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An Analysis of the Role of Self-employment in the Economic Development of the rural Northeastern United States

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An Analysis of the Role of Self-employment in the Economic Development of the Rural Northeastern United States

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Abstract

Generating employment and alleviating poverty are the biggest challenges for regional economic growth in rural areas of the Northeastern United States. Despite the revival of the economy in much of the nation's heartland, rural areas are still suffering from high poverty and unemployment rates. Self-employment, a measure of entrepreneurship, indicates an opportunity for rural communities to improve quality of life and accelerate regional economic development. Taking into consideration the problem of unemployment in rural communities, there is a need to focus on generating self-employment opportunities at micro level to enhance economic growth and reduce the per capita income 'gap' between rural and urban areas. The overall objective of the study is to identify and estimate the impacts of self-employment in the economic development of the Northeastern United States. The empirical model of this study is derived from the three-equation simultaneous model of Deller et al., (2001). The study estimated the relationship of employment, population and per capita income to self-employment. Research findings show that employment and population have a positive relationship to self-employment indicating positive contribution of self-employment to regional economic development.

Key Words: Self-employment; Economic Development; Rural Northeast Region; Simultaneous Analysis

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1. Introduction

Entrepreneurship, as an economic engine, is an important part of the economic system today. Entrepreneurs as economic agents are engaged in entrepreneurial activities in most capitalist economies. Aggregation of these activities leads to economic growth at a macro level (Minniti, 2008; Wennekers and Thurik, 1999; Shane, 2006). Entrepreneurial supply is different among countries but the main difference is whether entrepreneurship is or is not productive. Entrepreneurial activities bring wealth when appropriate conditions exist and entrepreneurship itself can be shown to take different forms (Baumol, 1996).

In recent years, economists have paid special attention to observe the conceptual relationship between entrepreneurship and economic development. Efforts for economic development at national, regional and local levels have focused to increase entrepreneurship. Entrepreneurs play a dominant role in the growth, development and prosperity of the economy. They are a reliable source of technological innovations in production processes (Schmitz, 1989; Spulber, 2008). Due to its importance, developed as well as developing countries are spending a considerable amount of their resources to increase the rate of entrepreneurship. Previous studies (Cabarcos et al. 2006; Gries and Naudé, 2008; and Mojica et al. 2009) measured the rate of entrepreneurship by the rate of self-employment.

Entrepreneurs as self-employed individuals have positive impacts on economic growth in industrialized countries. Creative and qualified self-employed individuals contribute to economic growth by inventing new products, production processes, distribution methods, and employing other people. However, the increase in employment is uncertain because entrepreneurial skills

are assumed to be risky and self-employed workers can learn their skills gradually after starting their businesses (Jovanovic, 1982; Mandelman and Montes-Rojas, 2009; Bögenhold and Fachinger, 2009).

Self-employment helps to start new firms, creates jobs, promotes inventions and innovations, and ultimately brings increased well being to society. Despite the unclear benefits of small businesses, governments provide subsidies or loans to entrepreneurs to start new small businesses and retain existing business activities. Researchers are interested in self-employment, if it can provide jobs to unemployed population and also for those who face job discrimination (Blanchflower, 2000; Parker, 2005).

Income inequality between rural and urban areas is increasing and a considerable proportion of the population is affected by this gap. Of the 7 million people living in rural areas in the Northeast region, approximately 11.6 percent of the total population is experiencing the effects of ural-urban income discrepancy. Rural per capita income was 67.5 percent of the urban per capita income at the end of the 1990s. This income gap demonstrates difficulty for urban workers in accepting jobs in rural areas which pay lower incomes (Goetz, 1999). According to the U.S. Census Bureau (2011), median income varies among the states in the Northeast, such as median income for West Virginia in 2008 was $49,082, while for New Jersey it was $85,761.

Two main characteristics of the Northeast region in rural areas are low population density and an increasing income gap between rural and urban population, both of which occur due to some serious economic development issues (Goetz, 1999). Some other economic indicators that affect economic development are poverty level and unemployment rate, especially in rural areas and poor states such as Maine, Vermont, and West Virginia (Yang and Snyder, 2007). One of the main problems with low population density is that it increases the cost of living. Policy makers

have noticed that rural areas have not participated in the economic boom during the 1990s. In other words, they were neglected in the "new economy" (Goetz, 1999). Although population has increased in most of the counties of the Northeast region from 1993 to 2008, growth in population density is very slow especially in rural areas and even negative in some counties.

Therefore, this study focuses on the role of self-employment in economic development by analyzing the interdependent relationship among growth in population density, employment, per capita income, and self-employment. Using econometric techniques, the analysis discovers a system of relationships between the endogenous factors using a four-equation simultaneous regional growth model, derived from the Deller et al., (2001) growth model. The specific objective is to identify and estimate the impacts of self-employment in the economic development of the rural Northeast region.

The Northeast region consists of 299 counties located in the states of Connecticut, Delaware, Massachusetts, Maine, Maryland, New York, New Jersey, New Hampshire, Pennsylvania, Rohde Island, Vermont, and West Virginia. The population of the Northeast region is approximately 62 million, which is equal to 22 percent of the U.S. population (U.S. Census, 2011). According to the USDA-ERS County Typology (2004), the region has a more urban population with 55 percent of its 299 counties classified as urban. In the region, 94 counties are non-metropolitan and are adjacent to a metropolitan area. However, this study covers 135 selected rural counties of the region.

2. Literature Review

Previous studies have shown that there is a strong relationship between self-employment and economic growth. In other words, an increase in the number of self-employed leads to economic development, specifically in rural areas. Blanchflower (2000) analyzed a number of

issues related to self-employment. The first issue was to estimate the limit of variation in self-employers' characteristics across countries. The second issue was to measure the relationship of self-employment and unemployment rates across countries. The third issue was to observe if self-employers are satisfied with their jobs. The fourth issue was to estimate the relationship between self-employment level and real growth rate of the economy. The final issue was to explore the mobility of self-employed across neighborhoods, regions, and towns. Two types of data were used for empirical analysis. First, a panel data from 23 countries from 1966 to 1996 was used. Second, for the same analysis, a time-series data from 1975 to 1996 was used. The results showed that non-farm self-employment decreased in the U.S. and in some other countries such as Austria, Belgium, Japan, Luxembourg, Netherlands, Norway, and Spain. Self-employment was reduced in most of the countries in 1966. The overall trend of being self-employed was greater among women instead of men. Self-employers were more satisfied with their jobs than regular employees. However, a rise in self-employment does not mean that the real growth of the economy will also increase. Generally, self-employers do not like to move from their neighborhood, regions, and towns. Blanchflower (2000) developed a flexibility index across countries based on the information of whether self-employers wanted to move from their neighborhood, regions, and town. The results of this index showed that some economies are flexible in terms of self-employers' movement such as the U.S., Canada, Germany, and the Netherlands.

Carree et al., (2002) estimated the relationship between self-employment and economic development at the macro level. Mainly, their analysis focused on three issues. The first issue was about the relationship between the equilibrium rate of self-employment and the stage of economic development. The second issue was about the convergence speed towards an

equilibrium rate when self-employment rate is not at an equilibrium point. The third issue was to show to what extent does deviating from the equilibrium rate of self-employment hinders economic growth. They used panel data of 23 OECD (Organization for Economic Co-operation and Development) countries from 1976 to 1996. A two-equation model was used for empirical analysis. They concluded that low barriers to the birth and death of self-employed/firms were necessary for the equilibrium to promote economic development. The results showed the growth penalty as having too few self-employed/firms. Therefore, it would be damaging for economic growth to have a self-employer/firm under the equilibrium.

Fairlie and Woodruff (2007) estimated the components of the difference between self-employment rates in Mexico and among Mexican immigrants in the U.S. They used data from 2000 Public Use Microdata 5-Percent Sample (PUMS) for the U.S. and 50 percent randomly drawn data from the 10 percent extended survey sample of the 2000 Census for Mexico. The self-employment rates of male and female Mexican immigrants in the U.S. are 6.0 and 6.1 percent, respectively. Whereas the male and female self-employment rates in Mexico are 25.8 and 17.0 percent, respectively. The results showed that there is a strong and positive relationship between self-employment and age in Mexico compared to the U.S. and also a large gap in the level of self-employment in two countries, due to the different structures of the economy.

Figueroa (2011) examined the single and joint effect of gender, rurality and unemployment in early-stage necessity and opportunity entrepreneurship (self-employment) in the U.S. She used a dataset that combined GEM US individual data for 2005-2009. She used logistic regression with robust and clustered errors for estimation and compared the results to the simple model with non-robust errors. The results showed that individuals who lived in rural

counties with a population less than 250,000 have a higher probability of engaging in early-stage necessity entrepreneurship.

Robbins et al., (2000) analyzed the relationship between the proportion of small businesses and four determinants of economic growth: productivity, gross state product (GSP), unemployment, and wage inflation at the state level in the U.S. They used panel data of 48 states from 1986 to 1995. A system of simultaneous equations with random effects was used for the analysis. The study showed that very small businesses provided economic benefits at a macro level. They concluded that as the number of small businesses (20 employees or less) increased, the level of productivity and GSP growth were increased at the state level. At the same time, wages, inflation and unemployment rate were reduced in small businesses. Therefore, macroeconomic policies were more beneficial to the states which were rich in small businesses. This was not true for small businesses which had 500 employees or less. Labor in these businesses was not more productive.

Seyfried (2005) estimated the relationship between economic growth and employment in the ten largest states of the U.S. He explained economic growth by real GDP and output gap. He used data from 1990 to 2003 and developed a model to measure the magnitude of employment on economic growth and the duration of the relationship between economic growth and employment. His lagged model showed that employment growth is strongly and positively related to economic growth.

The studies reviewed in the previous paragraphs estimated the rate of self-employment. Some analyzed the relationship between self-employment and economic growth. Others estimated the rate of self-employment based on gender and rurality. However, this study is unique from other studies by using a Three-Stage Least Squares (3SLS) method to estimate

empirically the simultaneous equations model where economic development is represented by changes in population density, employment, and per capita income.

3. Empirical Model

As indicated earlier, the focus of this study is to analyze the relationship between self-employment and economic development represented by changes in population, employment, and per capita income. The empirical model is derived from the two-equation simultaneous model of Carlino and Mills (1987). They build this model by modifying Steinnes' model (1982). Deller et al., (2001) extended it into a three simultaneous equations model which incorporated the interdependencies among income, population and employment changes. Some studies extended the model of Deller et al., (2001) to estimate the relationship of economic development and entrepreneurship (Mojica, 2009), amenities (Kahsai, 2009), environmental regulation (Nondo, 2009), and modeling small business growth, migration behavior, local public services and median household income (Gebremeriam, 2006). This study also uses Deller's model by specifying a four-equation model. The general form of the four simultaneous equations model representing the interaction among population density (P), employment (E), income (Y), and self-employment (SE) is specified as:

$$P^* = f(E^*, Y^*, SE^* / X^P) \qquad (1a)$$
$$E^* = f(P^*, Y^*, SE^* / X^E) \qquad (1b)$$
$$Y^* = f(P^*, E^*, SE^* / X^Y) \qquad (1c)$$
$$SE^* = f(P^*, E^*, Y^* / X^{SE}) \qquad (1d)$$

Where $P^*, E^*, Y^*,$ *and* SE^* represent equilibrium levels of population density, employment, per capita income, and self-employment, respectively in the *ith* county; X^P, X^E, X^Y, and X^{SE} are a set of exogenous variables that have either direct or indirect effects on population density, employment, per capita income, and self-employment.

Equations (1a) to (1d) represent actual population density, employment, income, self-employment, and exogenous variables in *Xs* that determine the equilibriums of population density, employment, income, and self-employment. The general equilibrium conditions specified in equations (1a) to (1d) expressed as a linear relationship can be explained as:

$$P^* = \alpha_{0P} + \beta_{1P}E^* + \beta_{2P}Y^* + \beta_{3P}SE^* + \sum \delta_{1P}X^P \qquad (2a)$$

$$E^* = \alpha_{0E} + \beta_{1E}P^* + \beta_{2E}Y^* + \beta_{3E}SE^* + \sum \delta_{2E}X^E \qquad (2b)$$

$$Y^* = \alpha_{0Y} + \beta_{1Y}P^* + \beta_{2Y}E^* + \beta_{3Y}SE^* + \sum \delta_{3Y}X^Y \qquad (2c)$$

$$SE^* = \alpha_{0SE} + \beta_{1SE}P^* + \beta_{2SE}E^* + \beta_{3SE}Y^* + \sum \delta_{4SE}X^{SE} \qquad (2d)$$

Mills and Price (1984) recommended that equilibrium levels of population density, employment, income, and self-employment are likely to be adjusting with distributed lags. The distributed lag adjustments models are specified as:

$$P_t = P_{t-1} + \lambda_P(P^* - P_{t-1}) \qquad (3a)$$

$$E_t = E_{t-1} + \lambda_E(E^* - E_{t-1}) \qquad (3b)$$

$$Y_t = Y_{t-1} + \lambda_Y(Y^* - Y_{t-1}) \qquad (3c)$$

$$SE_t = SE_{t-1} + \lambda_{SE}(SE^* - SE_{t-1}) \qquad (3d)$$

The subscript (t-1) represents the initial conditions of endogenous variables: population density, employment, income and self-employment and $\lambda_P, \lambda_E, \lambda_Y$, *and* λ_{SE} are speed-of-adjustment coefficients to the desired level of population density, employment, income, and self-employment. Adjustment coefficients are assumed to be $0 \le \lambda_P, \lambda_E, \lambda_Y, \lambda_{SE} \le 1$. Generally positive and higher values represent quick growth rates.

Equations (3a)-(3d) indicate that present conditions of population density, employment, income, and self-employment depend on their initial conditions and a change between equilibrium value and its lagged value. Rearranging equations (3a)-(3d), we have:

$$\Delta P = P_t - P_{t-1} = \lambda_P (P^* - P_{t-1}) \Rightarrow P^* = \frac{1}{\lambda_P}(P_t - P_{t-1}) \quad (4a)$$

$$\Delta E = E_t - E_{t-1} = \lambda_E (E^* - E_{t-1}) \Rightarrow E^* = \frac{1}{\lambda_E}(E_t - E_{t-1}) \quad (4b)$$

$$\Delta Y = Y_t - Y_{t-1} = \lambda_Y (Y^* - Y_{t-1}) \Rightarrow Y^* = \frac{1}{\lambda_Y}(Y_t - Y_{t-1}) \quad (4c)$$

$$\Delta SE = SE_t - SE_{t-1} = \lambda_{SE} (SE^* - SE_{t-1}) \Rightarrow SE^* = \frac{1}{\lambda_{SE}}(SE_t - SE_{t-1}) \quad (4d)$$

Where Δ represents region's change of growth rate of population density, employment, per capita income, and self-employment. The changes in endogenous variables are gained from the difference between the log values of the observations of 2008 and the observations of 1993 as depicted below:

$$\Delta P = LOG(P_{2008}) - LOG(P_{1993}) \quad (5a)$$
$$\Delta E = LOG(E_{2008}) - LOG(E_{1993}) \quad (5b)$$
$$\Delta Y = LOG(Y_{2008}) - LOG(Y_{1993}) \quad (5c)$$
$$\Delta SE = LOG(SE_{2008}) - LOG(SE_{1993}) \quad (5d)$$

By substituting equation (4a) through equation (4d) in equation (2a) through equation (2d), respectively and rearranging the equations, we can obtain a linear form of the estimation model. Therefore, the empirical estimation model is formed of a system of four simultaneous equations representing population density, employment, per capita income, and self-employment, respectively. This system is defined as:

$$\Delta P = \alpha_{0P} + \beta_{1P}\Delta E + \beta_{2P}\Delta Y + \beta_{3P}\Delta SE + \beta_{4P}P_{1993} + \beta_{5P}E_{1993} + \beta_{6P}Y_{1993}$$
$$+\beta_{7P}SE_{1993} + \sum \delta_{1P}X^{P} + u_1 \quad (6a)$$
$$\Delta E = \alpha_{0E} + \beta_{1E}\Delta P + \beta_{2E}\Delta Y + \beta_{3E}\Delta SE + \beta_{4E}P_{1993} + \beta_{5E}E_{1993} + \beta_{6E}Y_{1993}$$
$$+\beta_{7E}SE_{1993} + \sum \delta_{2E}X^{E} + u_2 \quad (6b)$$
$$\Delta Y = \alpha_{0Y} + \beta_{1Y}\Delta P + \beta_{2Y}\Delta E + \beta_{3Y}\Delta SE + \beta_{4Y}P_{1993} + \beta_{5Y}E_{1993} + \beta_{6Y}Y_{1993}$$
$$+\beta_{7Y}SE_{1993} + \sum \delta_{3Y}X^{Y} + u_3 \quad (6c)$$
$$\Delta SE = \alpha_{0SE} + \beta_{1SE}\Delta P + \beta_{2SE}\Delta E + \beta_{3SE}\Delta Y + \beta_{4SE}P_{1993} + \beta_{5SE}E_{1993}$$
$$+\beta_{6SE}Y_{1993} + \beta_{7SE}SE_{1993} + \sum \delta_{4SE}X^{SE} + u_4 \quad (6d)$$

The endogenous variables represented by $\Delta P, \Delta E, \Delta Y$, and ΔSE indicate a county's growth rates in population density, employment, per capita income, and self-employment, respectively. Error terms are shown by $u_1, u_2, u_3, and\ u_4$ and the exogenous variable vector is represented by X. The initial period (subscript t-1) is the year of 1993. The lag adjustment models assume that endogenous variables are adjusted over a period of time not adjusted instantaneously to their equilibrium levels. Deller and Lledo (2007) and Deller et al., (2001) identified that the speed-of-adjustment coefficients are embedded in the coefficients of $\alpha, \beta,$ and δ. This framework permits the estimation of structural relationships while simultaneously isolating the effects of self-employment on regional economic growth. Thus, the estimation of equations (6a) to (6d) is from the short-run adjustment of population density, employment, per capita income, and self-employment to long-run equilibriums ($P^*, E^*, Y^*,$ and SE^*). The empirical equations are defined as:

$$GRPOP = \beta_0 + \beta_1 GREMP + \beta_2 GRPCI + \beta_3 POP_{93} + \beta_4 EMP_{93} + \beta_5 PCI_{93}$$
$$+ \beta_6 SE_{93} + \beta_7 POVERTY + \beta_8 EGOV + \beta_9 START + \beta_{10} CMHV + \beta_{11} NONWTE$$
$$+ \beta_{12} NFIRM + \beta_{13} ROADDEN + \beta_{14} OPERATIVE + \varepsilon_1 \quad (7a)$$

$$GREMP = \beta_0 + \beta_1 GRPOP + \beta_2 GRPCI + \beta_3 GRSE + \beta_4 EMP_{93} + \beta_5 PCI_{93}$$
$$+ \beta_6 PCITAX + \beta_7 EGOV + \beta_8 CMHV + \beta_9 NFIRM + \beta_{10} ROADDEN + \varepsilon_2 \quad (7b)$$

$$GRPCI = \beta_0 + \beta_1 GREMP + \beta_2 GRSE + \beta_3 PCI_{93} + \beta_4 SE_{93} + \beta_5 PCITAX + \beta_6 NFIRM + \beta_7 ROADDEN + \beta_8 OPERATIVE + \beta_9 COLLD + \beta_{10} UNEMP + \beta_{11} RETIRE + \varepsilon_3 \quad (7c)$$

$$GRSE = \beta_0 + \beta_1 GREMP + \beta_2 GRPCI + \beta_3 PCI_{93} + \beta_4 SE_{93} + \beta_5 POVERTY + \beta_6 START + \beta_7 WORKER + \beta_8 SURVUVAL + \beta_9 DEATH + \beta_{11} SIZE + \beta_{14} EXPAND + \varepsilon_4 \quad (7d)$$

4. Types and Source of Data

The secondary data used in the study is from 1993 to 2008. All the endogenous variables are explained as growth rates from 1993 to 2008. Table 1 provides the description of endogenous variables, initial condition of endogenous variables and also explains the sources of data. The data for population density, employment, per capita income, and self-employment are collected from the U.S. Census Bureau, Bureau of Economic Analysis - Regional Economic Information System (REIS), and County and City Data Book (C&CDB) from 1993 to 2008.

The study used percentage growth in population density (ΔP), employment (ΔE), per capita income (ΔY), and self-employment (ΔSE) from 1993 to 2008 as endogenous variables. The initial conditions of the endogenous variables are expected to influence the values of population density, employment, per capita income, and self-employment. These variables are collected from County and City Data Book (C&CDB) and Bureau of Economic Analysis (BEA).

Other than self-employment measures, a number of exogenous variables such as human capital, accessibility, economic, and demographic variables are included for empirical analysis. All exogenous variables used to explain percentage growth rate in population density, employment, per capita income, and self-employment are shown in Table1.

All exogenous variables are defined in five categories. Accessibility variable includes inter-state road density (*ROADDEN*) and the data is collected from the WVU Natural Resource Analysis Center (WVU-NRAC). Human capital variables include percentage of population

Table 1: Definition and Data Sources for Endogenous and Exogenous Variables

Variables	Definitions	Source
Endogenous		
ΔP	Growth in population density from 1993 to 2008	C&CDB /Computed
ΔE	Growth in employment from 1993 to 2008	BEA / Computed
ΔY	Growth in per capita income from 1993 to 2008	C&CDB / Computed
ΔSE	Growth in number of non-farm proprietors from 1993 to 2008	BEA/Computed
Initial Condition Variables		
POP_{93}	Population density 1993	C&CDB
EMP_{93}	Employment 1993	BEA
PCI_{93}	Per capita income 1993	C&CDB
SE_{93}	number of nonfarm proprietors from 1993	BEA
Explanatory Variables		
OPERATIVE	Percentage of population between 16 years and 64 years	C&CDB
COLLD	Percentage of population of 25 years and older with bachelor degree or higher	C&CDB
PCITAX	Per capita income tax	
UNEMP	Unemployment rate	C&CDB
POVERTY	Percentage of all age population below poverty	US Census Bureau
CMHV	County's median housing value	C&CDB
EGOV	Per capita government expenditures	C&CDB
ROADDEN	Inter-state road density	NRAC
RETIRE	Percentage of population above 65 year	C&CDB
NONWTE	Percentage of non-white population	C&CDB
WORKER	Ratio of new employers in the county per 1000 in the labor force	BDS/Computed
EXPAND	Number of expansions per county	USBS
START	Start-up of new firms per county	USBS
SIZE	Firm size with less than 500 employees per county	USBS
NFIRM	Number of existing firms per county	C&CDB
SURVIVAL	Number of firms survived for five years	USBS/Computed
DEATH	Death of existing firms per county	USBS

between 16 years and 64 years (*OPERATIVE*) and percentage of population of 25 years and older with bachelor degree or higher (*COLLD*) and the data is collected from City and County Data Book (C&CDB).

Economic variables include per capita income tax (*PCITAX*), unemployment rate (*UNEMP*), percentage of all population below poverty (*POVERTY*), serious crime rate (*CRIME*), county's median housing value (*CMHV*), and per capita government expenditures (*EGOV*). The data on economic variables are collected from US Census Bureau and City and County Data Book (C&CDB).

Demographic variable includes percentage of population above 65 years (*RETIRE*), and percentage of non-white population (*NONWTE*) and the data is collected from City and County Data Book (C&CDB).

Self-employment variables include the ratio of new employers in the county per 1000 in the labor force (*WORKER*). Other measures of self-employment are, start-up of new firms per county (*START*), death of existing firms per county (*DEATH*), number of expansions per county (*EXPAND*), firm size per county (*SIZE*), survival rate of firms (*SURVIVAL*), and number of existing firms (*NFIRM*). First, to measure self-employment, the ratio of new employers in the county per 1000 in the labor force (*WORKER*) is derived by dividing the number of new employers by total of all firm's employers multiplied by a thousand. New jobs are the contribution of new firms when they start and grow in the economy. It is strongly supported by previous studies that the new firms tend to surpass the excellence in their performance in terms of job creation (Baptista, 2008; Audretsch and Feldman, 2004; and Geroski, 1995). Firm size per county (*SIZE*) is derived by dividing the number of employees by the number of firms. Data on

entrepreneurial variables are collected from U.S. Census Bureau's Statistics of the U.S. Businesses (USBS), City and County Data Book (C&CDB), and Business Dynamics Statistics.

5. Empirical Results

a) Growth in Population Density

The results of population density growth equation for the rural Northeast region using 3SLS estimation are presented in Table 2. The population density growth equation is estimated against growth in employment (*GREMP*) and growth in per capita income (*GRPCI*), the initial condition of growth in population density (POP_{93}), growth in employment (EMP_{93}), growth in per capita income (PCI_{93}), and growth in self-employment (SE_{93}), and some control variables are included to measure economic effects. The initial conditions of the endogenous variables are used due to the assumption that growth depends on initial conditions. The initial condition of population density (POP_{93}) is negative and significant at the 5 percent level. It indicates that counties with initial high population density are growing slower compared to counties with low initial population density. The counties with higher per capita income initially experienced higher growth in per capita income in 2008. Therefore, the coefficient of initial condition of per capita income (PCI_{93}) is negative and significant at the 10 percent level. These results are consistent with existing studies (Deller et al. 2001).

Growth in employment (*GREMP*) has a significant and positive relationship with *GRPOP* explaining that an increase in employment growth leads in-migration to increase. Median housing value (*CMHV*) and *GRPOP* are significantly and positively related to each other at county level. This implies that local government spending programs such as investment in education, health care, highways, and crime prevention enhance population density growth in that county. The significant and positive relationship of non-white population (*NONWTE*) with

Table 2: Three Stage Least Square Results

Variables	Population		Employment		Per capita income		Self-employment	
	Coefficient	z-stat	Coefficient	z-stat	Coefficient	z-stat	Coefficient	z-stat
GRPOP			.6886161*	3.08				
GREMP	.3281952***	1.95			.6065662	1.00	3.93488*	2.50
GRPCI	.0660876	1.15	.0155636	0.33			-.5110726	-0.82
GRSE			.0096037	0.33	-.0169272	-0.18		
POP_{93}	-.1266332**	-2.40						
EMP_{93}	.0702944	0.64	.0266711	0.15				
PCI_{93}	-.1643391***	-1.78	.1313152	1.27	-.9176009*	-2.48	-.4768187	-1.17
SE_{93}	.004835	0.15			.1803542	0.31	2.809231*	2.35
POVERTY	-.0001039	-0.11					-.0017635	-0.17
START							-.4999718	-0.93
EGOV	-.0192558	-0.80	.0060049	0.14				
COLLD					-.00142116	-0.37		
CMHV	.1913144*	4.88	-.0970975	-1.33				
NONWTE	.0011585***	1.68						
NFIRM	.023308	0.27	.0045229	0.03	-.1815602	-0.29		
ROADDEN	.0562414*	2.73	-0.0501278***	-1.63	.0569245	0.55		
OPERATIVE	-.0912668	-0.46			2.090143*	2.96		
PCITAX			.0092603	0.58	.0152956	1.55		
UNEMP					.010579	0.28		
WORKER							-.0801815***	-1.74
SURVIVAL							.1598513	0.21
DEATH							.364452	0.68
SIZE							-2.421913**	-2.09
EXPAND							-.8312544	-0.96
N	135		135		135		135	
R^2	0.2849		0.6730		0.6416		0.2869	
Note:: * ,**,and *** indicate a coefficient is significant at 1%, 5%, and 10% level respectively								

population density growth rate (*GRPOP*) indicates that the non-white population such as Black, Hispanic, and Asians tend to have large families compared to white population. This leads to fast increases in the growth rate of population density.

Generally, rural areas have fewer roads compared to urban areas, which makes it difficult for rural population to have access to urban areas for employment and other purposes. This situation encourages out-migration from rural to urban areas. However, large road density in rural areas makes easy access to urban/metro areas not only making people remain residing in rural areas, but also encouraging population from urban areas to travel to rural areas for employment and business purposes. The positive and significant relationship between road density (*ROADDEN*) and growth in population density (*GRPOP*) supports the hypothesis.

Poverty rate (*POVERTY*) is negatively related to population density growth (*GRPOP*). This implies that high poverty rate encourages people to move out from one county to another county and increases out-migration from counties of high poverty rates to counties of low poverty rates. However, the coefficient of poverty rate (*POVERTY*) is not significant.

b) Growth in Employment

The employment growth equation is estimated against endogenous variables of growth in population density (*GRPOP*), growth in per capita income (*GRPCI*), and growth in self-employment (*GRSE*), the initial condition of endogenous variables of growth in employment (EMP_{93}) and growth in per capita income (PCI_{93}), and some control variables are included to measure economic effects.

Growth in population density (*GRPOP*) has a significant and positive relationship with employment growth (*GREMP*) indicating that more job opportunities encourage in-migration and implies that "jobs follow people". The coefficient of road density (*ROADDEN*) is significant at 10 percent level and negatively related to employment growth (*GREMP*). It implies that as road density increases, the marginal cost of production decreases due to an increase in the cost of transporting goods and services. Other control variables are not significant possibly due to low employment growth rate in rural counties in the regions. The number of existing firms (*NFIRM*) is positively related to employment growth (*GREMP*). This implies that a large number of existing firms in a certain county provide job opportunities, which increases employment growth (*GREMP*).

Population growth in the Northeast region is low, which indicates less supply of labor and ultimately causes wage rate to increase. Consequently, firms do not have any option other than employing labor with high salary/wage, if they want to stay in business. Hence, a positive relationship between *GREMP* and *GRPCI* support the expected hypothesis. High per capita

income tax (*PCITAX*) causes disposable income to decrease for the population in certain counties. This encourages people to be self-employed rather than to have waged/salaried jobs. Thus, a positive relationship occurred between employment growth (*GREMP*) and per capita income tax (*PCITAX*).

c) Growth in Per Capita Income

The per capita income growth equation is estimated against endogenous variables of growth in employment (*GREMP*) and growth in self-employment (*GRSE*), the initial condition of endogenous variables of growth in per capita income (PCI_{93}) and growth in self-employment (SE_{93}), and some control variables are included to measure economic effects. The coefficient of initial condition of per capita income (PCI_{93}) is negative and significant at a 1 percent level. This implies that counties with low per capita income in 1993 have high per capita income later compared to the counties which have high per capita income in 1993.

Percentage of population between 18 and 64 years of age (*OPERATIVE*) is significantly and positively related to per capita income growth (*GRPCI*) indicating that the share of active population in a certain county has higher per capita income than the counties which have more retired population. Growth in self-employment (*GRSE*) has a significant and negative relationship with per capita income (*GRPCI*) explaining that counties with large number of self-employed population have low per capita income compared to counties that have high share of wage/salary employed population. The significant and positive relationship between growth in employment (*GREMP*) and per capita income growth (*GRPCI*) implies that counties which face job creation problem have low per capita income than counties that have more jobs opportunities. A significant and positive coefficient of unemployment rate (*UNEMP*) shows that as unemployment increases, per capita income increases, which is not an expected result.

d) Growth in Self-employment

The self-employment growth equation is estimated against endogenous variables of growth in employment (*GREMP*) and growth in per capita income (*GRPCI*), the initial condition of growth in per capita income (PCI_{93}) and growth in self-employment (SE_{93}), and some control variables are included to measure economic effects. Growth in employment (*GREMP*) has a significant and positive relationship with self-employment growth (*GRSE*). This implies that an increase in employment opportunities increases self-employment, which is an unexpected situation.

The coefficient of initial condition of self-employment (SE_{93}) is positive and significant at a 1 percent level. This implies that counties with less number of self-employees in 1993 have less number of self-employees later compared to the counties which have high self-employees in 1993. High wage and salary rates for number of new jobs created (*WORKER*) discourage people to be self-employed. It makes them seek salaried jobs rather than working as self-employees. In rural counties, starting a business as self-employed is usually not big enough to meet the expenses of their families. Therefore, people prefer to have wage and salaried jobs. Similarly, if the size of firms (*SIZE*) increases, number of self-employees decreases. The significant and negative coefficient of firm size (*SIZE*) is as expected.

Growth in self-employment (*GRSE*) has positive relationship with per capita income (*GRPCI*) meaning that counties with large numbers of self-employed people have higher per capita income compared to counties that have a high share of waged and salaried population. However, the result is insignificant. Poverty rate (*POVERTY*) has a significant and negative relationship with self-employment growth (*GRSE*) explaining that high poverty rates make people to accept even low waged/salaried jobs.

6. Summary and Conclusion

As explained earlier, the main objective of this study was to estimate the relationship between self-employment and regional economic development in the rural Northeast region of the United States. To estimate the empirical model explaining the relationship between self-employment and economic development indicators (growth in population density, employment, and per capita income), a system of simultaneous equations was used. Based on the estimated results, it is evident that self-employment is positively related to rural economic development from 1993 to 2008.

The positive relationship of population density growth with employment growth and per capita income growth leads to increased population density in rural counties of the region. The positive relationship between self-employment and growth in employment indicate that more employment opportunities show more self-employed population which is unexpected. Generally, more job opportunities lead to earn more income in wage/salaried jobs and discourage self-employment. The employment growth positively affects per capita income growth indicating that an increase in the number of jobs created ultimately causes an increase in per capita income. The empirical results show a negative relationship between self-employment and per capita income growth which indicates that self-employers earn less income than wage/salaried jobs. Some other factors such as survival rate of firms have positive effects on self-employment growth. Thus, from the empirical findings it is evident that self-employment plays an important role in enhancing economic development in the region. The overall conclusion of the study is that self-employment can be considered as an important tool to reduce poverty, unemployment, and to enhance economic development in the rural counties of the region. Self-employment earns income for rural residents and families and increases societal welfare in the region.

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