates: An Update Based on the Kauffman Index

by Stephan J. Goetz
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Located at: The Pennsylvania State University

7 Armsby Building, University Park, PA 16802-5602

Phone: 814-863-4656   FAX: 814-863-0586

E-mail: nercrd@psu.edu   URL: http://www.cas.nercrd.psu.edu

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State Entrepreneurial Climate Estimates: An Update Based on the Kauffman Index

Stephan J. Goetz, Ph.D.[1]
Pennsylvania State University
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Abstract

The study uses the Kauffman Index (*KI*) of entrepreneurial activity (Fairlie 2008) and Solow-type residuals from a year-to-year change (*ΔKI*) model to update and expand on an earlier attempt to estimate entrepreneurial climates for each state. Patent activity and human capital are found to be associated with intensifying entrepreneurial activity. However, financial investments typically associated with innovation tend to depress entrepreneurial activity, possibly due to a crowding-out effect. Higher local unemployment rates are associated with more entrepreneurial activity, reflecting entrepreneurship of necessity as opposed to opportunity. While greater labor market freedom clearly encourages entrepreneurship, higher levels of healthcare premiums paid by small businesses discourage such activity. Based on the Kauffman Index, Tennessee, Wyoming, California, Delaware and New York have the best entrepreneurial climates; West Virginia, Alabama, Nevada, Pennsylvania and Connecticut rank at the bottom.

> *Much of the difference between countries such as America, where entrepreneurship thrives, and those where it does not is cultural rather than regulatory… In many emerging economies, business … failure is stigmatized, rather than being a badge of honour, as it is in Silicon Valley.*
>
> L. Rottenberg, co-founder of Endeavor
>
> *The Economist*, August 2, 2008, p. 69

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Introduction

In the quest to unravel the determinants of entrepreneurship the ability to measure one key ingredient has remained elusive: that of the entrepreneurial climate or culture of the place in which the entrepreneurial activity occurs (e.g., Acs et al. 2008). Entrepreneurial climate or culture is argued to be both a vital and a distinctive feature of the American economy (Schramm 2006), and it has been shown to account in potentially important ways for state-level differences in entrepreneurship (Goetz and Freshwater 2001). The latter authors estimated a measure of entrepreneurial climate using Solow-type residuals from an econometric model to rank the individual states using data from the mid-1990s.

The present study updates and expands on Goetz and Freshwater (2001) (GF) who developed a production function of the entrepreneurial process relating "inputs" of entrepreneurship to entrepreneurial "outputs" or outcomes. GF measured their dependent variable – entrepreneurial activity – using a composite variable consisting of initial purchase offers (IPOs) and INC 500 firm counts. Their inputs included various measures of ideas and innovations, human capital, and financial capital. GF estimated a statistical model using state-level data and used the resulting parameters to calculate Solow-type residuals that were postulated to capture state-level entrepreneurial climate differences. These three independent factors were found to account for over one-half of the variation in entrepreneurial activity at the state-level in the mid-1990s.[2]

An important innovation in the present study is the use of the state-level *Kauffman Index of Entrepreneurial Activity*, which is compiled annually by Fairlie (2008) from Current Population Survey data. This measure is in fact very different from the one used by GF, as explained below. A second innovation is that the present study examines change over time in entrepre-

[2] GF also included a quadratic term for financial capital and an interaction term between human capital and their measure of innovation.

neurial activity – i.e., dynamics – rather than just a static level at one point in time. Estimating change models is usually more difficult than estimating levels models and adjusted R-square values are lower, but the results are more credible because endogeneity issues are reduced. Finally, this study considers additional important determinants of entrepreneurship, beyond ideas and innovations and the human and financial variables considered in GF.

Recently the number of state indices and rankings on various economic and quality of life indicators reported in the popular media as well as by academics and consulting firms has increased substantially. Examples include Best Places to Live (both CQ Press and Sperling's Best Places); Best Places to Retire (*Money Magazine*); Best Places to Live and Launch a Business (*ibid.*); The Business and Tax Index (Small Business and Entrepreneurship Council); The 2007 State New Economy Index (Atkinson and Correa 2007); The Assets and Opportunities Scorecard (Corporation for Enterprise Development); The Michigan Entrepreneurship Score Card (Small Business Foundation of Michigan and GrowthEconomics, Inc., which includes data for all states); and The State Competitiveness Report 2007 (Beacon Hill Institute). In this context, another important objective of this study is to shed light on the causes and effects among these different variables. Policy makers need to know not only where their states or cities stand relative to others in terms of benchmarks but also to learn about the levers or inputs that can influence key dependent variables or objectives. To that end the regression model developed and estimated here is also used to trace out cause and effect relationships among the different variables.

Definitional, Measurement and Data Issues

A key reason why the measurement of entrepreneurial climate remains elusive is that entrepreneurship is itself a somewhat nebulous concept. Rocha (2004:367) writes that the definition of what constitutes entrepreneurial activity "has evolved from a trait or supply side (who is the entrepreneur) to a context or demand side approach (the influence of firms and markets on how, where, and why new enterprises are founded)." Further, there are two strands in the literature, one that "defines entrepreneurship as either the creation of new economic activity…, often resulting in the creation of new organizations…, or the pursuit of innovation" (*ibid.*). The present paper focuses on the first strand for the dependent variable and, as do GF, includes innovative activity as an independent or explanatory variable.

Not all small businesses are necessarily entrepreneurial, and not all entrepreneurial businesses are necessarily small. A number of authors have examined self-employment as a proxy for entrepreneurship, but not all self-employed workers are entrepreneurial and *vice versa*. Another key issue is distinguishing entrepreneurship of necessity (e.g., due to a lay-off) from entrepreneurship of opportunity or choice, including lifestyle preferences (e.g., CFED 1998, Yenerall 2008). The measures used by GF, the INC 500 fastest-growing firms and IPOs issued, arguably reflect entrepreneurship of opportunity – at least in the fast-growth phase – but not necessarily entrepreneurship of necessity. Thus, their measure captures only a subset of the different types of entrepreneurship.

A commonly-used measure is that of self-employment or proprietors' employment. There are two alternative sources for such data at the sub-national level.[3] One is the U.S. Census of Population Long Form (including the Public Use Micro Sample), collected every 10 years and now annually under the American Communities Survey. This data source is used, for example, in Acs et al. (2008) and in Glaeser (2007). Self-employment data are also reported annually by the Bureau of Economic Analysis using Form 1024 Schedule C filings by individual businesses or proprietors. This data source is used, for example, by Goetz and Rupasingha (2007) as a

[3] In addition, the Bureau of Labor Statistics reports monthly self-employment data for the nation.

measure of entrepreneurial activity within communities, as well as in Shrestha et al. (2007) and in Goetz and Shreshta (2009). The self-employment shares relative to all workers that are reported in the BEA's Regional Economic Information System (18.1% in 2006) are considerably higher than those collected through US Census forms or the BLS (6.6% in July 2008, not seasonally adjusted) from household surveys. It is important to note that the federal government is the only source of these kinds of data. The individual states collect and report statistics only on workers covered by unemployment insurance benefits (the ES 202 or employment security series). Thus, the states collect virtually no data on an increasingly important component of their workforces. Furthermore, the data represent static snapshots at one point in time, and provide no information on overall business churn (entry and exits).

Another important indicator is the annual Kauffman Index of Entrepreneurial Activity, which is compiled by Fairlie (2008). This indicator is calculated using data from the Current Population Survey and it is defined as "*the percent of individuals (ages twenty to sixty-four) who do not own a business in the first survey month that start a business in the following month with fifteen or more hours worked per week.*" In 2007, the value of the index stood at 0.30%, which is the approximate long-run average for the period 1996-2007 (Fairlie, Figure 1, page 3). The lowest level of geography for which this measure is available is the State.

Unlike the measures described earlier, the Kauffman Index is a genuine firm or entrepreneurial start-up rate. Unlike the GF measure, this index also captures entrepreneurship driven both by necessity and by opportunity. Thus, it is a comprehensive measure reflecting a behavioral change due both to local economic conditions (such as employment growth or decline) and to opportunities that may be based on local patenting activity or market disequilibria, as well as non-local opportunities that reflect demand and economic growth elsewhere. For these reasons, the Kauffman Index is employed in this study to assess entrepreneurial climate, as an alternative to the more narrow measure used in GF.

The Kauffman Index is not correlated with the measures of entrepreneurship employed by GF (instead these measures are almost orthogonal). For example, the simple correlation coefficient between the Index and IPOs as a share of worker earnings is 0.068, and it is −0.099 for INC500 firms as a share of all firms (Table 1). The Kauffman Index is also correlated in a statistically significant manner with the self-employment rate provided by the BEA (0.513**, significant at below the 1 percent level). The state of Massachusetts illustrates the differences in these measures well. Massachusetts ranks 1st among the states on venture capital, 2nd in IPOs and 5th on fastest growing firms. It also ranks number 1 on high-tech jobs and the overall State New Economy Index (Atkinson and Correa, 2007: 14-15). However, it ranks only 43rd among the states in terms of the Kauffman Index of Entrepreneurial Activity (15).

As a final consideration, the US Census-based self-employment numbers were in the past only available every 10 years (e.g., from the PUMS data), down to the county-level and based on the long-form of the questionnaire. This data set also contained very limited industry detail. While the American Community Survey data will be published more frequently than once a decade, it is not yet clear how reliable the data will be at the sub-state level (counties). The CPS data are available more frequently and also at the state geography. The BEA's Regional Economic Information System data are published with only about a two-year lag (although that is expected to be shortened[4]), but these numbers also are available at the county-level, albeit without any industry detail.

[4] James M. Zavrel, Chief, Regional Income Branch, Regional Economic Measurement Division, BEA, pers. comm. Aug. 12, 2008.

Entrepreneurial Climate or Culture

If defining and measuring entrepreneurship is difficult, then the same is true *a fortiori* for entrepreneurial climate. Nevertheless, this climate or culture is widely recognized as being important to entrepreneurial drive and numbers. Beinhocker (2006: 430-1) describes four different cultural norms that can affect economic wealth creation. The first norm concerns individuals' attitudes towards their ability to control their own economic destinies and fortunes. He suggests that "economically successful cultures appear to strike a balance between optimism that improvement is possible, and realism about one's current situation" (430). A second norm relates to cooperation among economic agents (*ibid*.): "Societies that believe in a fixed pie of wealth have a difficult time engendering cooperation and tend to be low in mutual trust," conditions which in turn are associated with slower economic growth (also see, e.g., Rupasingha et al. 2002). The perception of time, and whether one lives for today or has the patience to defer rewards until tomorrow, is the third norm that varies across societies according to Beinhocker. He maintains that an unwillingness to wait and defer gratification, as if "tomorrow doesn't matter," is associated with less innovation.

The fourth cultural norm is especially germane to this paper, as it affects innovation. Beinhocker writes that "deductive tinkering is much more effective if the deductive part is strong, and thus cultures that look to rational scientific explanations of the world rather than religious or magical explanations tend to be more innovative" (430). These varying cultural norms also mean, for example, that the same level of patent-generating activity within a society or nation may be associated with different levels of new product development, depending on the (average) culture of the business owners who potentially develop patents into marketable products. Consistent with Florida's (2002) basic argument, Beinhocker writes that "…a culture needs to be tolerant of heresy and experimentation, as strict orthodoxy stifles innovation. Finally, it is important that the culture be supportive of competition and that it celebrate achievement, since overly egalitarian cultures reduce the incentives for risk-taking" (*ibid*.). The latter point is also stressed in Schramm (2006).

Shaffer et al. (2004: 200) write that in economic development, "[c]ulture performs the critical functions of judging what is desired currently and in the future, opinions about entrepreneurship, and views about change. … A culture that values traditionalism hampers economic development, while a culture that is willing to accept change and technological innovation facilitates economic development." Likewise, Galston and Baehler (1995: 31) argue that "some communities are structurally open to, while others structurally resist, modern forms of knowledge and technique." For present purposes, this also means that the same level of entrepreneurial "inputs" lead to different levels of entrepreneurial output, assuming these can be measured, as originally argued by GF.

Galston and Baehler (1995: 30) suggest that "… cultural differences are usually less significant within than across national boundaries…". Nevertheless, important regional differences in entrepreneurial culture or climate also exist within nations. For example, the US West has long been known for its "entrepreneurial spirit," reflecting both the characteristics of migrants and the idea that business laws are more relaxed in the region. Vermont is labeled as a state in which the entrepreneurial spirit is "alive" by the popular media. Farmers are known to be relatively more entrepreneurial and independent than the rest of the population, so that farming regions may be expected to have better entrepreneurial climates.

Differences in entrepreneurial climate or culture are perhaps most obvious and best understood at the level of nations. For example, GEM (1999) examine differences in entrepreneurial climate or culture across 10 OECD countries and point out that the desire to become rich, and possibly enter into the risk of bankruptcy, is "frowned upon" in Germany, whereas traditional social pressure in France to join large firms stigmatizes those who start their own company. The case of the former German Democratic Republic was even more extreme: "[s]elf-employment had been severely restricted under the socialist regime … because it did not fit into a socialist economic system" (Frey 2008: 77). In the US, on the other hand, individuals who venture out to start their own company tend to be celebrated and admired for their hard work and business acumen. Surveys show that Americans consistently agree at higher rates with the notion that individuals are stewards of their own economic destinies than is the case in Europe, for example. Indian and Chinese expatriate traders are well-known in many African countries to be especially entrepreneurial, and certain West African tribes are better-known as traders than others. On the other hand, Parker (2004: 74) refers to "different cultural traditions" to explain why more highly-educated whites may be more likely to be self-employed than comparably educated Indians.

Similar to industry-specific knowledge being "in the air" (Marshall 1930), a community either has an entrepreneurial climate or it does not. Like urban sprawl, this is something one knows when one sees it, but it remains very difficult to measure. Birch et al. (1999) identified 10 principles that could be used to assess whether a community was entrepreneurial. These ranged from whether or not entrepreneurs were written about and celebrated in local newspapers and other forums to whether a state's political leadership met frequently with entrepreneurs to seek their advice. More recently, Florida (2002, 2008) has pointed to the "openness of communities to new ideas" as well as acceptance of differences as key measures of innovation and willingness to pursue risky activities.

Acs and Armington (2006:57) define entrepreneurial culture "as a social context where entrepreneurial behavior is encouraged" (based on Johannison 1984). Citing Illeris (1986) they go on to describe three different perceptions or attitudes that individuals may have towards work, including working for oneself ("self-employment"), working for others ("wage-work"), and developing a "career." Passed on inter-generationally, "these life-modes are cultural and socially determined, and they influence the propensity of individuals to create new businesses" (*ibid.*). Acs and Armington suggest that self-employment rates or proprietor shares may reflect the degree to which the local climate favors entrepreneurs, but find no empirical support for this proposition in their study (*op.cit.*147).

The next section describes the research plan and methods along with the data used in this study. This is followed by the regression results and their interpretation. The subsequent section provides the 2007 entrepreneurial climate estimates for the states, which are also compared with the rankings obtained earlier by GF. The final section presents a conclusion along with suggestions for future research in this area.

Research Plan, Method and Data

This study builds on the work of Goetz and Freshwater (2001) but uses a different measure of entrepreneurship (the Kauffman Index of Entrepreneurial Activity), a change rather than levels measure as the dependent variable, and a more comprehensive set of regressors as explanatory variables. A key data source for the regressors is Atkinson and Correa's (2007) *The 2007 State New Economy Index*, supplemented by other sources as noted below. The basic plan is to estimate a regression model that contains a measure of entrepreneurship as the dependent variable or output, and a set of factors known to be associated with (or determine) levels of entrepreneurial activity – i.e., inputs into the entrepreneurial process. As mentioned above, the effectiveness or efficiency with which a given level of input is translated into entrepreneurial outputs varies across communities – in our case, states. This variation or difference is captured in the error term and it represents a proxy for entrepreneurial climate similar to a Solow-type residual in an economic growth model:

$$E = \alpha + \beta I + \boldsymbol{\gamma H} + \boldsymbol{\delta F} + \boldsymbol{\zeta Pol} + \boldsymbol{\eta \Omega} + u$$

where:

E = entrepreneurship or entrepreneurial activity

I = a measure of ideas and innovations

$\boldsymbol{H}$ = a vector of human capital measures

$\boldsymbol{F}$ = a vector of financial capital

$\boldsymbol{Pol}$ = a vector of policy measures that affect entrepreneurship

$\boldsymbol{\Omega}$ = a vector of basic conditions affecting entrepreneurship

u = a residual error term used as a proxy for entrepreneurial climate,

which is estimated from:

$$\hat{u} = \hat{E} - E \equiv C$$

and α, β, $\boldsymbol{\gamma}$, δ, ζ, and η are parameters corresponding to each of the explanatory variables included in the regression. One goal is to obtain a high R-square value. The higher this value, the better is the estimate of the entrepreneurial climate, C.

Dependent variable

As already noted, measuring entrepreneurship consistently and comprehensively remains a significant challenge, not only because the concept itself remains elusive but also because there are no public data sets collected specifically for this purpose. The arguably best available data source, that captures both entrepreneurial efforts of opportunity and of necessity, is the Kauffman Index constructed from Current Population Survey data (Fairlie 2008). This is a *bona fide* measure of new firms that are created within states between two different points in time and as such it captures the entrepreneurial energy present, and it is consistent with the definition used in Rocha (2004), i.e., the creation of new organizations. It is not a pure measure of innovativeness, however, although it subsumes such activity.

Instead of measuring the *level* of entrepreneurship at a point in time, however, the *change* over time in the Kauffman Index is used in this study as the dependent variable. In general it is more difficult to account for or explain changes in variables than it is to account for their levels, but doing so reduces the potential statistical problem of endogeneity bias. Thus, the measure used here is:

$$\Delta KI = KI_{2007} - KI_{2006}$$

Including KI_{2006} as a regressor in the model serves to control for initial or starting conditions. The parameter estimate on this variable is expected to be negative, to reflect convergence across the states over time in terms of the rate of new business formations. As constructed, the dependent variable measures the degree to which new business formations – i.e., entrepreneurial activities – are increasing or accelerating over time, rather than just capturing the intensity of such activity or how important they are at a point in time. This dynamic measure, it can be argued, allows us to calculate a more accurate entrepreneurial climate measure than would a comparable analysis using only levels of the index.[5] It measures whether workers in the state are becoming more entrepreneurial over time, holding constant the initial level of entrepreneurship (KI_{2006}).

Independent variables

Five categories of variables are considered here, the first three of which are similar to those used by GF.

Innovations (*I*). The number of independent inventor patents per 1,000 population in 2004 and 2005, as reported in Atkinson and Correa (2007: 37), is used to measure innovation. This is a basic measure of innovation that can potentially lead to new firm formations, and the lag to the year 2005 provides a small amount of lead time between patent filing and implementation of the business plan. The associated parameter estimate is expected to be positive ($\beta>0$).

Financial capital (***F***). Two measures are included here, one the amount of Small Business Innovation Research (SBIR) dollars awarded per million population in the state (from SBA) and the spending of industry research and development funds (industry investment in R&D as a percent of total worker earnings in 2006 using NSF data and as reported in Atkinson and Correa 2007: 49). The parameter estimates for these variables are expected to be positive ($\boldsymbol{\delta}>0$), although GF reported a negative effect when just a linear term was included in their model.

Human capital (***H***). Two measures of human capital are used in this study. One is the percent of managerial, professional and technical staff as a share of the total workforce in 2005 (using BLS data), as reported in Atkinson and Correa (2007: 23). This variable is expected to have a positive effect as it captures a larger pool of individuals potentially capable of and interested in starting their own firms. The other variable is the share of employment in traded services for which av-

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[5] The coefficient estimates are similar when the dependent variable (ΔKI) is replaced by KI_{2007} except for the fact that the sign on KI_{2006} flips, as expected. This change variable is also virtually uncorrelated with BEA's measure (Table 1).

erage wages exceed the national median (also from Atkinson and Correa 2007). Here the expected effect is ambiguous. A higher wage not only means a higher opportunity cost of working for oneself, but also higher wage labor costs if a newly-formed firm needs to hire workers. If the attendant productivity is not commensurately higher, then the effect of this variable is likely to be negative. This is also based on 2005 data from the BLS.

Policy variables (***Pol***). Two alternative policy variables are included. The first is from the Economic Freedom of North America index for 2003 (the most recent year available) and it measures freedom in the labor market as follows: government employment as a share of the total, union activity, and state minimum wage legislation (http://www.heritage.org/Index/). A higher index value indicates more freedom, and Texas and Delaware rank at the top on this measure. The expected sign of the parameter estimate is positive, such that more labor market freedom encourages entrepreneurial activity. The second measure is the level of health care premiums for small businesses with fewer than 99 workers. This is the average premium paid by singles and families in 2004. The data are from the DHHS, Agency for Healthcare Research and Quality, and the effect is expected to be negative (www.meps.ahrq.gov/Data_Pub/IC_Tables.htm).

General conditions (**Ω**). In a growth model, such as the one used here, it is important to control for the initial value of the variable serving as the dependent variable. In this case, the value of the Kauffman Index in 2006 (KI_{2006}) is entered as a regressor, with the expectation of a negative coefficient estimate to reflect convergence over time. Another variable is the local (state) unemployment rate, from the BLS and measured in 2005. If patents, human capital and financial capital are proxies for entrepreneurial opportunity, then the unemployment rate captures or controls for entrepreneurship that is based on necessity rather than opportunity. We expect the coefficient estimate for this variable to be positive, so that poorer local labor market conditions reflect fewer work opportunities and thus greater incentives for individuals to work for themselves. Descriptive summary statistics for the variables used in this study are reported in Table 2.

Regression Results

Heteroscedasticity-corrected regression results are presented in Table 3.[6] With an R-square value of 0.704 (adjusted R^2=0.638), this regression model provides a good fit. In comparison, the R-square value reported in GF was only 0.60 (0.55 for the adjusted R^2). Note that these numbers are not directly comparable as the dependent variables are different, but it is clear that this new version produces a better "fit." This also means the entrepreneurial climate measure estimated here is more accurate in a relative sense. All of the regression coefficients are statistically significant at the 5 percent level or lower.

While the effect of patent-generating activity (Inventor Patents) is positive, as expected (and also produced the second-highest beta coefficient), the results for both measures of financial capital are negative. Interestingly, GF obtained the same result for the linear term on their measure. This therefore implies, in the current context, that SBIR and industry financial investments in R&D tend to crowd out new firm formation – possibly because latent entrepreneurs are employed in labs and other businesses rather than starting their own firms. The kind of capital deployed therefore also matters to entrepreneurial activity, since patenting activity likely depends on funding available.

For human capital the result is as expected (positive) for managerial, professional and technical (MPT) workers, but negative for high-wage traded services employment. The implications of this latter result are twofold: (1.) In states where traded services employees are highly-paid the opportunity cost of becoming self-employed is higher, and (2.) A self-employed worker

[6] Tests of spatial dependence bias failed to reveal any significant statistical problems.

seeking to hire service employees in these states would have to pay higher wages. The importance of the MPT workers is also evident from the fact that this variable yielded the highest standardized beta coefficient of all regressors. Also, while degrees of freedom limitations prevented us from considering them as additional regressors, variables such as the SAT score and the AP pass rate are positively and significantly correlated with the MPT workers share in the state.[7] Thus, in states with more highly educated workers those workers also pay attention to the schooling of their children.

For the policy variables only health care premiums have the expected (negative) sign. The potentially disastrous financial consequences of health problems that require medical care may discourage new firm formation through self-employment, as has been noted in popular press articles (e.g., *BusinessWeek*). Table 2 reveals that the range and standard deviation on this variable are rather small. The effect of the labor market freedom variable, on the other hand, is as expected positive. States that score well on this variable have proportionately fewer government employees, which leaves a larger workforce share likely to start their own firm (to the extent that public sector employees are less likely than private workers to become self-employed). It is perhaps useful to think of these two policy variables and the high-wage traded services measure as capturing the cost of doing business across the states.

The coefficient estimate for the Kauffman Index in 2006 (KI_{2006}) is, as expected, negative. This indicates convergence in the rate of new firm formations over time across the states, or states that started out with lower rates in 2006 are catching up with states that had higher rates to begin with. The parameter estimate for the unemployment rate is positive, also as expected, indicating that individuals do turn to starting their own firms when local labor markets expe-

[7] Each of the following correlation coefficients with the MPT variable is statistically different from zero at below the one percent level: AP pass rate (0.610); predicted SAT score (0.469); NAEP reading score (0.439) and NAEP math score (0.398).

rience a surplus of workers relative to demand. Conversely, states with tight labor markets have smaller rates of new firm formation, all else equal.

Estimating Entrepreneurial Climates

The concept of deriving an entrepreneurial climate measure from regression residuals (unexplained variation in the dependent variable) can best be understood by using a production function $y=f(x)$ that maps inputs (x) into an output (y) which is this case is entrepreneurial activity or energy. Here states are used as the units of analysis, and so the estimates represent state-level climate. Given a plot of y versus x, and a regression line fit through the data points, some y-values will lie above the regression line and some below it, at the same level of input x. The explanation for this is that some states more effectively convert or use the input in the production process than others; in other words, they receive a "bigger bang for the buck" because of a more favorable or conducive entrepreneurial climate. This greater effectiveness is translated into a higher rate of entrepreneurial activity. For example, the same number of inventor patents in a state may lead to widely-varying rates of new firm formation. Alternatively, a factor that leads to lower levels of entrepreneurial activity (such as industry R&D spending in this study) may have a stronger negative effect in some states than in others. The bottom line is that a superior entrepreneurial climate allows a state to attenuate the effects of a negative factor (input into entrepreneurial activity), while taking even greater advantage of a positive factor.

The state rankings reported in Table 4 are based on the equation for entrepreneurial climate presented above and the residuals calculated from the regression equation with ΔKI as the dependent variable. The top five states, with the best climate, are Tennessee, Wyoming, California, Delaware and New York. In contrast, West Virginia, Alabama, Nevada, Pennsylvania and

Connecticut have the least favorable entrepreneurial climate. This ranking compares with Idaho, Arizona, Tennessee, Louisiana and Wyoming as the top five states on the Kauffman Index in 2007 (KI_{2007}) and West Virginia, Alabama, Delaware, Pennsylvania and Ohio appearing at the bottom. Also, a total of ten states are within five points of their climate rank in the GR study. Arizona and California are in the top ten of both climate rankings, while Connecticut is in the bottom ten on both measures.

Figure 1 shows that some states have high rates of entrepreneurial activity despite having a poor climate (because the levels of entrepreneurial inputs are favorable in these states), while others have low activity despite having a good climate. Yet other states have poor climates and poor activities, or conversely.

Conclusion and Extensions

The Kauffman Index (KI) of Entrepreneurial Activity and changes in this index over time are influenced systematically by important economic factors that vary at the state-level. For the most part, the effects of the factors are consistent with what economic theory would predict, but in some cases the results are unexpected. For example, the effect of R&D spending was negative, but this could be explained by crowding out of self-employment activity by employers. It does not necessarily portend less entrepreneurial activity, only that the activity takes place in an incorporated business rather than an unincorporated proprietorship.

These results in turn suggest that the KI is a useful gauge of entrepreneurial activity across the nation for policy makers, practitioners and academics, and that it should to be compiled and reported in future years. This is especially critical because no other federal or state agency reports such an index (although of course the federal government collects the basic data needed to compile the index). It is also of interest to note the relatively high degree of correlation between the KI and the annual self-employment or proprietorship rates reported by the Bureau of Economic Analysis at the county-level. Unlike the *KI*, the latter is not a measure of *new* firm formation, but it can be used as a complement to examine the intensity of self-employment at a point in time and the *net* change in self-employment over time (without being able to capture churn, since gross inflows into and outflows out of self-employment are not available). Further, this provides good reason to believe that the kind of analysis carried out here at the state-level can also be carried out with the BEA data at the county-level, where both the variation among regressors and the degrees of freedom are much greater.

It is important to stress that the KI captures entrepreneurship broadly defined – including firm formation based on cutting-edge scientific innovations and firm formation that is a response to local economic decline, such as mass layoffs at a factory or services providers. The first type is captured by inventor patent activity while the second is captured in the state unemployment rate. Future research that distinguishes between these two types – opportunity vs. necessity – may provide important new insights into local determinants of entrepreneurship as well as public policy levers that encourage or discourage such activity.

Clearly, the basic approach outlined here offers promise both in terms of “explaining” why entrepreneurship occurs and also deriving state entrepreneurial climate estimates. As noted, this approach could be stepped down further to lower-level geographies such as labor market areas or counties. With a growing time series of data, panel data estimation methods could be applied to control for state fixed effects, and to measure the response of entrepreneurship over the business cycle.

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Table 1: Pearson Correlation Coefficients, selected measures of entrepreneurship

Variable	KI_{2007}[a]	KI_{2006}[a]	deltaKI[b]	SELF06[c]	IPOs[d]	INC500[e]
KI_{2007}[a]	1	.436**	.522**	.475**	.068	−.099
KI_{2006}[a]	.436**	1	−.539**	.513**	.129	−.214
deltaKI[b]	.522**	−.539**	1	−.041	−.059	.111
SELF06[c]	.475**	.513**	−.041	1	−.002	−.211
IPOs[d]	.068	.129	−.059	−.002	1	.298*
INC500[e]	−.099	−.214	.111	−.211	.298*	1

N=50 States; Statistical significance levels: * is 5% or lower; ** is 1 % or lower.

a. $KI_{2006,\ 2007}$: Kauffman Index of Entrepreneurial Activity in 2006 or 2007

b. deltaKI; change in the KI between 2006 and 2007 ($KI_{2007}-KI_{2006}$).

c. SELF06: Self-employment as a percent of all workers, BEA, 2006.

d. IPOs: Initial purchase offers per dollar of worker earnings, 2004.

e. INC500: INC 500 fastest growing firms as a share of all firms, 2006.

Table 2: Descriptive Statistics for Regressors and Dependent Variable

Variable	Minimum	Max.	Mean	Std. Dev.
ΔKI (%)	−.220	.190	−.005	.095
Inventor Patents	.031	.143	.0772	.0263
SBIR Awards ($/cap)	.34	72.43	11.74	12.20
Industry R&D Invest. (%)	.36	7.13	2.33	1.46
Managerial, Professional & Technical jobs (MPT)	.200	.300	.204	.023
High-Wage Traded Services employment	.100	.200	.131	.034
Labor Market Freedom[a]	5.8	8.2	7.324	.525
Health Care Premium ($)	5,494	7,941	6,719.2	642.8
KI_{2006} (%)	.160	.600	.300	.090
Unemployment Rate (%)	2.7	7.8	4.9	1.1

Sample size: 50 States

a. See text for definition; a higher value indicates more freedom.

Table 3: Determinants of the Change in the Kauffman Index Over Time (OLS Regression Results, Weighted)

Variable	Coefficient	St. Err.	Beta
Constant	−.747**	.261	
Inventor Patents	2.12**	.412	.579
SBIR Awards ($/cap)	−.003**	.001	−.402
Industry R&D Invest. (%)	−.027**	.009	−.382
Managerial, Professional and Technical jobs	2.77**	.811	.620
High-Wage Traded Services employment	−1.36**	.427	−.445
Labor Market Freedom	.079**	.020	.426
Health Care Premium ($)	−.0034*	.0016	−.219
KI_{2006} (%)	−.601**	.108	−.559
Unemployment Rate (%)	.027**	.009	.289
Adjusted R-square	0.638		

Dependent Variable: delta*KI* (Δ*KI*); sample size=50.
Weighted Least Squares Regression - Weighted by KI2007
Statistical significance levels: * is 5% or lower; ** is 1 % or lower.

Table 4: State Entrepreneurial Climate Estimates and Rankings, 2007, based on the Kauffman Index of Entrepreneurial Activity – see notes below

State	**Climate[a] Estimate**	**Rank**	GF[b]	delta*KI*[c]	Rank	*State*	**Climate[a] Estimate**	**Rank**	GF[b]	delta*KI*[c]	Rank
Alabama	**-0.110**	**49**	18	-0.150	47	Montana	**-0.008**	**26**	48	-0.200	49
Alaska	**0.046**	**8**	47	0.120	6	Nebraska	**0.011**	**20**	7	0.030	18
Arizona	**0.048**	**7**	8	0.160	2	*Nevada*	**-0.099**	**48**	30	-0.030	31
Arkansas	**0.052**	**6**	12	-0.030	32	New Hamps.	**0.012**	**18**	29	0.070	11
California	**0.062**	**3**	4	0.050	16	New Jersey	**-0.008**	**25**	13	0.020	23
Colorado	**0.011**	**19**	3	0.060	13	New Mexico	**-0.062**	**42**	37	-0.100	42
Connecticut	**-0.091**	**46**	49	-0.080	40	***New York***	***0.054***	***5***	35	0.020	22
Delaware	**0.062**	**4**	33	-0.050	37	North Carolina	**0.028**	**15**	23	0.120	5
Florida	**-0.031**	**32**	5	0.020	25	North Dakota	**-0.053**	**40**	45	-0.040	33
Georgia	**-0.038**	**34**	2	-0.040	34	Ohio	**-0.063**	**43**	31	-0.030	30
Hawaii	**0.018**	**16**	44	-0.190	48	Oklahoma	**-0.015**	**29**	20	-0.090	41
Idaho	**0.043**	**9**	40	0.090	8	Oregon	**-0.002**	**22**	27	-0.030	29
Illinois	**-0.043**	**35**	19	0.060	12	*Pennsylvania*	**-0.092**	**47**	25	-0.020	28
Indiana	**-0.048**	**38**	26	0.030	20	Rhode Island	**-0.015**	**28**	24	-0.070	39
Iowa	**-0.004**	**23**	17	-0.050	36	South Carolin.	**-0.061**	**41**	34	0.080	9
Kansas	**-0.045**	**37**	15	0.030	19	South Dakota	**-0.018**	**30**	22	-0.120	45
Kentucky	**0.041**	**11**	9	0.080	10	***Tennessee***	***0.136***	***1***	39	0.190	1
Louisiana	**0.038**	**13**	41	0.140	3	Texas	**-0.051**	**39**	10	-0.010	26
Maine	**-0.043**	**36**	43	-0.150	46	Utah	**-0.077**	**44**	6	0.050	14
Maryland	**0.029**	**14**	11	0.050	15	Vermont	**0.041**	**10**	50	0.040	17
Massachusetts	**-0.005**	**24**	21	-0.110	44	Virginia	**0.004**	**21**	1	-0.060	38
Michigan	**0.012**	**17**	28	0.130	4	Washington	**-0.091**	**45**	14	-0.050	35
Minnesota	**-0.012**	**27**	16	0.020	24	*West Virginia*	**-0.143**	**50**	36	-0.110	43
Mississippi	**-0.033**	**33**	32	-0.220	50	Wisconsin	**0.039**	**12**	46	0.020	21
Missouri	**-0.029**	**31**	38	-0.010	27	***Wyoming***	***0.072***	***2***	42	0.110	7

Denotes a top 5 state; *denotes a bottom 5 state.* Shading denotes a state that is within five points on either climate ranking scale used (Goetz-Freshwater or the Kauffman Index – see notes below). *Source*: Author's calculations using OLS regression results.

Notes:

a. *Climate:* is the estimated entrepreneurial climate in the state as calculated from the regression residuals ($\hat{u} = \hat{E} - E$) of the weighted OLS equation containing the change in the Kauffman Index between 2006 and 2007 as the dependent variable:

$$E = \text{delta}KI = \alpha + \beta I + \boldsymbol{\gamma H} + \boldsymbol{\delta F} + \boldsymbol{\zeta Pol} + \boldsymbol{\eta \Omega} + u \,.$$

The change in the Kauffman index between 2006 and 2007 measures the entrepreneurial intensity (E) of each state, and the procedure is analogous to that used by Robert Solow in calculating the contribution of rising productivity to economic growth (the Solow residual). *Rank* denotes the state's climate rank (1 denoting the best, 50 the worst entrepreneurial climate).

b. GF denotes the climate rank obtained by Goetz and Freshwater (2001), using a more restrictive definition of entrepreneurship as the dependent variable. The rank is included for comparison purposes only.

c. KI_{2006} is the value of the Kauffman Index of Entrepreneurial Activity in 2006.

Figure 1:

Initial Entrepreneurial Activity Index (KI_{2006}) vs. Entrepreneurial Climate