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Maribel N. Mojica

Tesfa Gebremedhin
tgebreme@wvu.edu

Peter V. Schaeffer
West Virginia University, peter.schaeffer@mail.wvu.edu

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Maribel N. Mojica[1]

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Peter V. Schaeffer[1]

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Abstract

This study provides evidence of the contribution of entrepreneurship to economic development in Appalachia. Using data on Appalachian counties, a system of simultaneous equations is empirically estimated to measure the effects of entrepreneurship on economic growth and development. We present an expanded Carlino-Mills growth model using changes in population, employment, and per capita income to represent growth. The goal of the investigation is to increase the understanding of entrepreneurship's contributions to economic growth, and its potential as a development strategy for a region, such as Appalachia, that is characterized by poverty and underdevelopment. The results show that start-up businesses contribute significantly to determining population growth. Employment growth is positively affected by self-employment rates as well as by firm formation rates.

1 Division of Resource Management, West Virginia University, P.O. Box 6108
Morgantown, WV 26506-6108
304-293-4832
maribel.mojica@mail.wvu.edu

Introduction

Increasing uncertainty in the world economy has created challenges for regions to pursue development strategies to achieve economic growth. Globalization, increased marketing integration, and new technologies have shifted led to attention from industrial recruiting to less traditional approaches, particularly entrepreneurship for creating economic growth through establishment of new firms or growth from established firms. New businesses and self employment contribute new jobs at the start of the business operation which results in income generation and later improve market competition as new firm formation increases in the industry (Fritsch and Mueller, 2004; Henderson, 2006). With new business formations and the growth of existing ones, the most obvious contribution of entrepreneurship to increased welfare in the society is the creation of new jobs and additional income due to multiplier effects (Robinson, Dassie, and Christy, 2004). Entrepreneurs create new wealth for themselves and to the communities by taking innovations to the market and commercializing new ideas. Many scholars and professionals believe that entrepreneurship is critical to maintain an economy's health and that business creation in low income areas is essential for economic development (Goetz and Freshwater, 2001; Acs, 2006; Lichtenstein and Lyons, 2001; Smilor, 1997). Minniti (1999) argues that entrepreneurs are catalysts for economic growth as they generate a network for innovations that promotes the creation of new ideas and new market formations.

Understanding economic development and identifying appropriate policies to foster development requires an understanding of entrepreneurship in a particular environment. Exploring the characteristics of entrepreneurship and its contributions to the local economy can help develop a map for designing specific development policies for Appalachia. An understanding of entrepreneurship becomes important to know how entrepreneurship matters in economic growth and development, and furthermore, how entrepreneurial capacity can be

expanded to increase the chance of achieving economic development. As Baumol, Litan and Schramm (2007) argue, supporting entrepreneurship becomes indispensable for the United States to regain a competitive lead in the world economy.

Though considerable attention has been paid to examining the links between entrepreneurship and economic development, the central focus of this study is to determine the importance of entrepreneurship in economic development on a regional perspective, specifically in the Appalachian region. The Appalachian region has been considered by many studies as an area symbolized by underdevelopment and poverty (Pollard, 2003). Forty-two percent of the population is in rural areas compared to the national average of twenty percent. In addition, many parts of the region can be considered remote due to poor infrastructure and topography. Median family income in Appalachia remains substantially below the national average. The poverty rate is higher and labor force participation is lower in the region compared to the United States as a whole. For instance, the poverty rate in the US increased from 13 percent in 1980 to 13.2 percent in 1990. In Appalachia, the poverty rate increased from 14.1 percent in 1980 to 15.4 percent in 1990 (Black and Sanders, 2004). This study will provide evidence whether entrepreneurship contributes to regional economic development. The main objective of this study is to increase the understanding of entrepreneurship, its contributions to economic growth, and its potential as a development strategy for the Appalachian region characterized by poverty and underdevelopment such as the Appalachia.

Related Studies

Although empirical research on the role of entrepreneurship is not well-developed, the literature has paid considerable attention to the link between entrepreneurship and economic growth. The first issue in examining the relationship between entrepreneurship and economic

growth is the definition of the term "entrepreneurship." Since entrepreneurship is a multidimensional concept and there is no general agreement on an economic theory of entrepreneurship, previous studies have defined and used the term in different ways. Beginning with Schumpeter (1934) an "entrepreneur" is an individual with innovative ideas, utilizing new combinations of means of production. Kirzner (1979) emphasized the entrepreneur as an enthusiast in discovering opportunities to make profit. Knight (1921) and Schultz (1980) described an entrepreneur as an individual who is willing to take risks in performing economic functions, while others (Hagen, 1962; McClelland, 1961; Kihlstrom and Laffont, 1979) argued that an entrepreneur is a person with certain unique psychological characteristics. Although these concepts have contributed greatly to the understanding of entrepreneurship, a universally accepted explanation or measure of the concept has not yet been found. Hence, previous studies have used different concepts according to the purpose of the study, the theory applied, and the availability of information needed for empirical research.

Acs et al. (2005) used start-ups of new firms as a measure of entrepreneurship that facilitates spillover of knowledge. This is based on the theory of endogenous growth where knowledge was added as a factor explaining economic growth aside from the traditional factors of production, capital, and labor. Entrepreneurship was used as a mechanism that transforms knowledge into growth. The study employed a fixed effects and simultaneous equations model to empirically examine the impacts of entrepreneurship on economic growth, using country-level data for years 1981-1998. The models used lagged values of gross domestic product (GDP) as a measure of economic growth regressed against variables explaining economic growth such as investments in knowledge, level of entrepreneurship, and a set of other variables. The level of entrepreneurship was represented by using the self-employment rate and was found to have a

positive impact on economic growth in both models. Countries with higher degrees of entrepreneurial activity were found to have higher rates of economic growth.

Audretsch and Keilbach (2005) introduced the concept of entrepreneurship capital, referring to the society's capacity to create entrepreneurial activity specifically to generate new firms. They hypothesized that a region with more entrepreneurship capital shows a better economic performance. This is based on the theory of entrepreneurship serving as a mechanism to transform knowledge spillovers to economic growth. Specifically, the study measured the impact of entrepreneurship on regional labor productivity and on the regional growth of labor productivity in Germany. Entrepreneurship capital was measured using the number of startup enterprises relative to the region's population. In addition, entrepreneurship capital was classified into three types: startups in all industries, high-technology startups, and startups in information communication and technology (ICT) industries. This was done to capture the effects of the two latter measures on economic performance since they involve R&D as well as greater financial risks. The results of the regression revealed that all three measures of entrepreneurship capital significantly affect the region's labor productivity. However, the results for the second model on the effect of entrepreneurship capital on the growth of labor productivity showed statistically significant effects only on the R&D intensive industries.

Acs and Armington (2005) also examined the relationship between entrepreneurship and economic growth, using the Census Business Information Tracking Series (BITS) dataset. These data cover US private sector businesses and track their employment and firm ownership. They were used to estimate a regression model of regional variation in rates of employment growth as determined by entrepreneurship. Economic growth was represented by average annual employment growth while entrepreneurial activity was measured using the formation rate of

firms with less than 500 employees and the business-owner share of the labor force. In addition, measures of agglomeration effects and human capital were included in the model. As hypothesized, the results revealed a positive and statistically significant coefficient on the firm birth rate. Business-owner share of the labor force was also found to make a positive and statistically significant contribution to employment growth. Specifically, the study reported that an increase in the new firm formation rate of one standard deviation from its mean causes the employment growth rate to increase by one-half standard deviation from its mean.

Van Stel and Suddle (2005) used regional data in the Netherlands to examine the relationship between new firm formation and change in regional employment. In addition, they investigated the relationship considering the difference in time period, sector, and degree of urbanization. They found that the maximum effect of new firms on regional development is reached after about six years. Fixed effects estimation was employed using employment growth as dependent variable regressed against startup rate, wage growth, and population density. To control for differences in time periods, the sample was divided into two time periods and the results showed that the impact of new firm formation to employment growth has been stable and exactly the same in both periods. Moreover, the study investigated the relationship between employment growth and startup rates across different sectors. They found that the effect of startup rate is highest in the manufacturing sector. Finally, they also found that the degree of urbanization significantly affects the growth of employment. The effect of startup rate was bigger in the Western side compared to the Northern provinces, where the average degree of urbanization is 51 percent and 12 percent, respectively.

In another study which used employment as the dependent variable (Folster, 2000) used simultaneous equations to determine whether entrepreneurs create jobs. The first equation

captures the individual's choice to pursue self-employment due to a fall in employment or as a result of demand fluctuation in the market and structural changes in business conditions. The second equation represented demand for labor as a function of wage rate, business environment, and the share of self-employed. The data is a pooled time-series cross section data set for 24 Swedish counties for the years 1976 to 1995. Simultaneity issues between self-employment and total employment was addressed by using instrumental variables and estimating the equations using 2-stage least squares. Results show a statistically significant and positive relationship between self-employment and total employment.

Camp (2005) reported that the most entrepreneurial regions in the U.S. had 125 percent higher employment growth, 58 percent higher wage growth, and 109 percent higher productivity. The study supports the view that entrepreneurship is the link between innovation and regional economic growth and development. Regression results revealed a four-year lag between measures of entrepreneurship and economic growth, and the positive and significant coefficients for entrepreneurship activity and the high levels of expected variation in the analyses suggest that entrepreneurship is a driver of regional economic growth. Moreover, Kreft and Sobel (2005) support entrepreneurship as the "missing link" between economic freedom and economic growth. Economic freedom generates growth as it promotes entrepreneurial activity. This relationship was studied using sole proprietorship and patent activity as measures of entrepreneurship and the freedom index. The freedom index is composed of a number of public policies affecting economic freedom. The results further support entrepreneurship as a conduit towards economic growth.

These studies support the theory that entrepreneurship contributes positively to economic growth. However, empirical analyses examining the role of entrepreneurship in fostering

economic growth at a county-level perspective is lacking, particularly for specific regions of the US. By using county-level data in a specific region like Appalachia, this study will examine more closely the relationships between entrepreneurship and economic growth.

Empirical Model

The main objective of this study is to examine the role of entrepreneurship in economic development represented by changes in employment, income, and population. In addition to entrepreneurship, the empirical tests include several socio-economic variables affecting economic growth. Based on previous studies, this study adopts the use of regional economic growth models in examining the relationship between entrepreneurship and economic growth. The simultaneous equation model in this study is based on the two-equation model of Carlino and Mills (1987). Their model employs population and employment dynamics in determining how regional factors affect patterns of growth. The emphasis is that households and firms aim to maximize utility by consuming goods and services, residential location relative to the place of work, and non-market amenities. The Carlino-Mills model recognizes that population growth interacts with employment growth. That is, without constraints on capital mobility and other barriers among regions, equilibrium of population and employment growth is reached when factors of production in all regions get the same economic return. The model has been widely used in estimating how different regional factors affect long-run economic growth.

Deller et al. (2001) expanded the model into a three-equation framework by incorporating the role of income in regional economic growth. This is based on the assumption that households and firms also consider labor quality to maximize utility. In sum, the model represents that firms choose an optimal location based on location cost and revenue advantages, agglomeration benefits, and labor quality.

Following Deller et al. (2001), Nzaku and Bukenya (2005) and Deller (2007), this study employs the model representing the relationship among population (P), employment (E), and income (I). The general form of the three-equation model is:

$$P^* = f\left(E^*, I^* / \Omega^P\right) \quad (1)$$

$$E^* = g\left(P^*, I^* / \Omega^E\right) \quad (2)$$

$$I^* = h\left(P^*, E^* / \Omega^I\right) \quad (3)$$

where P^{**}, E^*, and I^* represent the equilibrium levels of population, employment, and per capita income, respectively, and Ω^P, Ω^E, and Ω^I are a set of variables describing initial conditions, measures of entrepreneurship, and other variables that are traditionally linked to economic growth. From the equilibrium framework of the model, a simple linear relationship among the variables can be presented as:

$$P^* = \alpha_{0P} + \beta_{1P}E^* + \beta_{2P}I^* + \sum \delta_{IP}\Omega^P \quad (4)$$

$$E^* = \alpha_{0E} + \beta_{1E}P^* + \beta_{2E}I^* + \sum \delta_{IE}\Omega^E \quad (5)$$

$$I^* = \alpha_{0I} + \beta_{1I}P^* + \beta_{2I}E^* + \sum \delta_{II}\Omega^I \quad (6)$$

Furthermore, population, employment, and income are likely to adjust to their equilibrium levels with initial conditions (Mills and Price, 1984). These distributed lag adjustments are incorporated to the model expressed as:

$$P_t = P_{t-1} + \lambda_P(P^* - P_{t-1}) \quad (7)$$

$$E_t = E_{t-1} + \lambda_E(E^* - E_{t-1}) \quad (8)$$

$$I_t = I_{t-1} + \lambda_I(I^* - I_{t-1}) \quad (9)$$

where P_{t-1}, E_{t-1}, and I_{t-1} are initial conditions of population, employment and per capita income, respectively; λ_P, λ_E, and λ_I are speed of adjustment coefficients to the desired level of population,

employment, and income, which are generally positive, with larger values indicating faster growth rates. Current employment, population and income levels are functions of their initial conditions and the change between the equilibrium values and initial conditions at their respective values of speed of adjustment (λ). Substituting equations7, 8, and 9 into equations 4, 5 and 6 while slightly rearranging the terms gives the model to be estimated and expressed as:

$$\Delta P = \alpha_{0P} + \beta_{1P}P_{t-1} + \beta_{2P}E_{t-1} + \beta_{3P}I_{t-1} + \gamma_{1P}\Delta E + \gamma_{2P}\Delta I + \sum \delta_{IP}\Omega^{P} \quad (10)$$

$$\Delta E = \alpha_{0E} + \beta_{1E}P_{t-1} + \beta_{2E}E_{t-1} + \beta_{3E}I_{t-1} + \gamma_{1E}\Delta P + \gamma_{2E}\Delta I + \sum \delta_{IE}\Omega^{E} \quad (11)$$

$$\Delta I = \alpha_{0P} + \beta_{1I}P_{t-1} + \beta_{2I}E_{t-1} + \beta_{3I}I_{t-1} + \gamma_{1I}\Delta E + \gamma_{2I}\Delta P + \sum \delta_{II}\Omega^{I} \quad (12)$$

where ΔP, ΔE, and ΔI are the region's changes in population, employment and per capita income, respectively. The speed of adjustment becomes embedded in the coefficient parameters α, β, and δ. Following Deller (2007), this model captures structural relationships while simultaneously isolating the influence of the level of entrepreneurship on regional economic growth. The equations estimate short-term adjustments of population, employment and income (Δ*P*, Δ*E*, and Δ*I*) to their long-term equilibrium (P^{*}, E^{*}, *and* I^{*}).

For the purpose of this study, measures of entrepreneurship are incorporated in the model, in addition to the variables that are traditionally linked to economic growth. These variables include measures of human capital, infrastructure, agglomeration, and a vector of additional socio-economic variables. The model estimation also investigates whether the degree of urbanization impacts economic growth. This is done by using a dummy variable to identify metro and non-metro counties.

The estimation methods drawn heavily from Greene (1996) and Wooldridge (2002). Ordinary least squares (OLS) give biased and inconsistent estimates of the structural model if independent variables include endogenous variables. The simultaneity bias comes from the

correlation between the right-hand side endogenous variable with the error terms. The models presented above imply simultaneity or reverse causation between dependent variables. Therefore, the estimation is done using two-stage least squares (2SLS) regression.

Data Specifications

Data on 410 counties of the Appalachian region drawn from several sources are used in the empirical analysis. Endogenous variables include county level growth in population, employment and per capita income for years 1995 to 2005 as indicators of economic growth. These data as well as their initial values are drawn from the publications of the Regional Economic Information System-Bureau of Economic Analysis (REIS-BEA) for various years. Entrepreneurship variables are derived from published data on non-farm proprietors from the REIS-BEA and firm births and deaths from the US Census Bureau. Data on education, agglomeration, natural amenities, infrastructure, families below the poverty level, government expenditure per capita, crime, and taxes are from the publications of BEA_REIS, the US Census Bureau, the Economic Research Services (ERS-USDA), County and City Data, and the Natural Resource Analysis Center at West Virginia University (NRAC-WVU). A descriptive summary of the variables is presented in Table 1.

Exogenous variables include entrepreneurship measures as well as socio-economic variables such as changing demographics of the workforce and other economic variables affecting economic growth. Controlling for these factors in addition to entrepreneurship measures increases the understanding of economic development in the Appalachian region.

Table 1. Descriptive statistics of variables.

Variable	Definition	Minimum	Maximum	Mean	Standard Deviation
Endogenous Variables					
CHPOP	Change in population, 1995-2005	-88141	252636	3589.30	16359.21
CHEMP	Change in employment, 1995-2005	-5119	118600	3398.39	8692.32
CHPERCAP	Change in per capita income, 1995-2005	2880	14738	7765.54	1720.59
Initial Conditions					
LPOP	Population in 1995	2566	1322460	53692.63	91220.84
LEMP	Employment in 1995	1203	825870	27139.84	56668.27
LPCI	Per capita income in 1995	10180	28369	16790.71	2832.76
Entrepreneurship Variables					
PROP	Number of proprietors per county in 1995	262.00	96914.00	4001.57	6962.20
$PROP_{LF}$	Number of proprietors in a county per 1000 people in the labor force in 1995	76.51	496.06	173.99	53.47
$CHPROP_{LF}$	Change in the number of proprietors in a county per 1000 people in the labor force between 1995 and 2005	-164.52	266.81	41.28	55.08
CHPROP	Change in the number of proprietors in a county between 1995 and 2005	-2645.00	31539.00	1469.00	2883.39
$BIRTH_{LF}$	Firm births per 1000 people in the labor force in 1998	0.38	2816.00	11.50	139.04
$CHBIRTH_{LF}$	Change in the number of firm births in a county per 1000 people in the labor force between 1998 and 2005	-20.94	204.00	0.08	10.40
BIRTH	Number of firm births per county in 1998	-19.00	2946.00	116.40	239.22
CHBIRTH	Change in the number of firm births between 1998 and 2005	-357.00	438.00	2.17	46.16
CHEXPAND	Change in the number of firm expansion per county between 1998 and 2005	-355.00	7884.00	18.78	392.49
CHDEATH	Change in the number of firm deaths per county between 1998 and 2005	-147.00	2802.00	6.45	140.98
$DEATH_{LF}$	Number of firm deaths per county per 1000 labor force in 1998	0.16	46.71	4.08	3.09
Other variables					
$EDUC_{HI}$	Share of population with high school education	35.50	87.20	61.19	10.16
METRO	Dummy variable for metro-and non-metro counties	0.00	1.00	0.26	0.44
POPDEN	Population density	7.18	1811.17	108.06	139.97
POVERTY	Percent of families below poverty	2.90	46.80	15.41	7.41
ROADDEN	Miles of road per square mile	0.08	0.74	0.33	0.12
STROADDEN	Miles of state road per square mile	0.00	0.61	0.22	0.11
NATAMER	Natural amenities ranking	-3.72	3.55	0.13	1.16
GOVEX	Government expenditure per capita	1168.00	33391.00	3791.97	2340.03
PCTAX	Per capita income taxes	43.00	1317.00	286.01	160.46
PROPTAX	Property tax per capita	22.20	99.10	72.54	17.17
CRIME	Crimes reported per 100,000 of population	0.00	8487.00	2262.91	1556.56
POP3564	Share of population 35 to 64 years old	27.78	47.08	39.60	2.29

The specified model of growth is used to analyze the impact of entrepreneurship to regional economic growth using changes in population, employment and per capita income growth as endogenous variables. Following the existing literature on entrepreneurship and economic growth (Acs and Armington, 2005; Camp, 2005; van Stel and Suddle, 2005; and Henderson, 2006), the model employs growth measures as endogenous variables. The model is specified as an equation with dependent variables as functions of entrepreneurship, human capital, infrastructure, agglomeration, and a set of socio-economic variables.

The choice of variables to represent entrepreneurship is based on theoretical considerations and on previous studies on entrepreneurship and economic growth. The entrepreneurship variables derived from data on self employment include number of proprietors in a county (PROP), number of proprietors in a county per 1000 people in the labor force ($PROP_{LF}$), number of proprietors in a county per 1000 people in the labor force between 1995 and 2005 ($CHPROP_{LF}$) and the growth in the number of proprietors per county (CHPROP). Measures of entrepreneurship derived from firm births per county (BIRTH), firm births per 1000 people in the labor force per county ($BIRTH_{LF}$), change in the number of firm births in a county per 1000 people in the labor force ($CHBIRTH_{LF}$), change in the number of firm expansion per county (CHEXPAND), change in the number of firm deaths per county (CHDEATH) and number of firm deaths per county per 1000 labor force ($DEATH_{LF}$). A positive relationship between the measures of entrepreneurial activity and economic growth is hypothesized based on theory and the results of previous studies. On the other hand, a negative relationship between measures of firm deaths and growth measures is hypothesized.

In addition to entrepreneurship, other explanatory variables are included in the employment growth model to better understand the factors affecting economic growth in the

Appalachian region. Human capital which reflects the quality of the labor force is measured using share of the population with high-school education ($EDUC_{HI}$). A higher share of the population with high school education indicates a higher quality of the labor force in the county. Furthermore, a higher quality of the labor force is expected to be more efficient and therefore reduces the average cost of the business leading to a higher employment and income growth. Hence, a positive relationship between the human capital variable and the measures of economic growth is hypothesized.

Infrastructure variables include the county's miles of road per square mile (ROADDEN) and miles of state road per square mile (STROADDEN). The quality of infrastructure affects the firm's average cost and is expected to affect employment and income growth. A positive relationship between the growth measures and the quality levels of a county's infrastructure is expected as infrastructure defines the ease of distribution of goods and services between the firms and the market.

Agglomeration of firms is found to positively affect growth by reduced costs of information transfer and knowledge spillovers arising from diversity (Henderson, 2006). To measure agglomeration, the empirical models include population density (POP_{DEN}) and a dummy variable to identify metropolitan counties (METRO). Agglomeration factors are expected to have a positive effect to both employment and income growth when agglomerations increase network externalities (Ciccone and Hall, 1996). Other socio-economic variables such as per capita income taxes (PCTAX), property taxes (PROPTAX), government expenditure per capita (GOVEX), and percent of families below poverty (POVERTY) will also be included in the empirical analyses. Taxes are expected to have a negative relationship with the measures of economic growth as it reduces demand for consuming goods and services as well as reducing firm profits. Government

expenditure is hypothesized to have a positive relationship with employment and income growth as it reflects investments for the welfare of the public. On the other hand, a negative relationship between percent of families below poverty and the measures of economic growth is expected. A higher percentage of families in poverty indicate slower increases in employment and income levels. CRIME is hypothesized to have a negative effect on measures of economic growth while percent of population 35 to 64 years old is expected to have a positive effect.

Results and Discussion

The growth model previously presented is estimated using simultaneous equations regressed using two-stage least squares regression (2SLS). This measures the simultaneous relationship between endogenous variables of population, employment and per capita income growth.

Multicollinearity is addressed by dropping highly correlated variables from the results of Pearson correlation tests to increase efficiency of estimation while maintaining variables for estimating relevant variables. Durbin-Watson coefficients are all close to 2.0 indicating no problem of autocorrelation in model estimates.

The dependent variables are changes in population, employment, and per capita income. These are tested simultaneously against the right-hand side endogenous variables, their lagged values (initial conditions), and a set of other exogenous variables traditionally linked to economic growth. Parameter estimation was done using Statistical Packages for Social Sciences (SPSS) software. The results of two-stage least squares estimation is presented in Table 2.

The population growth equation is regressed against its lagged value, the other two endogenous variables (employment growth and per capita income growth), entrepreneurship measures, and socio-demographic variables. Results show that change in population (ΔP) is

significantly and positively associated with change in employment (ΔE). This supports the "people follow jobs" theory. That is, increases in the number of jobs result to increases in population. The relationship between change in population and per capita income (ΔI) is also statistically significant. However, the coefficient is negative indicating that for Appalachia, counties with increasing population have declining per capita income. This may be attributed to population increases in rural areas where income is not growing at least at the same rate as the population increases. The initial value of population growth (P_{t-1}) exhibited a significant relationship with change in population; however, the sign of the coefficient is negative. Counties with higher initial population showed negative growth in population.

In terms of entrepreneurship, population growth is significantly affected by the number of proprietors (PROP), number of firm births (BIRTH), change in the number of firm births (CHBIRTH), change in the number of firm deaths (CHDEATH), and number of firm deaths per 1000 people in the labor force ($DEATH_{LF}$). Variables representing entrepreneurial capacity are hypothesized to have a positive effect towards population change. This is supported by the positive coefficient in the BIRTH variable indicating that increases in the number of start up businesses increases population growth. The growth in the number of firm start ups (CHBIRTH) also showed a positive effect on change in population. Furthermore, the negative coefficient in CHDEATH variable supports the theory indicating that increases in the number of firm failures result to decreases in population. The negative sign in the $DEATH_{LF}$ variable also signify the negative effect of the increases in the number of firm deaths per 1000 labor force towards population growth. These results support the hypothesis that entrepreneurial opportunities attract people and that entrepreneurial capacity positively contributes to economic growth. However, the sign of the coefficient for PROP is found to be negative.

As a measure of agglomeration, population density (POPDEN) is found to significantly and positively affecting change in population. As hypothesized, an increase in the number of people per square mile leads to increases in population. Percent of families below poverty level (POVFAM) is also found to be statistically significant in determining change in population. The negative sign of the coefficient indicate that counties with more families under poverty have declining population growth. Miles of road per square mile (ROADDEN) is used to represent quality of infrastructure and is found to be positively affecting population growth. This supports the theory that better infrastructure attracts people towards a community. Contrary to expectations, the number of reported crimes per 100,000 (CRIME) indicates a significant but positive coefficient. This result may be attributed to representation of crime data in the analysis.

The results of estimating the change in employment equation showed both endogenous variables used as explanatory variables as positive and statistically significant in determining employment growth. This supports the hypothesis tested in previous studies where population growth (ΔP), employment growth (ΔE), and per capita income growth (ΔI) have positive interactions. While holding other factors constant, the results suggest that an increase in population leads to a 0.45 increase in the number of people employed. The results in Table 2 show that "people follow jobs and jobs follow people". Also, an increase in number of people gives a $ 0.08 increase in per capita income. Appalachian counties with higher income growth showed increases in employment growth. This supports Deller's (2001) extension of the Carlino and Mills (1987) model where per capita income is hypothesized to positively drive employment change. Employment change, however, is negatively related with its lagged value (E_{t-1}). This means that counties with higher levels of employment growth had lower levels of employment initially.

Table 2. Two-Stage least squares (2SLS) estimation results (3-equation model).

	CHPOP Equation		CHEMP Equation		CHPCI Equation	
Variable	**Coefficient**	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**p-value**
Endogenous Variables						
ΔP	-	-	0.4498***	0.0000	-0.3745**	0.0232
ΔE	0.8519***	0.0000	-	-	0.2960	0.1447
ΔI	-0.1507***	0.0029	0.0801**	0.0322	-	-
Initial Conditions						
P_{t-1}	-0.6872***	0.0000	-	-	-	-
E_{t-1}	-	-	-0.7479***	0.0002	-	-
I_{t-1}	-	-	-	-	0.3541***	0.0000
Entrepreneurship Variables						
PROP	-0.6299***	0.0000	0.5299***	0.0000	-	-
PROPLF	0.0069	0.7034	0.0022	0.8767	0.0709	0.1222
CHPROPLF	-	-	-	-	-0.0766	0.1616
CHPROP	-	-	0.2129***	0.0000	0.1792	0.1161
BIRTLF	0.0004	0.9773	0.0175	0.1420	0.0460	0.2618
CHBIRLF	-0.0065	0.7350	-	-	-	-
BIRTH	0.8820***	0.0000	0.7239***	0.0023		
CHBIRTH	0.1095***	0.0000	0.0464**	0.0317	-0.0455	0.3883
CHEXPAND	-	-	0.2787***	0.0009	-	-
CHDEATH	-0.1045***	0.0001	-0.3322***	0.0002	-0.1173*	0.0594
DEATHLF	-0.0278*	0.0849	0.0447***	0.0052	-0.0046	0.9153
Other variables						
$EDUC_{HI}$	-0.0404	0.1522	-	-	0.1715**	0.0329
POPDEN	0.0818*	0.0558	-	-	-	-
METRO	-	-	0.0012	0.9317	-0.0204	0.6918
POVFAM	-0.1189***	0.0000	0.0526***	0.0082	0.0309	0.7075
ROADDEN	0.0375**	0.0475	-0.0219	0.1161	0.0451	0.5635
STROADDEN	-	-	-	-	-0.1208*	0.0985
NATAMER	0.0065	0.6714	-0.0464***	0.0004	-0.0286	0.5257
GOVEX	-0.0182	0.2120	0.0062	0.6076	-0.0479	0.2591
PCTAX	-0.0002	0.9899	0.0263*	0.0930	-0.0741	0.2011
PROPTAX	0.0097	0.5481	-0.0155	0.2486	-0.0056	0.9074
CRIME	0.0352*	0.0583	-0.0343**	0.0308	-0.0211	0.7102
POP35_64	-	-	-	-	0.0884**	0.0535

***, **, * Significant at 1 %, 5 %, and 10%, respectively

Most of the entrepreneurship variables used in the analysis is significant and all have the expected signs. The number of proprietors in 1995 (PROP) increases employment growth. This is also true for the variable measuring change in the number of proprietors between the years 1995 and 2005 (CHPROP). Increases in the number of self-employed have increased employment growth in Appalachian counties. Particularly, the coefficient for PROP means that an increase in the number of self-employed leads to a 0.53 increase in total employment. Furthermore, the coefficient of the number of firm births in 1995 (BIRTH) and the increase in the number of firm start-ups (CHBIRTH) have significant and positive coefficients. The coefficient for BIRTH indicates that an increase in the number of start up businesses leads to a 0.72 increase in the number of employed people. Furthermore, the variable which represents high-growth firms (CHEXPAND) also showed a positive and significant coefficient indicating that increases in firm expansion positively determines employment growth. These results support the hypothesis that entrepreneurial activity contributes positively towards employment growth. The variable $DEATH_{LF}$ is also significant; however, the sign is positive.

The share of families below poverty (POVERTY) is significant and negative which indicates that Appalachian counties with higher percentages of families under poverty had increases in employment. Natural amenities rank (NATAMER) is found to be negative although significant in determining change in employment. Per capita taxes (PCTAX) also had a significant relationship with employment growth; however, the sign is positive, contrary to expectations. The number of reported crimes per 100,000 people (CRIME) is negative and significant as hypothesized. This shows that increases in crime rates discourage employment growth.

As further shown in Table 2, the per capita income (ΔI) equation is regressed against its lagged value (I_{t-1}), population growth (ΔP) and employment growth (ΔE), entrepreneurship measures, and a set of socio-demographic variables. Change in population (ΔP) is significant but the sign is negative. This means that for Appalachia, counties with higher levels of population had declining per capita income. This is the same observation with the change in population equation which could mean that rural counties in Appalachia had per capita income growth rates that did not rise as quickly as population growth rates. Per capita income in 1995 (I_{t-1}) is significant and positive as hypothesized. The coefficient specifically indicates that a dollar increase in per capita income in 1995 results to $ 0.35 growth in per capita income.

In terms of entrepreneurial activity, change in the number of firm deaths (CHDEATH) is found to be significant and has a negative coefficient as expected. This means that a higher level of firm failure leads to declining per capita income. The coefficient indicates that an increase in CHDEATH results to a $ 0.12 reduction in per capita income.

The variable used to represent the quality of human capital ($EDUC_{HI}$) had a positive sign as hypothesized. A higher share of population with high school education indicates a higher quality of the labor force. The coefficient suggests that a one percent increase in the share of population with high school education results to a $ 0.17 increase in per capita income. Miles of state road per square mile (STROADDEN) is significant but negative. The share of population 35 to 64 years old (POP35_64) is also significant and positive as expected. This portion of the population is usually the most productive ones and is theorized to increase per capita income. The result indicates that an increase in the proportion of the productive age of population results to a $ 0.09 increase in per capita income.

Summary and Conclusions

The main objective of this study is to determine the relationship between regional growth and entrepreneurship. Data on 410 counties of Appalachia is employed where measures of entrepreneurial activity are constructed and regressed against measures of economic growth. Appalachia is chosen for the study as the region is characterized by underdevelopment and poverty. The study adopts the use of regional economic growth models in examining the relationship between entrepreneurship and economic growth. The simultaneous equation model is used where the dynamics of population growth, employment growth, and per capita income growth is utilized to determine how regional factors affect patterns of economic growth.

The results of the model estimation generally support the main hypothesis tested in the study, showing evidence on the positive effects of entrepreneurial activity towards economic growth. Estimating the change in population equation shows that counties with increasing employment had increasing population growth. However, per capita income growth and population growth are negatively related. In terms of entrepreneurship, the results show that population growth is positively affected by entrepreneurship variables constructed from firm births data. The number of firm births and the growth in firm births positively determine population growth in Appalachian counties. In addition, firm death is found to negatively affect change in population. While population density and the quality of infrastructure increase county population, percentage of families below poverty level and the initial value of population have negative effects towards population growth.

The empirical results in estimating the change in the employment equation indicate that growth in population is positively related with employment growth. From the results in estimating the population and employment growth equations, this study further supports the

"jobs follow people and people follow jobs" theory. The results also show that employment growth and per capita income growth are positively related. Entrepreneurship variables constructed from self-employment and firm data are found to have positive effects in increasing job creation. Self-employment, the growth in the number of self-employed, start-up businesses, the growth in start-ups, and the growth in firm expansion positively determine employment growth in Appalachia. Firm death is found to negatively affect employment which further supports the theory on the role of entrepreneurship in increasing job creation. Crime rate is also found to reduce job creation. However, estimation results indicate negative relationships between natural amenities ranking and employment growth which is in contrast to hypothesis. Per capita taxes and poverty show positive relationships with employment growth.

Empirical results in estimating the per capita income equation show that population growth negatively affect increases in per capita income. The initial value of per capita income is found to be positive in determining per capita income growth. In terms of entrepreneurship, the 2-SLS estimation indicates a negative relationship between growth in firm deaths and per capita income growth. In addition, the hypothesis on the positive effects of education in increasing income is proved. While the results show positive relationships between the share of population 35 to 64 years old and per capita income growth, negative relationship exists between state road density and change in per capita income.

The empirical evidence shows the need for an entrepreneurial environment that may be created to encourage entrepreneurial activity as a strategy to battle unemployment. One major finding of this study in support to the results of previous studies is that increases in entrepreneurial activity, particularly increases in self-employment and firm births significantly contribute to employment growth. The greatest gains in entrepreneurship can be realized by

reducing government-imposed burdens on entrepreneurs and through programs that encourage entrepreneurial activities i.e., subsidies and tax breaks. Furthermore, supporting existing entrepreneurs and avoiding firm deaths may help in achieving economic growth. Since the findings of this study indicate that firm expansion and deaths were found to significantly affect regional economic growth, supporting existing firms in achieving expansions and avoiding failures may help in attaining economic growth in Appalachian communities. This may be done by creating programs that will help educate entrepreneurs on how to survive in today's market conditions and how to achieve economic growth in their businesses.

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