Business Dynamism and Economic Growth: U.S. Regional Evidence*

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Abstract

We document empirical evidence on the determinants of U.S. regional growth over the last 25 years, with a special attention to the role of entrepreneurial activity or 'business dynamism'. The main data source is the Business Dynamics Statistics (BDS) released by the U.S. Census Bureau. The key findings are: i) business entry and exit rates are similarly distributed across states, ii) neither entry nor exit rates have had a significant impact on regional growth, iii) higher business density results in faster regional growth, iv) entry rates have fallen over time and the states with greater business detrending have had weaker economic growth, v) states where entry and exit show substantial comovement (business churning) tend to grow faster, especially after 2007, vi) state-level population growth has no substantial effect on regional growth, and vii) the convergence hypothesis holds across the states of the U.S.

JEL classification: O30, O40, O51.

Key words: Business dynamism; Entry-exit rates; Economic growth.

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1 Introduction

Recent research has documented a declining trend in business entry and exit rates in the U.S. economy (Decker *et al.* (2014), Hathaway and Litan (2014)). Similarly, both job creation from startups, and job destruction from business closings have also experienced a downward trend (Davis *et al.* (2006), Davis *et al.* (2010)). Taken together, these stylized facts are indicative of a decline in business dynamism and entrepreneurial activity. Although understanding the precise sources of these trends and their implications for productivity is an active research area (Haltiwanger (2011)), their consequences for U.S. economic growth have not yet been determined. The purpose of this paper is to fill this gap. The main question that we ask is: what are the long-run effects of business dynamism on U.S. regional growth? We use the term 'business dynamism' as a catchall for the characteristics of incumbents participating in the market, along with the role of the flows of entry and exit. We consider six dimensions of business dynamism and assess how they have influenced regional growth.[1] These six aspects are: entry, density per capita, density per unit of land, trend, churning (capturing the entry-exit comovement in the short-run), and size. The empirical analysis is based on U.S. regional data over the period 1987-2013.

The results reveal that the rate of business entry is not a significant driver of U.S. regional growth. Business entry has a *negative* but statistically insignificant effect. This finding is striking because endogenous growth theories suggest a positive effect of business creation on growth (Aghion and Howitt (1992)).[2] Regarding other characteristics of entrepreneurship, business density (measured in either per capita or per unit of land terms) has a positive and statistically significant effect on regional growth. We also observe that states that experienced a sharper decline of entry rates over time have decreased their average rate of economic growth. By contrast, the comovement between business creation and destruction, which we refer to as the Schumpeterian business churning, has had a positive effect on growth. Finally, a higher prevalence of small-size business units has a (mild) negative effect

[1] To our knowledge, this paper is first to provide evidence on the link between the declining business dynamics and U.S. regional growth.

[2] Particularly, innovation-based growth theories (Romer (1990), Aghion and Howitt (1992)) imply that the long-run rate of growth should be positively related to the flow of entry.

on growth.

Labour mobility across the states is an important and well known feature of the U.S. labour market. Molloy *et al.* (2011) report a secular decline in inter-state migration over the last decades, but they still find greater internal mobility in the U.S. than in the Euro Area.[3] Since fertility rates are quite similar across the U.S. states, one way to capture this internal mobility is via state-level population growth. We find that although population growth has a positive effect on regional growth, the effect is not statistically significant.

We also find strong evidence for β-convergence *a la* Barro and Sala-i-Martin (1992) across the U.S., whereby states with low initial per capita income have tended to grow faster and converge towards the level of per capita income of richer states.

In our robustness checks, the business churning effect has been more prominent after 2007 while the business size effect is more prominent in the pre-Great Recession period.

The rest of the paper is organized in four sections. Section 2 describes our data sources, the empirical framework, and some stylized facts. Section 3 reports and discusses the results of the cross-sectional regression estimations. Section 4 concludes.

2 Data

We use regional data from the U.S. economy on business dynamics and economic growth. The sample period runs from 1987 to 2013 (27 annual observations) for each of the 50 states and the District of Columbia (D.C.). The first and last periods are dictated by data availability. The Bureau of Economic Analysis (BEA) compiles state-level annual data for real Gross Domestic Product (GDP) per capita which is available from 1987 onwards.[4] Each observation is defined by state s and year t. Let $y_t(s)$ denote the real GDP per capita of the state s in year t. The source for entry and exit data is the Business Dynamics Statistics (BDS) from the U.S. Census Bureau, with annual data covering the 50 states and D.C.[5] The last available observation is year 2013. We directly retrieve the following

[3] Kaplan and Schulfhofer-Wohl (2012) claim that the observed decline is basically due to a methodological change in the statistical procedure used to obtain the data.

[4] Source: https://www.bea.gov/regional/.

[5] Source: http://www.census.gov/ces/dataproducts/bds/data.html

time series from the BDS: the total number of establishments, $N_t(s)$, establishment entry, $N_t^E(s)$, and establishment exit, $N_t^X(s)$. An establishment is defined in the BDS as 'a single physical location where business is conducted or where services or industrial operations are performed'. Establishment entry (exit) is defined as the number of births (deaths) within the last 12 months. We have chosen not to look at firm-level data because in the BDS a firm with establishments in multiple states is counted multiple times, once in each state, irrespective of the portion of the firm residing in that state.[6]

The BDS normalizes the ratio of entry and exit rates by the average of the current and previous observations (the Davis-Haltiwanger-Schuh (DHS) denominator).[7] Hence, the business entry rate of state s in year t is (in percentage terms)

$$B\_Entry_t(s) = 100\left(N_t^E(s)/(0.5(N_t(s)+N_{t-1}(s)))\right),$$

whereas the corresponding exit rate is

$$B\_Exit_t(s) = 100\left(N_t^X(s)/(0.5(N_t(s)+N_{t-1}(s)))\right).$$

2.1 Empirical framework

Our main objective is to examine how business dynamism has affected U.S. regional economic growth. We adopt a cross-sectional regression approach that is widely used in the empirical analysis of economic growth. The dependent variable is the average state-level growth rate of real GDP per-capita, $g_y(s)$. There is a methodological discontinuity of the time series in 1997, when data change from SIC (1987-1997) industry definitions to NAICS (1997-2013) industry definitions. We construct $g_y(s)$ as a weighted average of the compound annualized growth rates for the 1987-1997 and 1997-2013 subperiods, where the weights are the number

[6]For example, if a fast-food franchise opens, the BDS counts it as an establishment entry and not as a firm entry.

[7]Following Haltiwanger *et al.* (2013), the DHS denominator is the average of employment for the current and previous period in order to prevent a bias to the relationship between net growth and size due to transitory shocks.

of observations in each period relative to the sample size.[8] This is given as

$$g_y(s) = \left(\frac{10}{26}\right) g_{y,SIC}(s) + \left(\frac{16}{26}\right) g_{y,NAICS}(s),$$

where $g_{y,SIC}(s) = \left(\frac{y_{1997}(s)}{y_{1987}(s)}\right)^{1/10} - 1$ and $g_{y,NAICS}(s) = \left(\frac{y_{2013}(s)}{y_{1997}(s)}\right)^{1/16} - 1$.

The baseline cross-sectional linear regression to explain U.S. regional growth is

$$\begin{aligned} g_y(s) &= \phi_0 + \phi_1 B\_Entry(s) + \phi_2 B\_Density\_P(s) + \phi_3 B\_Density\_L(s) + \phi_4 B\_Trend(s) \\ &\quad + \phi_5 B\_Churning(s) + \phi_6 B\_Small(s) + \phi_7 g_P(s) + \beta \log y_{1987}(s) \\ &\quad + Dum(s)\gamma' + u(s) \qquad (1) \end{aligned}$$

where $s = 1, ..., 51$, ϕ_0 is a constant, and $u(s)$ is the error term. There are six regressors that capture a variety of aspects of business dynamism and three dummy variables. The first regressor is $B\_Entry(s)$ that denotes the average annual rate of business entry for the state s over the period 1987-2013 obtained from the sample mean

$$B\_Entry(s) = \frac{1}{27} \sum_{t=1987}^{2013} B\_Entry_t(s).$$

Likewise, we also computed the average annual rates of establishment exit as another potential regressor

$$B\_Exit(s) = \frac{1}{27} \sum_{t=1987}^{2013} B\_Exit_t(s).$$

It turns out that the states with high (low) B_Entry also have high (low) B_Exit (see Table 1). As discussed below, the cross-sectional correlation between the average rates of business entry and exit in the U.S. regional data is 0.96. This near-one correlation means that we can examine the effect of either average entry or average exit rates, but not both, to avoid collinearity. We choose $B\_Entry(s)$ to enter the baseline specification (1) and $B\_Exit(s)$ is left out.

[8] The NAICS-based statistics of GDP by state are consistent with U.S. GDP while the SIC-based statistics of GDP by state are consistent with U.S. gross domestic income (GDI). With the comprehensive revision of June 2014, the NAICS-based statistics of GDP by state incorporated significant improvements to more accurately portray the state economies. Two such improvements were recognizing research and development expenditures as capital and the capitalization of entertainment, literary, and other artistic originals. These improvements have not been incorporated in the SIC-based statistics, which may bring aggregation problems to construct a single time series.

The second regressor, $B\_Density\_P(s)$, is the sample mean of the stock of establishments per 1,000 people in the state s

$$B\_Density\_P(s) = \frac{1}{27} \sum_{t=1987}^{2013} \frac{N_t(s)}{P_t(s)/1,000},$$

where the series of population, $P_t(s)$, have been taken from the Regional Data statistics produced by the BEA.[9] In addition, we consider spatial business density, $B\_Density\_L(s)$, to test whether the agglomeration of businesses has any effect on growth. We obtain this regressor as the sample mean of the ratio between the stock of establishments and the land area

$$B\_Density\_L(s) = \frac{1}{27} \sum_{t=1987}^{2013} \frac{N_t(s)}{L(s)},$$

where $L(s)$ is the number of square kilometers of land area in the state s reported in the Geography section of the U.S. Census Bureau.[10] Next, we introduce a fourth regressor, $B\_Trend(s)$, that captures business trend. We fit a state-specific linear trend, $\alpha_0(s) + \alpha_1(s)\,t$, on the annual establishment entry rates, and take the Ordinary Least Squares (OLS) estimated slope coefficients for the linear trend

$$B\_Trend(s) = \alpha_1^{OLS}(s).$$

The fifth dimension of entrepreneurial activity that we consider brings the short-run co-movement in the processes of business creation and destruction. As a previous step for its calculation, we have taken the three-year moving average of state-level entry and exit rates

$$B\_Entry_t^{MA}(s) = \frac{1}{3} \sum_{i=-1}^{1} B\_Entry_{t+i}(s),$$

$$B\_Exit_t^{MA}(s) = \frac{1}{3} \sum_{i=-1}^{1} B\_Exit_{t+i}(s),$$

for each year t running from 1988 to 2012.[11] The three-year moving average captures the lags between the deaths and births of establishments due to administrative requirements,

[9]See https://www.bea.gov/regional/ .

[10]Land area is defined as total area minus water area.

[11]Both the first and last year of the sample period are lost to obtain the three-year moving average.

time-to-build, etc., that are missed in the contemporaneous correlation. Thus, we compute the coefficient of linear correlation between the two moving averages to have the business churning indicator

$$B\_Churning(s) = corr\left(B\_Entry_t^{MA}(s), B\_Exit_t^{MA}(s)\right).$$

A positive correlation, $B\_Churning(s) > 0$, reflects Schumpeterian forces that drive entry and exit up or down together. A negative correlation, $B\_Churning(s) < 0$, on the other hand, reflects forces consistent with large demand shifts that make openings and closings of establishments move in opposite directions. That is, when entry is high, exit is low and vice versa.

The sixth regressor, $B\_Small(s)$, examines whether small businesses exert a positive influence on economic growth. $B\_Small(s)$ is the fraction of small businesses (defined as establishments with less than 20 employees) relative to all private establishments in the state.[12] These numbers are directly reported in the Statistics of U.S. Businesses (SUSB) of the U.S. Census Bureau. Since data availability does not cover the whole sample period, $B\_Small(s)$ is obtained with the observations of year 2000 that is at the median of the sample period.

Apart from the six elements of entrepreneurial activity, two traditional explanatory factors of growth have also been included in the baseline regression (1). First, to account for the effects of labour mobility across the states, we use the average annual growth rate of population in percentage terms

$$g_P(s) = \frac{100}{26} \sum_{t=1988}^{2013} \left(\frac{P_t(s)}{P_{t-1}(s)} - 1 \right)$$

as one additional regressor.

Second, there might be convergence patterns due to differences in marginal returns to capital across the states.[13] Following the standard approach in the empirical literature of economic growth (Barro (1991) and Barro and Sala-i-Martin (1992)), we have added the

[12]Innovation might be concentrated around young and small businesses which typically have few workers employed.

[13]Nevertheless, our focus is not placed on the implications of the neoclassical growth theory.

initial level of the natural logarithm of per-capita real GDP, $\log y_{1987}(s)$, to the regression. The convergence effect would imply $\beta < 0$ in (1), that is, a state with average entrepreneurial activity and a low initial per-capita income will tend to grow faster.

Finally, we include three dummies in the term $Dum(s)\gamma'$, to control for special circumstances. The first dummy captures the statistical errors observed in years 1989-1990 only in the states of Alaska, Oregon and Washington.[14] The second dummy brings the extraordinary effects of Hurricane Katrina in the states of Lousiana and Mississippi. Finally, the third dummy refers only to D.C. as a particular case for its administrative and political status.

2.2 Stylized facts

Figure 1 plots the annual time series of real GDP per capita (both in levels and per-cent growth rates), the per-cent rates of establishment entry and exit, and the per-cent rates of job creation and destruction associated to openings and closings, respectively. The series of real GDP per capita have been normalized at 100 in year 1987 for all the states and D.C. There is significant dispersion in the U.S. regional economic performance over the last 26 years. State-level growth barely replicates the aggregate business cycles except for the 2008-09 economic recession and the bands of variability are wide (between -10% and $+15\%$ in a year in terms of real GDP per capita growth). The state with the fastest growth is North Dakota, which multiplies by a factor of 2.5 real GDP per capita from 1987 to 2013, while Alaska, with negative growth, reduces its real GDP per capita in 2013 to 87.6% of its 1987 level. The average level of real GDP per capita in chained 2009 dollars has risen from \$49,066 in 1987 to \$33,920 in 2013. It implies a 49% higher relative value, which corresponds to a compound rate of growth of 1.54% per year.

Tables 1 and 2 provide all the cross-sectional regional data used in this paper, displayed in alphabetical order across the 50 states and the District of Columbia. Hence, Table 1 shows the compound annual rates of U.S. regional economic growth, $g_y(s)$, and the above-mentioned variables that capture business dynamism over the period 1987-2013. Table 2 compares $g_y(s)$ with other explanatory factors: the initial real GDP per capita (in natural

[14] We have named this dummy as 'NW' to denote 'North West' states.

logarithm) and the average annual rate of population growth. Looking across the numbers of these Tables, we can see some remarkable facts. The fastest annual growth has been observed in North Dakota (3.74%), Oregon (3.01%), South Dakota (2.86%), Iowa (2.34%) and Nebraska (2.19%). Thus, growth concentrates on the Mid-West region and 3 of the top-5 states are aligned to the 100^o meridian on Earth. Such geographical coincidence can be explained by the bulk of investment plans on oil and gas drills undergone in the last decade.[15] On the bottom of the growth standings, we have found a much more geographically disperse set with Alaska (-0.30%), Nevada (0.29%), Hawaii (0.67%), Florida (0.77%) and Michigan (0.83%), all of them with annualized rates of growth below the 1% threshold.

There are also significant differences across states regarding business entry rates. The states with the highest average annual rates are Nevada (16.3%), Utah (14.7%) and Florida (14.6%), where sectoral activities are oriented to services. Meanwhile, the lowest entry rates are found in industrial states such as Iowa (9.6%), Pennsylvania (9.8%) and Ohio (9.9%). As documented in Table 1, the ranking on average exit rates is quite similar to the respective entry rates. The pairs of average entry and exit rates across states are collected in Figure 2, which show a remarkable alignment along the linear fit. The correlation between these two columns is 0.96. Therefore, we find that the distribution of entry and exit rates across states is nearly identical (which recommends against the introduction of both variables in the baseline regression (1).

Figure 1 displays three states with unrealistically high numbers in 1990 for establishment entry rates (between 23% and 29%) and in 1989 for establishment exit rates (between 21% and 26%). These states are Alaska, Oregon and Washington which have been grouped in the 'NW' dummy entering (1) capturing the statistical error.

As for the dimensions of business density collected in Table 1, the maximum number of establishments per 1,000 people are found in D.C. (31.3), Wyoming (31.1) and Vermont (30.8), whereas the values of low business density are observed in poorer states such as Mississippi (18.7), Arizona (19.4) and Kentucky (19.6). The business density in terms of

[15]Both the discoveries of shale gas reserves and the successful use of horizontal drilling and hydraulic fracturing brought the energy boom in the region from 2006 through 2013.

land is also led by D.C. which turns out to be an outlier in the distribution when taking a value of 104 establishments per square km, followed in the far distance by New Jersey and Rhode Island with 10.4 and 9.2 establishments per square km, respectively. The bottom-3 states in this category are large territories such as Montana (0.07 establishments per square km), Wyoming (0.06 establishments per square km), and Alaska (0.01 establishments per square km).[16]

Meanwhile, both the entry and exit rates show a downwards trend as markedly spotted in Figure 1. The decline in business creation and entrepreneurial activity have characterized aggregate firm and labor dynamics in the U.S. over the last decades (Haltiwanger *et al.* (2011), Pugsley *et al.* (2015)). Is the business detrending also empirically observed at U.S. regional level? Table 1 shows that all the states have a negative $B\_Trend(s)$ slope coefficient in the linear time trend of the establishment entry rates during the period 1987-2013, with the exception of North Dakota that has a 0.0 flat slope. The states that have suffered the largest decline in entry rates are New Hampshire, Washington, and Alaska, with estimated slopes around -0.25. The interpretation of this result implies that these states have reduced the entry rate at a pace of 0.25% per year over the 1987-2013 period. When business creation and destruction is measured in terms of jobs (bottom graphs of Figure 1), the downwards time trend is also observed across the U.S. states.

The $B\_Churning(s)$ variable measures the synchronization between business creation and destruction as discussed in subsection 2.1. The entry-exit comovement varies from the negative average correlation of Idaho (-0.51) to the strong positive correlation of Pennsylvania (0.79). Other states with a high degree of business churning (i.e., the substitution between entries and exits) are Mississippi and Kentucky, both of them with a correlation coefficient at 0.78. As for business size, Montana, New York and Vermont were the states with the highest fraction of small establishments in 2000 ($B\_Small(s)$ around 0.78) and the cases with the lowest fraction of small establishments were Ohio, Tennessee and D.C. where the ratios reported in Table 1 do not reach 0.68.

[16]Wyoming is a curious case because it leads the standings in business per capita whereas it is at the bottom of that on business per unit of land.

Figure 3 displays the pairwise data of state-level annual rates of growth ($g_y(s)$) and each of the eight regressors introduced in (1). There is also a linear fit that shows the slope of the univariate relationship. Table 3 provides all the cross sectional correlations. The visual analysis of Figure 3 indicates several signs of the relationships. Entry rates are inversely related to growth. The case of Nevada with the highest average entry rate at 16.3% and the second lowest growth (0.29% per year) may be crucial for the negative relationship. By contrast, the density of establishments per capita, $B\_Density\_P(s)$, has a positive effect. The spatial density, $B\_Density\_L(s)$, cannot be really tested graphically because of the D.C. outlier. The business trend has a positive correlation with regional growth (0.45); the states with smaller decline in entry rates over time usually come out with higher rates of growth. Neither the churning entry-exit comovement nor the prevalence of small business provides any significant one-to-one impact on regional growth (their correlations are low in Table 3 and their linear fit is rather flat in Figure 3). Finally, the convergence effect shows up clearly in Figure 3, with a strong inverse relation between the level of real income per capita in 1987 and the economic growth that came over the next 26 years (the linear correlation is -0.56).

3 Results

Table 4 presents the estimation results for specification (1) by the OLS method with heteroskedasticity robust standard errors. The overall fit of the model to the data is good and reflected by the high adjusted-R^2 coefficient at 0.836.

The rate of business entry, $B\_Entry(s)$, does not have a statistically significant effect on U.S. regional growth. In fact, the point estimate is negative, ϕ_1=-0.024, with a p-value of 0.811. This is one of our key findings. The states with higher average entry rates did not experience any statistically significant effect on their economic growth relative to the states with lower average entry rates.

The estimated coefficient on the number of establishments per capita, $B\_Density\_P(s)$, is, however, positive (ϕ_2=0.112) and statistically significant (p-value=0.000). Innovation-based growth theories (for example, Romer (1990), Aghion and Howitt (1992)), imply that

ϕ_1 and ϕ_2 should be both positive, consistent with the notion that the higher the number of productive businesses, the higher the economic growth. We find this effect only on the stock of establishment per capita, not on the rates of establishment entry.

The influence of the spatial business density, $B\_Density\_L(s)$, is also positive (ϕ_3=0.063) and statistically significant at the 1% confidence level. This finding suggests that agglomeration of business activity benefits economic growth. The trend associated to the establishment entry rates, $B\_Trend(s)$, has a positive effect on regional income growth (ϕ_4=7.090, with a p-value of 0.000). That is, states experiencing a sharper decline in business trend experienced slower growth, hence a positive sign of the estimated coefficient. In other words, the decline in entrepreneurial activity has had a strong detrimental effect on regional economic growth. In quantitative terms, the interpretation of the estimated coefficient says that one state that is able to keep 1 basis point per year (0.01%) on the observed decline of the business entry rate will achieve an annual rate of growth 7 basis points (0.07%) higher.

How does the short-run comovement of the entry-exit process influence economic growth? As Table 4 shows, we obtain a positive $B\_Churning(s)$ coefficient ($\phi_5 = 0.727$) and a statistically significant impact (p-value=0.000) on economic growth. Combining this result with the previous ones indicates that although the average entry rate by itself does not affect regional growth, the short-run comovement of the entry-exit processes does have an important fostering effect. Hence, U.S. regional evidence is consistent with this aspect of the Schumpeterian creative destruction hypothesis. States such as Nebraska or Vermont, where the 3-year window correlation between entry and exit rates has been positive and high, report above-average economic growth. The replacement of the least efficient establishments when entry is high or the creation of innovative growth-pushing establishments when exit is high would explain this phenomenon through a positive and high churning indicator. Florida and Nevada are on the opposite side of the story: they had negative churning correlation and they are among the group of states with the lowest economic growth in the period.

Regarding business size, we find that having a high share of large versus small establishments does not exert any strong effect on growth. The estimated coefficient of $B\_Small(s)$ is negative ($\phi_6 = -5.874$), and statistically significant only at the 5% confidence level (p-

value=0.050). The result thus suggests that having large establishments may have some advantages for growth, possibly due to scale-effects, and the prevalence of small establishments does not conclusively influence regional growth.

Summarizing, five of the six dimensions of business dynamics examined turn out to be relevant driving factors for U.S. regional growth. Only the entry rate has not played any significant role.

The baseline estimation controls for economic convergence and population growth, as two conventional factors for explaining U.S. regional growth. As reported in Table 4, population growth has a positive ($\phi_7 = 0.190$) but not statistically significant effect on economic growth (p-value 0.333). Thus, movement in labour flows across the states, reflected in the state-population growth, does not appear to have a substantial impact on economic growth. The positive sign may be due to reverse causality: the states with high growth will offer better job opportunities and will receive net domestic immigrants from other states. As one opposing effect, a high rate of population growth ought to have a direct negative impact on per capita growth. These two opposing effects seem to cancel each other in our estimation as the coefficient is not statistically different from zero.

As for the convergence hypothesis, we do find strong evidence that supports β-convergence across the states because the sign of the estimated coefficient of the log of the initial per capita income in (1) is negative ($\beta = -1.884$) and it is statistically significant (p-value 0.000). According to this result, one state with a per-capita real income 10% below the U.S. level in 1987 has grown 0.19% more annually over the period 1987-2013. The gap between poor and rich states has shrunk over the period that goes from 1987 to 2013. The convergence can explain the reduction in labor mobility as the benefits of inter-state migration might now be lower than in the past, as argued in Molloy *et al.* (2011).

Finally, the model specification (1) adds three dummy variables in the $Dum(s)$ matrix. The *NW* dummy captures the outliers of the entry rates of Alaska, Oregon and Washington in 1989-90. It is statistically significant and positive to mean that the excessive entry rates is under-predicting growth in these three states as it makes the downwards business detrending steeper. The *Katrina* dummy is negative as expected due to the adverse effects of the hurricane on the economic growth of the states where it hit. The *D.C.* dummy is negative and statistically significant at the 95% probability threshold. This result suggests that the special characteristics of D.C. have had an adverse impact on its economic growth over the last decades.[17]

3.1 Robustness

i. The Great Recession (2008-2013)

Do the empirical findings obtained in the baseline estimation change if we exclude the years of the financial crises and the Great Recession? To address this natural question we check the sensitivity of the results when excluding the years from 2008 through 2013. Table 5 shows the estimated coefficients using the cross-sectional variables for the 1987-2007 period. All the six dimensions of business dynamics have the same sign as in the baseline results (compare Tables 4 and 5). There are, however, two noteworthy differences related to statistical significance. First, although business churning still has a positive estimated coefficient, it is no longer statistically significant (p-value = 0.631). This reflects the fact that the short-run cyclical effects captured by the joint entry-exit process are particularly relevant for the Great Recession period (2008-2013). Second, small business size now has a negative and statistically significant effect at 95% confidence (p-value 0.042). This empirical finding suggests that the Great Recession may have been particularly harmful in states with large-size businesses because the effect of small-size establishments was not significant in the full-sample estimation (1987-2013).

ii. Job-Creation and Destruction

As another robustness exercise, job creation and job destruction are used as an alternative way of measuring business formation. Following the data description of the U.S. Census Bureau, the job creation rate by births, $JC(s)$, is the annual average of the count of jobs created by establishment births over the last 12 months divided by the DHS denominator. Similarly, the job destruction rate by deaths, $JD(s)$, is the annual average of the count of

[17] In fact, D.C. shows a good performance on entrepreneurial activity because its business density is high (ranked 1/51 both in terms of people and land), and its detrending of the entry rate is very mild (ranked 3/51). However, D.C.'s economic growth has been close to U.S. average (ranked 22/51 in g_y).

jobs destroyed during establishment deaths over the last 12 months divided by the DHS denominator. These changes bring new business indicators for entry, density, trend, and churning, which are entering the OLS regression with the *Job* prefix. In addition, the business size effect is now evaluated in terms of jobs as we introduce $Job\_Small(s)$ as the fraction of jobs observed in enterprises with less than 20 employees in 2000, in replacement to the corresponding number in terms of establishments, $B\_Small(s)$. Table 6 presents the results.

The overall fit of the model is not as good as in the baseline estimation because the R^2 coefficient falls to 0.709. The effects of both job density (per 1,000 people) and job creation trend are still found to be strong. However, job density per unit of land and job creation-destruction churning lose predictive power relative to the benchmark specification in terms of business establishments. The estimated coefficient on spatial density is virtually zero, whereas the churning estimate is positive but with a much higher standard error that reduces the statistical significance. Such differences might be explained by the discrepancies observed with multi-establishment firms. By contrast, the results are very similar to the baseline estimation with respect to the conventional explanatory factors for growth: the β-convergence remains markedly influential and the rate of population growth plays no role on US regional growth.

iii. Housing Wealth and Entrepreneurship

We have also looked deeper into the lack of relation between establishment entry rates and regional growth. In short samples, housing wealth may support entrepreneurship, and housing wealth depends (in part) on the elasticity of land supply. This recommends the use of Saiz (2010) housing elasticities as Instrumental Variables (IV). Hence, we have ran an IV regression where the establishment entry and exit rates were instrumented by the Saiz elasticities. We did not get meaningful results at all. Next, we then checked the Shea (1997) partial R^2 measure which is a diagnostics for the 'instrument weakness problem' and it turned out that this statistic is close to zero. This means that the Saiz elasticities are weak instruments for the particular context that we investigate.

iv. Causality

The cross-sectional analysis we conducted in this paper is useful in examining how business formation affects growth. It, however, does not provide much information on causality. To examine evidence on the causal role of business entry in the U.S. regional growth process, we examined Granger-causality tests between state-level annual entry rates, $B\_Entry_t(s)$, and their corresponding annual rates of growth of real GDP per capita, $g_{y_t}(s)$.[18] To summarize the findings, we do not reject the hypothesis that business entry does not cause real income growth in 49 of the 51 cases. The only two states for which the hypothesis is rejected are Nevada and Wyoming. Examining the reverse causality, we do not reject the hypothesis that economic growth does not cause business entry in 46 of the 51 cases. There is evidence for reverse causality for Florida, Hawaii, South Dakota, and Washington. These Granger-causality results are consistent with the fact that business entry by itself has not contributed to U.S. regional economic growth.

4 Conclusions

How has business dynamism affected U.S. regional growth? We have conducted a cross-sectional analysis of the determinants of long-run regional economic growth in U.S. from 1987 to 2013 to answer this question. The average annual rates of growth of real GDP per capita range between 3.74% (North Dakota) and -0.30% (Alaska), with the median value at 1.47% (Illinois). We have also found significant differences on state-level annual rates of business entry, both across time and states. The highest average entry rates are found in Nevada (16.3% per year) and Florida (14.6% per year) and the lowest average entry rates are observed in Iowa, Pennsylvania and Ohio (below 10% per year in all three cases). We document two stylized facts in the BDS data. First, there is a similar distribution across the states of the U.S. for the average entry rates and the average exit rates. Second, there is a downwards trend in the evolution of both entry and exit over the last 25 years.

We combine six elements that describe entrepreneurial activity to characterize business

[18] To save space, these results are not reported here but are available upon request.

dynamism, and also include traditional factors in an linear model to explain U.S. regional growth. The estimation results show no significant role of the business entry rate. Nevertheless, the slope in the downward time trend observed for these entry rates over time has a statistical influence on regional growth. In particular, states with a milder decline in the business entry rates documented from 1987 to 2013 tend to have greater economic growth (for example, North Dakota or Wyoming). Moreover, other characteristics of entrepreneurial activity have effects on regional growth. A positive comovement between entry and exit rates brings higher rates of economic growth, consistent with the notion of Schumpeterian creative destruction. The business density, either in terms of people or land, also plays a positive role for regional US growth. Finally, the state-level large size of the business units has provided a beneficial effect on regional growth, especially in the pre-Great recession period. We have also re-visited the convergence hypothesis and found strong statistical support for it. By contrast, population growth does not drive any relevant influence on economic growth.

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Figure 1: Regional U.S. annual data for the 50 states and the District of Columbia, 1987-2013

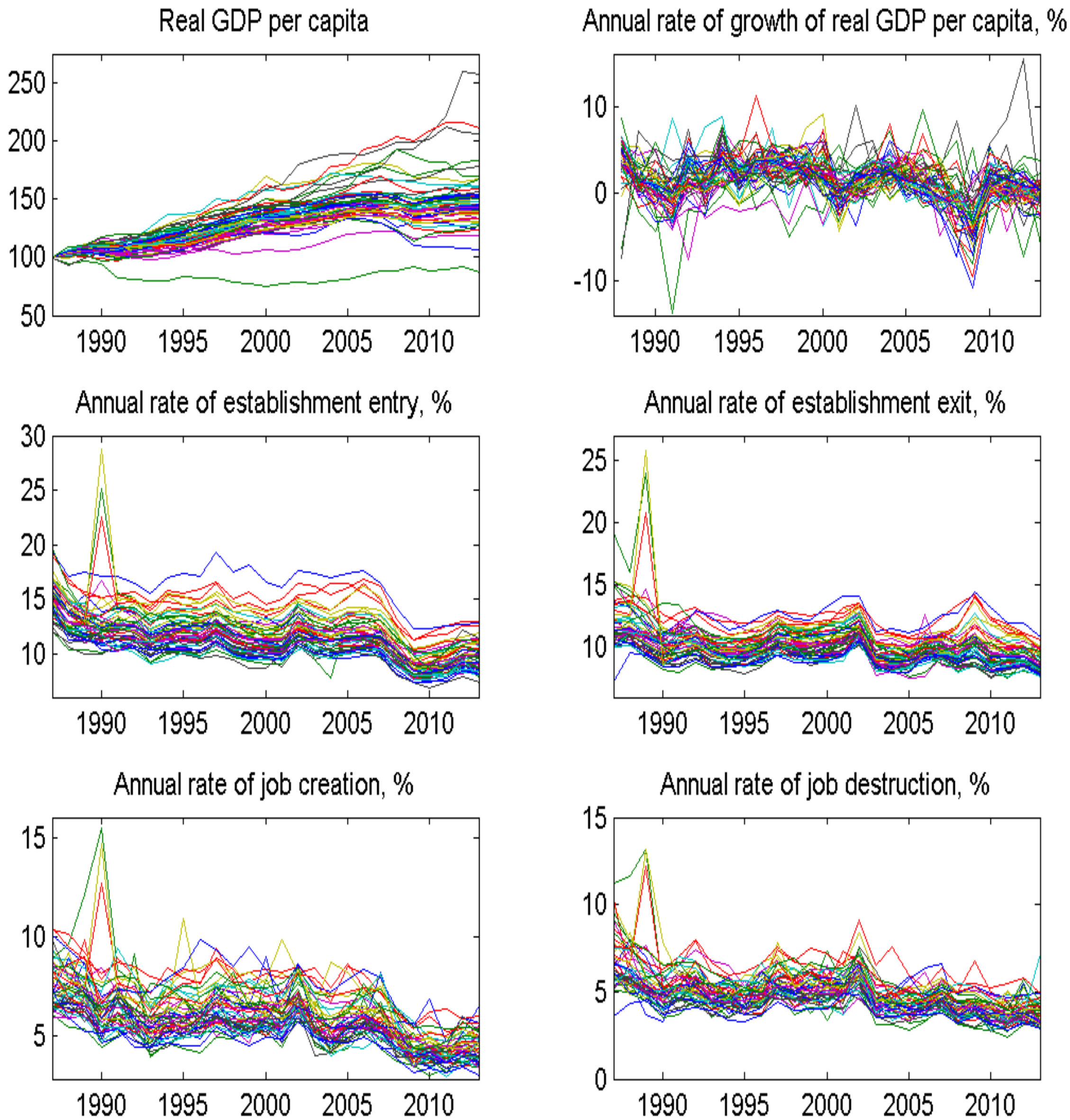
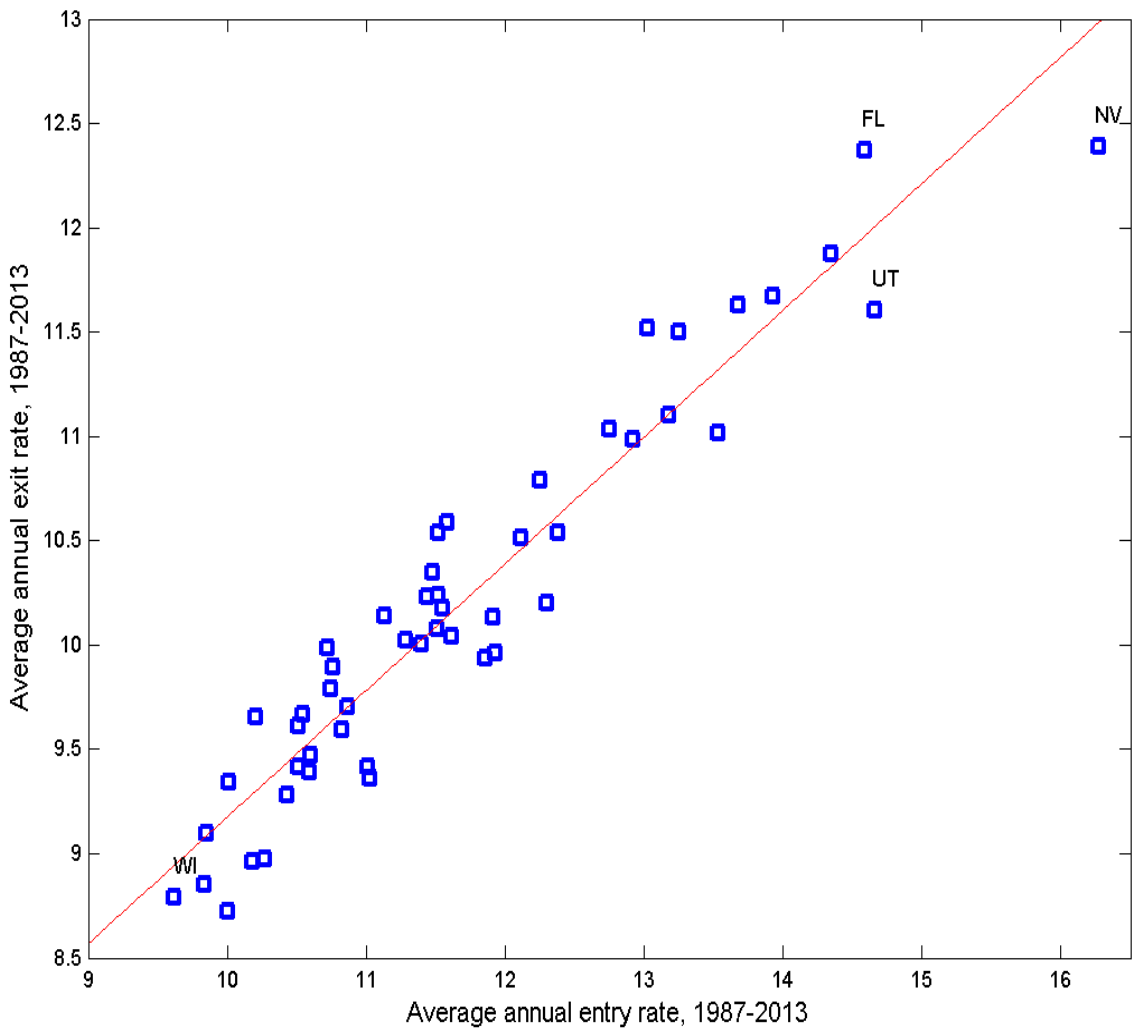
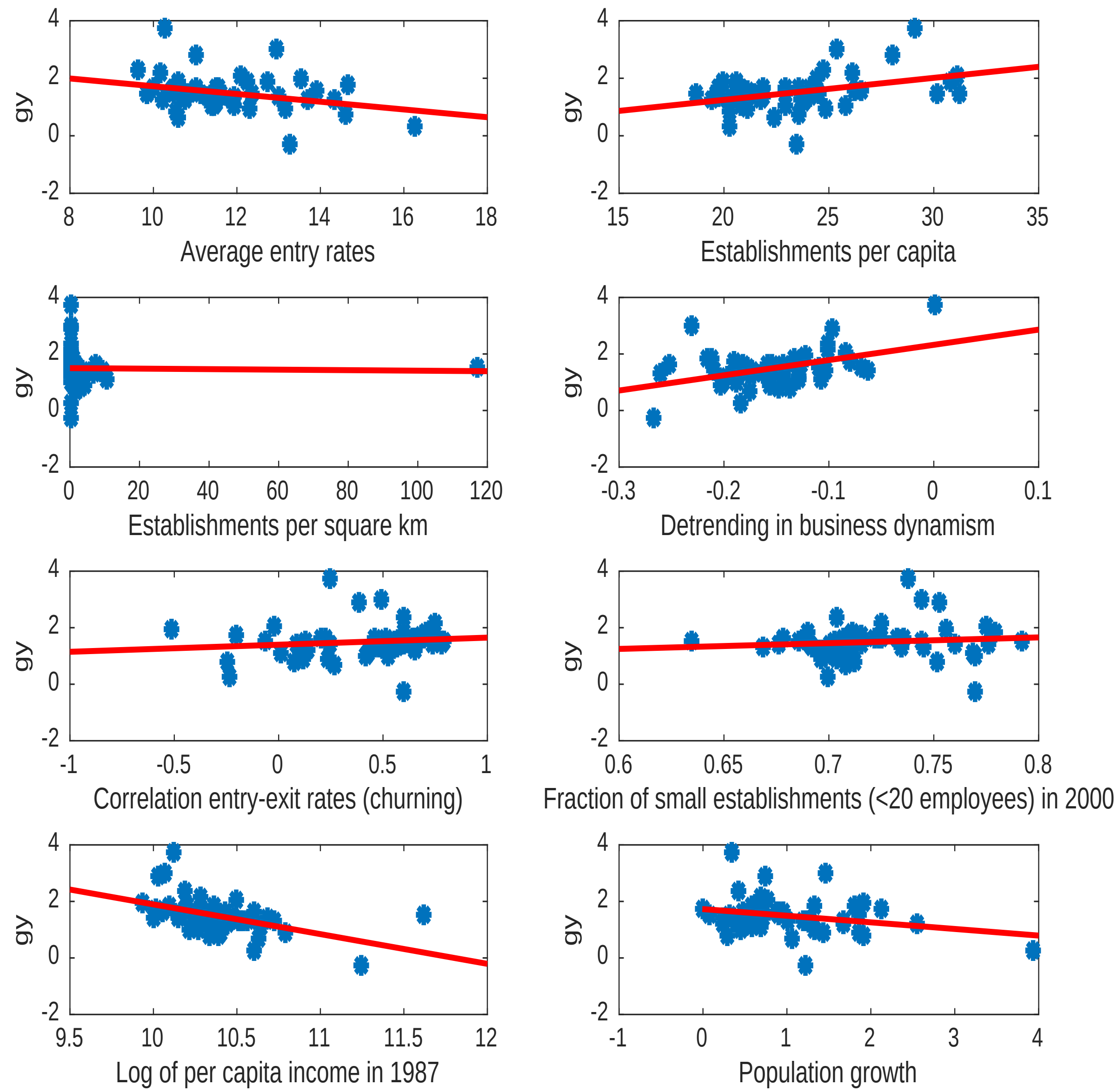


Figure 2: Entry and exit for the 50 states and the District of Columbia, 1987-2013



Notes: FL=Florida, UT=Utah, NV=Nevada, WI = Wisconsin.

Figure 3: Variables in the empirical specifications: cross-sectional averages for the 50 states and the District of Columbia, 1987-2013



Note: gy = growth rate of output.

TABLE 1: Regional US data, 1987-2013. Business stylized facts

State(s)		$g_y(s)$	$B\_Entry(s)$	$B\_Exit(s)$	$B\_Density\_P(s)$	$B\_Density\_L(s)$	$B\_Trend(s)$	$B\_Churning(s)$	$B\_Small(s)$
Alabama	1	1.38(31)	11.28(29)	10.03(27)	19.7(47)*	0.67(30)	-0.21(45)	0.63(14)	.691(45)
Alaska	2	-0.30(51)*	13.25(8)	11.50(8)	23.4(23)	0.01(51)*	-0.27(51)*	0.59(18)	.770(5)
Arizona	3	1.25(38)	14.34(4)**	11.87(3)**	19.4(50)*	0.33(41)	-0.20(42)	0.10(42)	.697(41)
Akansas	4	1.68(14)	11.55(22)	10.17(22)	20.8(37)	0.41(39)	-0.18(37)	0.65(11)	.725(21)
California	5	1.33(34)	13.02(10)	11.52(7)	20.8(38)	1.73(14)	-0.15(26)	0.56(20)	.734(18)
Colorado	6	1.56(20)	13.93(5)**	11.67(4)**	26.5(7)	0.42(37)	-0.16(29)	0.13(40)	.744(13)
Connecticut	7	1.31(36)	10.21(45)	9.66(36)	23.9(18)	3.50(5)**	-0.16(31)	0.65(12)	.735(17)
Delaware	8	0.90(46)	12.30(14)	10.20(21)	24.9(12)	3.25(8)	-0.20(44)	0.23(36)	.704(34)
D.C.	9	1.50(22)	10.51(42)	9.41(41)	31.3(1)**	104(1)**	-0.07(3)**	0.55(22)	.634(51)*
Florida	10	0.77(48)*	14.59(3)**	12.37(2)**	23.5(22)	2.70(10)	-0.14(19)	-0.24(50)*	.751(11)
Georgia	11	0.92(45)	13.18(9)	11.10(9)	21.1(35)	1.14(21)	-0.16(28)	0.12(41)	.696(42)
Hawaii	12	0.67(49)*	10.59(39)	9.39(42)	22.4(27)	1.66(15)	-0.17(34)	0.27(33)	.708(30)
Idaho	13	1.95(7)	13.53(7)	11.02(11)	24.4(15)	0.15(44)	-0.12(12)	-0.51(51)*	.755(9)
Illinois	14	1.47(25)	10.86(33)	9.71(34)	21.7(31)	1.85(13)	-0.10(9)	0.09(43)	.715(24)
Indiana	15	1.58(19)	10.43(43)	9.28(45)	21.2(33)	1.38(19)	-0.16(30)	0.46(27)	.678(48)*
Iowa	16	2.34(4)**	9.61(51)*	8.79(50)*	24.7(13)	0.50(34)	-0.10(8)	0.59(17)	.704(35)
Kansas	17	1.43(28)	10.74(36)	9.79(33)	24.5(14)	3.10(9)	-0.14(20)	0.73(6)	.708(31)
Kentucky	18	1.50(23)	10.82(34)	9.59(38)	19.6(49)*	0.77(28)	-0.18(36)	0.78(3)**	.685(47)*
Louisiana	19	1.22(40)	10.76(35)	9.90(32)	20.2(45)	0.79(26)	-0.13(14)	0.66(10)	.696(43)
Maine	20	1.04(44)	11.40(28)	10.00(28)	25.8(10)	0.41(38)	-0.20(43)	0.52(23)	.769(6)
Maryland	21	1.37(32)	11.61(20)	10.04(26)	21.2(34)	4.44(6)	-0.18(35)	0.48(26)	.711(28)
Massachusetts	22	1.68(13)	10.51(41)	9.61(37)	23.6(21)	7.32(4)**	-0.13(13)	0.52(24)	.732(19)
Michigan	23	0.83(47)*	10.54(40)	9.67(35)	20.3(43)	1.32(20)	-0.15(24)	0.07(44)	.713(26)
Minnesota	24	1.63(17)	11.02(31)	9.36(43)	24.1(16)	0.57(33)	-0.13(17)	0.23(37)	.722(23)
Mississippi	25	1.44(26)	11.13(30)	10.14(23)	18.7(51)*	0.43(35)	-0.17(33)	0.78(2)**	.701(38)
Missouri	26	1.09(42)	11.44(27)	10.23(20)	23.0(24)	0.72(29)	-0.13(16)	0.43(30)	.707(33)
Montana	27	1.50(24)	12.38(13)	10.54(16)	30.1(4)**	0.07(49)*	-0.11(11)	-0.06(47)*	.792(1)
Nebraska	28	2.19(5)**	10.18(46)	8.96(48)*	26.1(9)	0.22(42)	-0.10(7)	0.75(4)**	.725(20)
Nevada	29	0.29(50)*	16.27(1)**	12.39(1)**	20.3(44)	0.14(45)	-0.18(38)	-0.23(49)*	.699(39)
New Hampshire	30	1.60(18)	11.52(24)	10.24(19)	26.3(8)	1.38(18)	-0.25(49)*	0.64(13)	.736(16)
New Jersey	31	1.11(41)	11.52(23)	10.54(15)	23.8(19)	10.4(2)**	-0.11(10)	0.01(45)	.769(7)
New Mexico	32	1.89(8)	12.25(15)	10.79(13)	20.5(41)	0.12(46)	-0.21(46)	0.59(16)	.712(27)
New York	33	1.43(27)	11.59(21)	10.59(14)	22.9(26)	3.53(7)	-0.06(2)**	0.59(19)	.776(3)
North Carolina	34	1.23(39)	11.86(19)	9.94(31)	21.8(30)	1.39(17)	-0.14(21)	0.14(39)	.704(36)
North Dakota	35	3.74(1)**	10.27(44)	8.98(47)*	29.1(5)**	0.11(48)*	0.00(1)**	0.24(35)	.738(15)
Ohio	36	1.42(29)	9.85(49)*	9.10(46)	20.9(36)	2.22(12)	-0.15(25)	0.59(15)	.676(49)*

Notes: Continued on next page. ** denotes Top-5 states, * denotes Bottom-5 states

Table 1 – continued from previous page

State(s)		$g_y(s)$	$B\_Entry(s)$	$B\_Exit(s)$	$B\_Density\_P(s)$	$B\_Density\_L(s)$	$B\_Trend(s)$	$B\_Churning(s)$	$B\_Small(s)$
Oklahoma	37	1.66(16)	11.48(26)	10.35(18)	21.9(28)	0.43(36)	-0.14(22)	0.70(8)	.724(22)
Oregon	38	3.01(2)**	12.92(11)	10.99(12)	25.4(11)	0.35(40)	-0.23(48)*	0.49(25)	.744(14)
Pennsylvania	39	1.51(21)	9.84(50)*	8.85(49)*	21.4(32)	2.27(11)	-0.13(15)	0.79(1)**	.703(37)
Rhode Island	40	1.40(30)	10.72(37)	9.99(29)	24.1(17)	9.22(3)**	-0.15(23)	0.25(34)	.760(8)
South Carolina	41	1.05(43)	11.91(18)	10.13(24)	20.8(39)	1.08(22)	-0.19(40)	0.42(31)	.699(40)
South Dakota	42	2.86(3)**	11.01(32)	9.42(40)	28.1(6)	0.11(47)*	-0.10(6)	0.38(32)	.752(10)
Tennessee	43	1.35(33)	11.51(25)	10.08(25)	20.3(42)	1.07(23)	-0.19(39)	0.55(21)	.669(50)*
Texas	44	1.85(10)	12.75(12)	11.03(10)	20.0(46)	0.62(31)	-0.13(18)	0.71(7)	.690(46)
Utah	45	1.76(11)	14.66(2)**	11.61(6)	20.6(40)	0.22(43)	-0.08(4)**	-0.20(48)*	.715(25)
Vermont	46	1.86(9)	10.60(38)	9.47(39)	30.8(3)**	0.77(27)	-0.22(47)*	0.74(5)**	.779(2)
Virginia	47	1.33(35)	11.93(17)	9.96(30)	21.8(29)	1.52(16)	-0.17(32)	0.46(28)	.692(44)
Washington	48	1.28(37)	13.67(6)	11.63(5)**	23.7(20)	0.80(25)	-0.26(50)*	0.45(29)	.745(12)
West Virginia	49	1.69(12)	10.01(47)*	9.34(44)	19.7(48)*	0.58(32)	-0.19(41)	0.68(9)	.710(29)
Wisconsin	50	1.66(15)	10.00(48)*	8.73(51)*	23.0(25)	0.87(24)	-0.15(27)	0.21(38)	.707(32)
Wyoming	51	2.06(6)	12.11(16)	10.51(17)	31.1(2)**	0.06(50)*	-0.08(5)**	-0.02(46)*	.776(4)

Notes: ** denotes Top-5 states, * denotes Bottom-5 states

TABLE 2: Regional US data, Traditional factors, 1987-2013

State(s)	#	$g_y(s)$	$\log(y_{1987}(s))$	$g_P(s)$
Alabama	1	1.38(31)	10.15(43)	0.72(27)
Alaska	2	**-0.32(51)***	**11.25(2)****	1.21(17)
Arizona	3	1.26(38)	10.24(35)	**2.56(2)****
Akansas	4	1.75(12)	**10.06(47)***	0.90(22)
California	5	1.34(34)	10.53(12)	1.26(16)
Colorado	6	1.57(20)	10.42(18)	1.87(6)
Connecticut	7	1.33(35)	**10.72(4)****	0.40(42)
Delaware	8	0.86(46)	**10.79(3)****	1.45(12)
D.C.	9	1.50(24)	**11.62(1)****	**0.07(50)***
Florida	10	**0.78(48)***	10.34(28)	**1.91(5)****
Georgia	11	0.94(45)	10.41(19)	1.85(7)
Hawaii	12	**0.69(49)***	10.63(7)	1.07(19)
Idaho	13	1.97(7)	**9.94(51)***	**1.91(4)****
Illinois	14	1.48(26)	10.48(15)	0.48(38)
Indiana	15	1.60(19)	10.26(34)	0.71(29)
Iowa	16	**2.34(4)****	10.18(40)	0.43(41)
Kansas	17	1.45(28)	10.35(27)	0.65(34)
Kentucky	18	1.53(22)	10.16(41)	0.69(32)
Louisiana	19	1.25(39)	10.44(16)	**0.24(48)***
Maine	20	1.08(43)	10.27(33)	0.44(40)
Maryland	21	1.37(32)	10.54(11)	1.02(20)
Massachusetts	22	1.68(14)	10.60(9)	0.47(39)
Michigan	23	**0.84(47)***	10.39(21)	0.29(46)
Minnesota	24	1.64(17)	10.43(17)	0.95(21)
Mississippi	25	1.51(23)	**10.00(50)***	0.56(37)
Missouri	26	1.10(42)	10.36(23)	0.69(31)
Montana	27	1.54(21)	10.15(42)	0.89(23)
Nebraska	28	2.20(5)**	10.28(32)	0.68(33)
Nevada	29	0.27(50)*	10.60(8)	3.94(1)**
New Hampshire	30	1.61(18)	10.37(22)	0.88(24)

Notes: Continued on next page. ** denotes Top-5 states, * denotes Bottom-5 states

Table 2 – continued from previous page

State(s)	#	$g_y(s)$	$\log(y_{1987}(s))$	$g_P(s)$
New Jersey	31	1.12(41)	10.65(6)	0.58(36)
New Mexico	32	1.91(8)	10.09(45)	1.33(14)
New York	33	1.46(27)	**10.68(5)****	0.38(43)
North Carolina	34	1.25(40)	10.36(25)	1.67(10)
North Dakota	35	3.71(1)**	10.12(44)	0.35(31)
Ohio	36	1.40(30)	10.34(29)	0.28(47)*
Oklahoma	37	1.66(16)	10.19(39)	0.70(30)
Oregon	38	3.00(2)**	10.07(46)	1.45(11)
Pennsylvania	39	1.50(25)	10.35(26)	0.30(45)
Rhode Island	40	1.40(29)	10.39(20)	0.24(49)*
South Carolina	41	1.06(44)	10.21(36)	1.33(13)
South Dakota	42	2.85(3)**	**10.03(48)***	0.75(26)
Tennessee	43	1.36(33)	10.28(31)	1.19(18)
Texas	44	1.86(10)	10.36(24)	1.81(8)
Utah	45	1.77(11)	10.19(38)	2.13(3)**
Vermont	46	1.86(9)	10.20(37)	0.57(36)
Virginia	47	1.33(36)	10.52(13)	1.29(15)
Washington	48	1.28(37)	10.56(10)	1.67(9)
West Virginia	49	1.70(13)	**10.01(49)***	-0.01(51)*
Wisconsin	50	1.66(15)	10.30(30)	0.71(28)
Wyoming	51	2.07(6)	10.50(14)	0.78(25)

Notes: ** denotes Top-5, * denotes Bottom-5.

TABLE 3: Cross sectional correlations in US regional data, 1987-2013.

	g_y	*B_Entry*	*B_Exit*	*B_Density_P*	*B_Density_L*	*B_Trend*	*B_Churning*	*B_Small*
g_y	1.0	-0.31	-0.37	0.39	-0.03	0.45	0.13	0.11
B_Entry		1.0	0.96	-0.13	-0.14	-0.24	-0.57	0.18
B_Exit			1.0	-0.16	-0.13	-0.28	-0.45	0.26
B_Density_P				1.0	0.35	0.31	-0.14	0.50
B_Density_L					1.0	0.24	0.07	-0.36
B_Trend						1.0	-0.27	0.03
B_Churning							1.0	-0.26
B_Small								1.0

TABLE 4: Baseline specification (1)

Regressor	Estimated coefficient	S.E.	t-stat	p-value
Constant	23.416***	2.227	10.512	0.000
B_Entry	−0.024	0.101	−0.238	0.811
B_Density_P	0.112***	0.026	4.260	0.000
B_Density_L	0.063***	0.018	3.354	0.000
B_Trend	7.090***	1.287	5.508	0.000
B_Churning	0.727***	0.174	4.159	0.000
B_Small	−5.874**	3.008	−1.952	0.050
g_P	0.190	0.197	0.967	0.333
$\log y_{1987}$	−1.884***	0.180	−10.431	0.000
Dummy 1, NW	1.095***	0.247	4.419	0.000
Dummy 2, KAT	−0.210	0.131	−1.600	0.109
Dummy 3, DC	−6.885***	2.240	−3.073	0.002

Notes: Dependent variable is g_y. $R^2 = 0.84$, N=51, Heterosckedasticity robust standard errors (S.E.). ***, **, * indicates statistical significance at the 1, 5, and 10 percent levels, respectively.

TABLE 5: Robustness I, Pre-Great Recession period (1987-2007)

Regressor	Estimated coefficient	S.E.	t- stat	p-value
Constant	25.201***	4.414	5.708	0.000
B_Entry	0.000	0.098	0.005	0.995
B_Density_P	0.115***	0.034	3.339	0.000
B_Density_L	0.079**	0.036	2.165	0.030
B_Trend	3.602***	0.901	3.994	0.000
B_Churning	0.120	0.250	0.479	0.631
B_Small	−7.606**	3.746	−2.030	0.042
g_P	0.017	0.175	0.099	0.921
$\log y_{1987}$	−1.956***	0.352	−5.546	0.000
Dummy 1, NW	0.729**	0.345	2.112	0.034
Dummy 2, KAT	−0.227	0.154	−1.474	0.140
Dummy 3, DC	−8.004**	4.045	−1.978	0.047

Notes: Dependent variable is g_y. $R^2 = 0.72$, N=51, Heterosckedasticity robust standard errors (S.E.). ***, **, * indicates statistical significance at the 1, 5, and 10 percent levels, respectively.

TABLE 6: Robustness II, Job formation data

Regressor	Estimated coefficient	S.E.	t- stat	p-value
Constant	17.839***	2.300	7.755	0.000
Job_Entry	0.142	0.201	0.705	0.480
Job_Density_P	0.126***	0.036	3.422	0.000
Job_Density_L	−0.003	0.024	−0.124	0.901
Job_Trend	7.048**	3.158	2.231	0.025
Job_Churning	0.885	0.592	1.496	0.134
Job_Small	−4.889	3.722	−1.313	0.189
g_P	−0.147	0.192	−0.769	0.441
$\log y_{1987}$	−1.838	0.227	−8.079	0.000
Dummy 1, NW	0.988	0.376	2.626	0.008
Dummy 2, KAT	−0.050	0.155	−0.322	0.746
Dummy 3, DC	1.274	2.706	0.470	0.637

Notes: Dependent variable is g_y. $R^2 = 0.71$, N=51, Heterosckedasticity robust standard errors (S.E.). ***, **, * indicates statistical significance at the 1, 5, and 10 percent levels, respectively. *Job_Small* is the fraction of jobs in enterprises with less than 20 employees in 2000.