Creating an environment for economic growth: creativity, entrepreneurship or human capital?

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Abstract: Researchers have long searched for the underlying causes of growth. In developed countries, as they shifted from industrial to knowledge economies, researchers have recently stressed the following sources of growth embodied in its workforce: human capital (linked to education), entrepreneurship (variously measured), and the creative class (associated with worker occupations). This study first proposes new conceptual ways to portray the interrelationship of these knowledge-based attributes. Then simultaneously considers all of these factors in an empirical model using U.S. counties. We find that human capital as measured by educational attainment and the intensity of small and medium-sized firms are statistically associated with subsequent growth, while other factors such as the share of creative class workers or the share of advanced technology industries are insignificant. We conclude that economic development strategies are too focussed on attracting large outside firms and attracting advanced technology firms and not enough attention is given to building a foundation of competitive small and medium-sized firms.

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Introduction

The question of what are the key drivers of economic growth has been at the heart of economics and economic geography since their very beginnings. Centuries of studies on the subject have produced a plethora of complementary (and sometimes competing) theories, but a high degree of uncertainty remains. What is undisputed is that the skills of the workforce matter. Especially as we progressed towards a 'knowledge-based' economy in the latter 20th Century, it became clear that the abilities of the workforce are a crucial feature for economic growth. Yet, it is more debatable as to what 'abilities' are most important and how should we label these abilities? Clearly, the answers are important not just to academics interested in regional growth, but also to policymakers trying to boost struggling local economies in an age of austerity.

Schumpeter in 1911 contended that entrepreneurial skills are paramount. An increase in the number of entrepreneurs leads to economic growth. Yet, Becker (1962, 1964) argued that what matters is collective worker know-how and skills, referred to as "human capital". A well educated workforce will result in enhanced productivity, which is the key for economic growth. More recently Florida (2002) popularised the term 'creativity' as the key driver for economic success. The knowledge strategies just described relate to the skills embodied in the workers and population. An alternative "knowledge" strategy is to attract innovation-intensive or advanced-technology firms to induce growth (e.g., see Yu and Jackson, 2011 for discussion of these strategies by the US federal government). Such sectoral strategies are often related to cluster strategies (e.g., Porter 1998; Porter and Stern 1998; Feser et al., 2008). In terms of policy, the difference then relates to attracting "smart people" versus attracting "smart firms/industries". Although we consider both, we will focus primarily on the former.

The aim of this paper is twofold. Firstly, on the theoretical front, it aims at clarifying the relationship between different concepts of 'knowledge', i.e. creativity, entrepreneurship and human capital. Secondly, it empirically tests how these different types of knowledge – and the ways they are traditionally measured - are interrelated and whether they have complementarities in creating an environment for regional economic growth. USA counties are used for our empirical appraisal. Contrary to most previous contributions, we test jointly the effect of entrepreneurship, human capital, and creativity measures -while controlling for a series of other possible explanatory variables – and we also account for possible endogeneity problems. This is a crucial point as endogeneity is very likely because workers and firms will naturally self-sort to places they expect to subsequently grow faster, creating a spurious positive relationship between the knowledge measures and growth. The vast majority of previous contributions have disregarded this issue.

In what follows, Section 2 presents the theoretical background and summarizes the results of a subset of key studies on the role of entrepreneurship, human capital and creativity. Section 3 describes our unique database which combines information from a variety of sources at both county and metropolitan level in the USA. Section 4 describes the empirical modelling strategy. Section 5 presents and discusses the implications for policy and future research, while section 6 concludes.

2. Theoretical background: creativity, entrepreneurship or human capital?

One of the most popular labels of our modern society is 'knowledge economy,' a society where what people know and how they use their knowledge is paramount. Knowledge has few apparent boundaries and it is not subject to the same constraints as other resources. A key feature of endogenous growth theory (Lucas, 1988) is that knowledge may not show decreasing returns at all or depreciate like other production factors. Knowledge can also easily 'flow' over space, either because people interact and exchange it through knowledge spillovers – or perhaps more importantly – because highly skilled and educated individuals are generally highly mobile (Yankow, 2003; Faggian and McCann 2009a,b; Faggian et al. 2006, 2007). Yet, regions need to have the absorptive capacity to benefit from these knowledge spillovers or a so-called "social filter." (Crescenzi, 2005; Rodrıguez-Pose, 1999; Rodrıguez-Pose and Crescenzi, 2008).

That knowledge is a main engine of our society is uncontroversial, but it is unclear whether all knowledge matters in the same way. Or, whether there are particular types of knowledge that are more crucial for economic growth.

In economics, several terms have been linked to the concept of 'knowledge'. Probably the most comprehensive term in describing the abilities and skills of a person is 'human capital'. Although dating back as far as Adam Smith, the concept was formalised by Nobel Prize winner Gary Becker in 1964. Human capital per sè is a very general concept that "*refers to the knowledge, skills and competencies embodied in individuals that increase their productivity*" (Faggian, 2005, p. 362). Such a general concept is almost impossible to quantify and hence, in the decades after Becker's contribution, it has been empirically 'operationalised' using formal education – mostly measured in years of schooling - as a proxy.

This empirical simplification of the concept of human capital has led to many criticisms and, ultimately, to the creation of alternative 'labels' to identify the '*knowledge that matters'*. A whole stream of literature underlines the importance of 'entrepreneurship', as opposed to human capital, as the key factor for societal economic success. Although a univocal definition of entrepreneurship does not exist, the concept is normally linked to that of innovation. In a recent survey, Wennekers and Thurik (1999) associate the term entrepreneurial with "*the manifest ability and willingness of individuals, on their own, in teams, within and outside existing organisations, to perceive and create new economic opportunities (new products, new production methods, new organisational schemes and new product–market combinations)*" (p. 46).

Kirzner (1997) offers a more concise, but effective definition of entrepreneurship as "*the recognition of a pure profit opportunity that had previously gone unnoticed*". Of course, this includes mundane process innovations that allow firms of all sizes to have a competitive advantage to recognition of niche markets by thriving small businesses. There is also an underlying assumption that an entrepreneur is an individual who is willing to take risks. As Schumpeter (1911) originally put it, he or she is a sort of "revolutionary" who can reform the pattern of production by exploiting an invention and is willing to face uncertainty and overcome obstacles in order to succeed. Hence, while much of the academic focus on entrepreneurs has been on radical innovations, successful small and medium-sized enterprises are typically defined by an owner who sees a niche profit opportunity and is willing to take some risk in order to succeed.

Whereas the concept of entrepreneurship is appealing, it faces the same problem as 'human capital' when it comes to be operationalised for empirical testing. Measuring "entrepreneurship" is challenging because it is defined on many dimensions such as innovation, risk-taking, and identifying markets and proxies to measure these dimensions need to be used. However, while in the case of human capital, education is almost universally accepted as a good proxy, in the case of entrepreneurial abilities, it has been hard to reach consensus on an appropriate definition (Cunningham and Lischeron, 1991; Malecki, 1994). Three of the most popular proxies are: self-employment rate, share of small-medium enterprises (SMEs), and new firm formation.

Self-employment rates are relatively easy to measure, so they have become standard in much of the empirical work (Acs et al. 1994, Blanchflower 2000, OECD 1998, Parker and Robson 2004, Evans and Jovanovic, 1989; Blanchflower and Oswald, 1998; Glaeser, 2007; Shrestha, et al. 2009; Goetz and Rupasingha, 2007; Stephens and Partridge, 2011). Self-employed individuals are proprietors (and partnerships) that own/operate businesses that range from employing no one else to medium-sized enterprises that employ thousands.[1] The assumption behind this proxy is that self-employed individuals are most likely to exhibit entrepreneurial characteristics such as greater risk-taking and ability to innovate and to commercially exploit inventions. Although these are reasonable assumptions, this proxy does not account for individuals who are highly entrepreneurial but work within an organization, labelled by some *intrapreneurs* (Gibb, 1990; Wennekers and Thurik 1999). As Glaeser (2007) acknowledges, this measure is biased towards the smallest entrepreneurs and makes little distinction between "*Michael Bloomberg and a hot dog vendor*". Another concern with the self-employment measure is that it may include those who are the not particularly entrepreneurial, such as those who start a business out of necessity because there are few other job opportunities. Yet, Stephens and Partridge (2011) contend that even "necessity entrepreneurs" could serve a useful role if their business take off, or at the very least, further diversifying a local economy.

An alternative to the self-employment rate is the share of SMEs (e.g. Chinitz, 1961). The assumptions behind this measure are not dissimilar from the ones behind the use of self-employment. SMEs can be very innovative and hence, very 'entrepreneurial'. However, the use of the share of SMEs as a proxy for entrepreneurship does not solve the problem which arises when using self-employment. Measured either by the self-employment rate or by the share of SMEs, entrepreneurship might seem to decline in industries where entrepreneurs have been successfully expanding their companies into "large" firms.

New firm formation has been used by some researchers (Armington and Acs, 2002; Kirchoff et al., 2002) as yet another measure of entrepreneurship. Shapero (1984) calls the decision to start a new company the 'entrepreneurial event'. However, although creating a new business clearly demonstrates willingness to take risks and the ambition to commercialize new ideas, this measure still has its shortcomings in that it does not account for entrepreneurial activities that are not 'new' (or neither tells us how successful these new activities are as new firms often fail). Moreover, data availability is more of a problem as many countries do not compile data on newly-created and closed businesses, much less on re-registered businesses and there are serious comparability issues (Vale, 2005). Hence, we will not employ this measure in this study.

[1] Of course, there could be privately held companies that employ tens of thousands, but these are usually organized as corporations. Specifically, for the U.S. Bureau of Economic Analysis (BEA) data we employ, the BEA defines self-employment or nonfarm proprietors as "…the number of sole proprietorships and the number of individual business partners not assumed to be limited partners."

What is clear, however, is that an entrepreneur has certain characteristics that are desirable for an economy. To varying degrees, he (or she) is the 'innovative' type, who has an idea, a 'vision,' and is willing to face uncertainty to succeed. Although education is not a necessary prerequisite to be an entrepreneur, a certain degree of overlap between being 'educated' and being 'entrepreneurial' has been found (Goetz and Freshwater 2001; Evans and Leighton 1989; Bates 1993; Audretsch and Fritsch 1994; Malecki 1994; Bregger 1996; Robson 1998).

A more recent extension to the relationship between knowledge and economic growth is the introduction of the concept of 'creative class' (Florida, 2002). Florida and his followers argue that it is not just the education a person possesses that really matters, but whether they are 'creative'. Hence, 'creativity' is a '*driving force in regional economic growth and prosperity*' (Florida 2002). These researchers contend the best way of measuring creativity is an individual's profession. From this, Mellander and Florida (2007) and Florida et al. (2008) argue that a particular set of occupations compose the 'creative class', and this measure of human capital outperforms the conventional use of educational attainment because it accounts for utilised skills rather than just *potential* talent. Marlet and Van Woerken (2004) stated that "the creative class sets a 'new standard' for measuring human capital."

Few would dispute that creativity matters and not all 'educated' are also 'creative', but the concept of creativity suffers from the same empirical problems as the concept of human capital and entrepreneurship. It is an elusive concept, very difficult to operationalise. Many authors dispute that the set of professions included in the creative class concept outperforms the use of simple educational attainment as human capital proxy. Hansen (2007) showed that the correlation between creative class and educational attainment is 0.94 and a very high correlation was also found in Finland, Denmark and Norway (respectively 0.96, 0.84 and 0.85).[2] Glaeser (2005) observed that, if the creative class has an effect over and above the traditional measure of human capital, then it should be positive in a model in which both variables are included. However, by estimating a simple regression based on US metropolitan areas, he found that while the percentage of adults with a college education has a positive and statistically significant impact on growth, the share of workers in the 'super-creative core' is statistically insignificant when the schooling variable is included. Moreover, the two variables are also highly correlated (0.75). Other contributions, such as Wojan et al. (2007), Rauch and Negrey (2006), and Donegan et al. (2008), also show that the creative class measure of human capital performs very similarly to the traditional education measure.

If we take the concept of human capital in its broadest sense, being creative or possessing entrepreneurial abilities are just parts of having a higher human capital. Since human capital is very difficult to measure and education is a very imperfect measure, creativity and entrepreneurship measures can just be seen as a way of better measuring human capital in a more comprehensive way (Figure 1). Although these measures might have considerable overlap, they do capture different aspects of "knowledge".

It should be noted that fostering new firms locally, rather than attracting them from elsewhere, is part of "high road" regional economic development policies (Malecki 2004). The entrepreneurial climate is likely more influential than weather in new firm formation (Goetz and Freshwater 2001). Marlet and van Worekens (2007) find that in Dutch cities and towns higher levels of human capital are correlated with employment growth, largely due to growth in commercial, mainly financial, services and to newly started companies. They

[2] See Andersen et al. (2008).

conclude that both a highly productive labour force and the right atmosphere to start up new businesses emerge in places with high levels of skilled and creative people. Concentrations of such people emerge as individuals "choose to locate on the basis of some sort of structured match between their talents and the forms of economic specialization and labor demand to be found in the places where they eventually settle" (Storper and Scott 2009, 162).

FIGURE 1 ABOUT HERE

In this paper, by using a unique comprehensive dataset, we simultaneously build proxies to measure education, entrepreneurship, and creativity in an effort to shed more light on what type of knowledge really matters for economic growth. In doing so, we also correct for possible endogeneity problems which might lead to biases in our results.

3. Methodology and data

To test the joint effect of creativity, entrepreneurship, and education on economic growth we use US counties as a case study. The wealth of publicly available data in the US allows for the creation of a rich database that serves the purposes of our empirical model. One of the key challenges that is typically underappreciated in related research is that self-sorting entrepreneurs or knowledge workers tend to locate in places that are growing, which can create a spurious positive association between our knowledge measures with growth.[3]

The most popular economic model describing movement of firms and people across locations is the spatial equilibrium approach, which is summarized by Glaeser and Gottlieb (2008). The key aspect of the model is that firms and households will relocate to places that offer them the highest expected future profits or future utility. Namely, firms, entrepreneurs and workers may be prone to migrate/locate in places they think will perform well in future in terms of job availability, wages, or profits. Alternatively, there could be a negative bias in the human capital/creativity coefficients, if for example, the least-productive high human capital (or creativity) people relocate to fast growing places because they are unable to get a job in their initial location (all else equal)—e.g., the unemployed arts major. The problem such sorting would cause is that individual actors may use information that is unavailable to the researcher such as election of a competent politician, investment in key public services or infrastructure, business attitudes or general buzz surrounding a place, and financial struggles or successes of key firms. Of course, many of these factors can be discovered in newspaper searches, but quantitative studies will find it nearly impossible to find common variables to measure such events for their entire sample. Statistically, these omitted variables can create endogeneity bias in our entrepreneur and human capital variables if they are sorting or moving in response to these events.[4]

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[3]For example, Low et al. (2005) found that business formation in rural areas may be due to fewer economic opportunities. Similarly, using instrumental variables, Stephans and Partridge (2011) found larger effects from small business formation in the depressed Appalachian Region after accounting for the fact that people are more prone to start businesses when they expect less future job creation. Likewise, McGranahan et al. (2010) and Stephens and Partridge (2011) find evidence that entrepreneurship and amenities (which also support growth) have a reinforcing effect in promoting growth.

[4]The recent literature on household and business location has keenly focused on endogeneity through omitted variables in which households and firms self sort based on future expectations or there is omitted fixed factor that may be correlated with the explanatory variables of interest. Policymakers may also implement certain policies based on their expectations about future growth. One solution to these endogeneity concerns is to implement natural experiment matching in which a counterfactual is obtained to compare to the control group.

First, to mitigate this endogeneity problem, we need to control for the key factors that underlie growth so that we minimize omitted variable bias. Though we are careful to account for supply and demand factors that influence economic activity, there could be residual endogeneity in that forward-looking firms and individuals will choose to locate in places that they expect will have faster growth beyond what our measures of economic activity already suggest. Likewise, omitted persistent effects such as culture may also bias the regression results Instrumental variables are one solution to correct for these types endogeneity, which we describe below.

We adopted a tripartite modelling strategy. Firstly, we estimate a simple OLS model (equation 1) with employment growth as dependent variable and a series of explanatory variables including two proxies for entrepreneurship (ENT1 and ENT2), 'traditional' human capital (in the form of education, EDU), and creativity (CREA).

$$EMPGR_i = \alpha + \beta_1 EDU_i + \beta_2 CREA_i + \beta_3 ENT1_i + \beta_4 ENT2_i + \beta_5 AME_i + \beta_6 HT_i + \beta_7 POP_i + \sum_{j=8}^{11} \beta_j ACC_i^j + State\ Fixed\ Effects + \varepsilon_i \quad (1)$$

where i=1,..., 3065 identify the US counties in the lower 48 states and the District of Columbia. Employment growth is calculated between the year 2000 and 2007. Our employment growth measures represents numbers of jobs, which does not differentiate between full and part-time employment.[5] The explanatory variables all refer to the initial year (2000) to avoid direct simultaneity with the dependent variable. We separately consider metropolitan counties from nonmetropolitan counties to account for heterogeneity in urban and rural environments. A description of how the variables are constructed and their sources is reported in Table 1.

For example, Hanson and Rohlin (2011) create counterfactuals because of the concern that government policies were developed based on policymakers expectations of future conditions. As noted above, another solution is instrumental variables. For example, Duranton and Turner (2011) instrument for interstate highway infrastructure because policymakers may provide additional infrastructure (or less infrastructure) based on their expectations of whether the region may be a future leading or lagging region. One final example that has some similarities to our case is Glaeser et al. (2012). They argue that historical coal mining communities have lower economic growth both directly due to productivity growth in coal mining and indirectly by coal mining creating an atmosphere that does not nurture entrepreneurship and small-firm formation. Thus, in their model of local growth, they instrument for small firm intensity with distance to historic coal mines.

[5]Job growth is a key measure of economic prosperity that is also correlated with population growth. Job growth also reflects the highest economic priority in the American economy since the year 2000 when job growth greatly slowed. Yet, our job growth measure does not account for part-time workers or the share of "high" or "low" wage jobs. Another indicator of economic well-being is average income or wages. We do not pursue those measures because average income may only reflect what is happening at the upper tail when there are rapid increases in income inequality, as in the United States. Likewise, high income may not translate into high utility because it may only compensate for disamenities (Glaeser and Gottlieb, 2008).

Table 1: Variables description

Variable	Description	Source
EMPGR	Employment Growth between the years 2000 and 2007	US Bureau of Economic Analysis
EDU	Percentage of people with bachelors or graduates degrees (2000)	US Census Bureau
CREA	Percentage of people in 'creative occupations' in 2000 (based on 2 digit occupational codes as in Florida 2002[6])	Our calculations based on US Census Bureau data
ENT1	Self-employment (non agricultural) (in the year 2000)	US Bureau of Economic Analysis
ENT2	Share of SMEs (in the year 2000)	US Census Bureau - County Business Patterns
HT	Employment share in high-tech sectors (in the year 2000)	EMSI Consulting company data. See Dorfman et al. (2011) for a detailed discussion of EMSI data. Our definitions of high-technology (or advanced-technology) industries follows from the US Department of Labor (see Hecker, 2005).
AME	Natural Amenity Index 1999 (values from 1 to 7, 7 being highest amenities)	US Department of Agriculture
POP	Log Population 1990	US Bureau of Economic Analysis
ACC8	Distance in km to nearest MSA	Partridge et al. (2008a, 2008b)
ACC9	Incremental distance to MSA>250,000 population	Partridge et al. (2008a, 2008b)
ACC10	Incremental distance to MSA>500,000 population	Partridge et al. (2008a, 2008b)
ACC11	Incremental distance to MSA>1,500,000 population	Partridge et al. (2008a, 2008b)

We also control for the share of employment in 2000 accounted for by high-technology industries. Thus, our results compare the influence of knowledge embodied across the entire workforce to the influence of having knowledge-intensive industries. This comparison is important because attraction of high-technology firms often form the heart of innovation and cluster strategies used by economic development practitioners.

To account for faster growth in high-natural amenity locations, we control for a one to seven natural amenity scale. The amenity scale uses climate (warm winters, less humid summers, clear days), access to water, and topography (such as mountains) in its construction. The log 1990 population is included to account for agglomeration effects. Moreover, we include different accessibility measures to reflect the distance penalty across the urban hierarchy, which Partridge et al. (2008a, 2008b) found to be a key factor driving spatial differences in growth. First is distance to reach a metropolitan area and then we add incremental distances to respectively reach a MSA of at least 250000, 500000, and 1.5 million people. Likewise, Polèse and Shearmur (2004) find that industry composition follows similar patterns of urban proximity, with the highest-order and most human-capital intensive firms located near the largest urban centers. Beyond these regional economic linkages, Shearmur (2010) notes that innovation spillovers and regional innovation systems have similar proximity relationships in the urban hierarchy (also see Doloreux and Shearmur, 2011). Overall, not controlling for distance, amenities, and population would confound the independent effects of "entrepreneurship" and knowledge-intensity with the likely fact the businesses and

[6] We thank Kevin Stolarick for providing us with the appropriate occupational Census codes.

knowledge workers will want to locate near larger agglomerations that are already growing faster.

Secondly, we address endogeneity problems by estimating a 2SLS regression with appropriate instruments for the endogenous independent variables. As noted above, potentially many of the variables in our model, except for the amenity index and the accessibility variables, might suffer from endogeneity. Following a common approach in the literature (Card and DiNardo, 2000), we use deep lags for the independent variables suspected of potential contemporaneous endogeneity. In particular, we use the population of 1950; the share of 'creative' people (managers and professionals) in 1950; the percentage of population over 25 with three or more years college in 1970; the share of non-agricultural self-employment in 1970; the percentage of SMEs in 1974 and the percentage of high-tech firms in 1990.

We also include an 'industry mix employment growth (Bartik, 1991; Blanchard and Katz, 1992), (INDMIX_GR) as an instrument for the effects of persistent local economic growth as a key measure of underlying growth.[7] We use the growth rate between 1990 and 2000 (n=10) to avoid simultaneity with the dependent variable. Industry mix growth represents the hypothetical employment growth rate if the county's industries grew at the national average over the sample period and it should be exogenous to the county because it is based on national patterns.

Thirdly, to correct for spatial autocorrelation we use Conley's (1999) 2SLS GMM estimator for spatially correlated errors. Conley's code uses a weighting function that declines linearly until the distance reaches a certain threshold, when it becomes zero. We use three degrees of latitude and longitude as our thresholds, which correspond to a square of about 200 x 160 miles (at 40 degrees latitude). The results are not sensitive to changing these thresholds.

Fourth, state fixed effects account for common features about each state that may be driving its growth including different sized counties, historic settlement, access to coasts, tax policy, business regulations, and public infrastructure. With state fixed effects, all variable coefficients reflect the effects of within state movements of the explanatory variables.

5. Results and discussion

The results of our estimations are reported in Table 2. Columns 1 and 2 report the results of the OLS estimation respectively for nonmetropolitan (non-MSA) and metropolitan (MSA) areas. The OLS results would be the preferred results to the extent that our concerns about endogeneity are not warranted. However, as reported in note (b) at the bottom of Table 2, endogeneity seems to be a problem in our model. Columns 3 and 4 report the results of the 2SLS spatial GMM. We omit the results of the non-spatial 2SLS as they are very similar to

[7] The industry mix employment growth rate for a state 's' in the period [t, t+n] is defined as:

$$\text{INDMIX\_GR}_s = \sum_i S_{is}^t * EMP\_GR_{i,USA}^{t,t+n}$$

Where S_{is}^t is the county's employment share in industry *i* (one-digit SIC) in the initial year *t* and $EMP\_GR_{i,USA}^{t,t+n}$ is the growth rate in industry *i* for the whole USA in the period [t, t+n]. Changes in *national industry* demand are the exogenous shifters for each county.

the spatial model, the only difference being in the standard errors, which are corrected for potential spatial dependence[8].

Starting with the control variables, most of the OLS results are in line with expectations. Closer accessibility to large MSAs (especially above the 250,000 and 500,000 inhabitants thresholds) plays a positive role on growth for both MSA and non-MSA areas. Amenities are significant only for non-MSA areas, though this is consistent with previous studies that find that amenities are a strong determinant of growth in nonmetropolitan areas (e.g., Deller et al., 2001; McGranahan et al., 2010). One caveat is the USDA amenity index measures only natural amenities.[9] MSAs are likely to offer urban man-made amenities linked to agglomeration economies that are not captured by this index.

The high tech share is less important than what some may have expected, playing a marginal role (10% level significance) only in non-MSA areas. Even though not strong, the positive relationship between high-tech and subsequent growth in nonmetropolitan areas seems to suggest that product cycle models might apply. As these high-tech technologies 'mature,' they disperse to low-cost rural areas for manufacturing. Nonetheless, Malecki (1981) notes that the likely success of high-technology strategies varies across different settings.

The results of most interest are those for the proxies for 'human factors', i.e. education, entrepreneurship and creativity. The OLS results show that education and both measures of entrepreneurship play a positive and significant role on growth, while creativity –measured in the traditional way - is either insignificant or negative. Although a VIF (variance inflated factor) test does not indicate multicollinearity among the regressors, removing the education variable does not change the results for creativity. Yet, a more restrictive definition of creative class works better, e.g. if we restrict the creative class measure only to professionals and managers, both the education and restricted creative class variables are positive and statistically significant (cf. McGranahan and Wojan, 2007). Nonetheless, the larger metropolitan human capital coefficient suggests a stronger affect for metropolitan counties than nonmetropolitan counties, suggesting urban areas have more to gain from increasing human capital (perhaps due to larger knowledge spillovers, see Abel et al., 2012).

Note (b) at the bottom of Table 2 reports the results of the endogenity test where the null hypothesis is that human capital, entrepreneurial, and creativity variables are exogenous. The results suggest the null hypothesis can be rejected hence making the OLS results biased. Columns (3) and (4) report the 2SLS results that adjust for the endogeneity effects such as self-sorting or future anticipation effects. Correcting for endogeneity and spatial autocorrelation does not significantly alter the results on accessibility, amenities, or high tech. However, the role of 'size' in terms of population does change. While in the OLS model, there appears to be some evidence of agglomeration economies in nonmetropolitan areas, the 2SLS spatial GMM results suggests that congestion effects dominate in MSAs.

[8]Note that all of conventional first-stage tests for the strength of our instruments show that we do not have a weak instruments problem with F-values exceeding the 10 threshold (Stock and Watson, 2007). The 2SLS spatial GMM results also include a test for overidentifying restrictions. The tests do not reject the null hypothesis of orthogonality between the instruments and the error term (at 5% level) showing that our instruments are valid. For more details on this test, see Carvalho et al. (2005).

[9]Bear in mind that state fixed effects are in the model. For amenities, this means that the influence of (say) all Minnesota counties being cold and all Arizona counties being warm are captured in the state fixed effects. The amenity variable only reflects the influence of changes in the amenity scale within (say) Minnesota or Florida.

Table 2: OLS and 2SLS SPATIAL GMM results

	OLS		2SLS SPATIAL GMM	
	(1)	*(2)*	*(3)*	*(4)*
Dep. Variable: Employment change 2000-2007 (%)	**Non-MSA**	**MSA**	**Non-MSA**	**MSA**
EDU	0.66*** (7.07)	1.31*** (4.97)	1.25*** (3.72)	3.16*** (3.51)
CREA	0.10 (0.74)	-0.66*** (-2.79)	-1.84*** (-2.75)	-3.76*** (-3.18)
ENT1	37.04*** (10.92)	74.02*** (4.71)	-31.33** (-2.27)	-9.45 (-0.25)
ENT2	114.39*** (3.63)	249.73*** (2.46)	409.93*** (5.53)	616.60*** (3.44)
AME	2.05*** (5.33)	-1.40 (-1.42)	1.90*** (4.62)	0.53 (0.55)
HT	13.89* (1.89)	-11.31 (-0.77)	15.93* (1.71)	24.47 (1.40)
POP	2.87*** (7.42)	-0.06 (-0.73)	-1.08 (-1.02)	-5.39*** (-3.19)
ACC8	-0.024*** (-4.30)	-	-0.046*** (-5.14)	-
ACC9	-0.014*** (-3.47)	-0.038*** (-3.44)	-0.020*** (-4.28)	-0.047*** (-4.09)
ACC10	-0.011** (-2.35)	-0.024*** (-2.80)	-0.007 (-1.28)	-0.027*** (-2.86)
ACC11	-0.002 (-0.60)	-0.002 (-0.28)	-0.006* (-1.65)	-0.005 (-0.61)
State Fixed Effects	**YES**			
Constant	-158.89*** (-5.13)	-237.11** (-2.40)	-376.28*** (-5.53)	-531.31*** (-3.29)
Crit. fn. test overid. restrictions	-	-	13.35	11.45
R-squared	0.31	0.45	-	-
No. of observations	2,247	818	2,247	818

Notes: (a) To rule out possible multicollinearity problems, we calculated the VIF for each regressor (values below 10 show no multicollinearity problem). In model (1) the maximum VIF value – associated with the amenity variable AME – is 4.17 and the average VIF for all regressors is 2.14. In model (2) the maximum VIF –associate with the Alabama state fiexd effect – is 5.58 and the average VIF is 2.26.

(b) Although we do not present the results here we estimated also the 'non-spatial' version of the 2SLS model (using the 'ivreg2' Stata command). The endogeneity test for the regressors (implemented with the 'endog' command) showed that we indeed had an endogenity issue. The null hypothesis that the education, entrepreneurship and creativity regressors were exogenous was rejected with a value of the χ^2 test equal to 65.29 and a P-value=0.000.

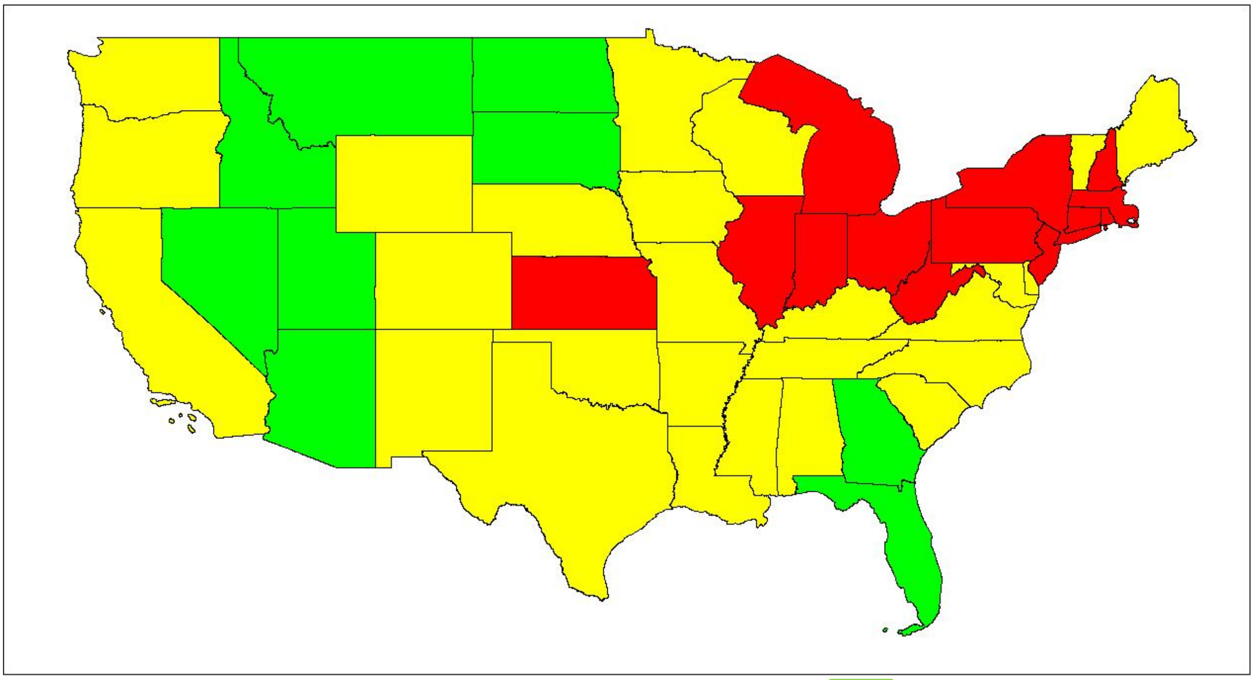
As for the control variables, the results on the other variables of interest do not vary much when correcting for endogeneity and spatial autocorrelation with the only exception of the self-employment rate (though the magnitude of the education coefficient increases), which loses its significance in metropolitan areas and even becomes negative in nonmetropolitan areas. We further note that removing either the self-employment or the SME variable does not change the result for the other coefficient, suggesting that this finding is not an artifact of multicollinearity.

The negative coefficient on self-employment after addressing endogeneity suggests that self sorting may explain the general OLS result in previous studies that self-employment (ENT1) is positively linked to growth[10]. On the other, it may reflect that having a greater share of small and medium-sized businesses (ENT2) that tend to buy locally or are locally owned is of paramount importance (Fleming and Goetz, 2011). The role of SMEs is also consistent with Audretsch and Thurik's (2001) contention that - as the comparative advantage has shifted towards knowledge-based economic activity- SMEs are becoming more and more important for growth. However, while further research would be needed to fully assess this point, it does suggest that state and local development efforts aimed at luring outside big firms to a region with generous subsidies and incentives is misguided when compared to cultivating home-grown small businesses (e.g., see Goetz et al., 2011).

Although we do not report the state fixed effect results in the table for the sake of space, Figure 2 gives a graphical representation for the 2SLS GMM spatial model with all counties included (MSA plus non-MSA).

[10] We caution that removing creativity seems to increase the importance of self employment.

Figure 2: State fixed effect



Negative, significant

Positive, significant

Insignificant

All else being equal, these results suggest that the states in the Northeast and Rustbelt have underperformed. This is not surprising due to their unattractive climate, weak industry composition, poor local government, fragmented governance and perceived high tax rates. The over-performers are high amenity mountain and Sunbelt states with pro-business climates and, especially in the case of North Dakota, commodity-driven growth. Some results may be a little surprising such as the non significant parameter of California, which performed poorly in the period under investigation. On the opposite end of the spectrum may be relatively fast growing states such as Washington, Colorado, and North Carolina that do not have positive and significant fixed effects (suggesting that the other control variables explain their growth).

6. Conclusions

Human capital – proxied by education - entrepreneurship and creativity have often been treated as separate phenomena. Most contributions focused on just one of them or, at most, on the relationship linking two of them. In this paper we argue that 'creativity', 'enterpreneurship' and education are all part of a more broadly defined concept of human capital, which is the most essential production factor in knowledge societies.

We also argue that empirical measures for creativity, entrepreneurship and human capital are highly imperfect and combining them might get us closer to capturing the complexity of the human abilities that count for economic growth. To assess their relative roles, we build a model explaining the economic growth of US counties in the period 2000 and 2007 in which we simultaneously consider the role of the human capital, entrepreneurship and creativity, while controlling for other important factors such as accessibility, amenities and share of high-tech industries.

When including all three factors, we find that education seems to prevail followed by the entrepreneurship measure associated with a concentration of local SMEs. Creativity – traditionally measured – does not appear as a dominant factor although different results are found for more 'restrictive' definitions. Likewise, other studies have found positive creativity effects in more specific local contexts—e.g., Stephens et al., (forthcoming) for the Appalachian region. Our results are robust after we correct for potential endogeneity problems and spatial autocorrelation. In fact, the results on human capital strengthen in the final 2SLS spatial GMM model. Nevertheless, the results support arguments that the best economic development strategies revolve around attracting/retaining highly educated workers and building a diverse small and medium business foundation (Malecki, 1994; Glaeser and Gottlieb, 2008; Glaeser et al., 2010; Partridge and Olfert, 2011; Yigitcanlar et al., 2007). Conversely, we find little evidence that despite its popular appeal, attracting high-technology industries contribute to subsequent growth in urban areas. Nonetheless, while having more educated workers is conducive to growth, we did not address the nagging question of how to attract (or create) these workers through migration or through one's own schools. More research is needed to examine this vexing policy challenge (see Brown and Scott, 2012 as a start).

The results on creativity do not necessarily imply that the concept itself has no value, but rather that the direction of causality is important and endogeneity should always be accounted for. Creative people might be very efficient in self-sorting themselves in places on a faster growth path. Moreover, with creativity being a relatively young concept, better measures might still be needed. Fine-tuning the proxies for creativity or dissecting the creative class into more detailed and homogeneous sub-components (e.g., Comunian et al. 2010) might influence the results, which is something that should be explored in future research.

In conclusion, we note that while these findings apply mainly to the United States, they may not apply to other countries. Namely, different economic structures, propensity to migrate, and governmental policies mean that the underlying growth processes may also differ. These possibilities are left to future research.

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Figure 1: Human capital, entrepreneurship and creativity