

FULL ARTICLE



Economic growth through entrepreneurship: Determinants of self-employed income across regional economies

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Abstract

Knowledge of the determinants of self-employment income is critical to entrepreneurial development strategies if the development goal is to increase incomes not just employment. Using American Community Survey data, unconditional quantile regression is used to investigate differences in the relationship between entrepreneurial income and an array of individual, industry, and regional characteristics across the self-employment income distribution. Personal attributes, such as education, race, age, and gender, both explain differences in self-employment income and vary in importance across the income distribution. Regional agglomerative effects are significantly positive and stronger at the upper end of the self-employed income distribution.

KEYWORDS

economic growth, entrepreneurship, income, self-employed

JEL CLASSIFICATION

J24; J31; O18; R11

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1 | INTRODUCTION

State and local government officials have traditionally focused on major industry and/or firm recruitment as a driver of job and income growth in regional economies. Some researchers have criticized this approach to economic development because it often fails to consider the public cost of providing additional services, such as roads, schools, police protection, water and sewer services, and the potential negative environmental costs that often accompany industrial growth (Leistritz & Sell, 2001). As an alternative entrepreneurial led growth facilitated through a support system, may provide a more cost-effective means to engender regional economic growth than an industrial recruitment-led approach (Shrestha, Goetz, & Rupasingha, 2007; Spindler, 1994; Yenerall, 2008).

While entrepreneurial activity is an intuitively promising vehicle for fostering economic development (Edmiston, 2007; Henderson, 2002), the extent to which self-employment facilitates local economic growth is unclear. The appeal of entrepreneurial based regional growth strategies is derived from entrepreneurial theory that view entrepreneurs as change agents who bear the risk associated with introducing innovations (Evans & Jovanovic, 1989; Formaini, 2001). In the new growth theory, entrepreneurs are innovators that possess the broad skill set necessary to utilize new technologies to meet new economic opportunities (Lazear, 2004; Romer, 1994).

Prior U.S. entrepreneurial research has focused on regional growth in the number of self-employed individuals rather than self-employment income (Edmiston, 2007; Gallardo & Scammahorn, 2011; Henderson, 2002; Low & Weiler, 2012; Van Praag & Versloot, 2007), or on the relationship between the number of self-employed individuals and various measures of regional economic activity (Acs, 2007; Bunten, Weiler, Thompson, & Zahran, 2015; Fleming & Goetz, 2011; Glaeser & Kerr, 2010; Low, 2009; McGranahan, Wojan, & Lambert, 2010). However, if entrepreneurs earn less than their salaried employment alternatives, increased entrepreneurship may not be an efficient regional development strategy.

In a national county-level study Low, Henderson, and Weiler (2005) examined the relationship between per job entrepreneurial income¹ and income determinants. County differences in average proprietor income was positively related to urban status, percent of county population with a college education, average county bank deposits, high speed internet access, and having an interstate highway. Counties located in the U.S. West and Midwest had lower, and Northeastern counties had higher, per job entrepreneurial income. In a study of Appalachian counties, Stephens and Partridge (2013) estimated total county income increased by 0.65% for a 1% increase in county proprietor income. These studies, however, did not investigate the determinants of per capita income within a regional context.

Other studies have focused on the importance of entrepreneurial characteristics and/or personal goals in explaining entrepreneurial income at the national level. A sampling of these studies includes those conducted by: Aldrich & Cliff, 2003; Evans & Jovanovic, 1989; Evans & Leighton, 1989; Gurley-Calvez & Hammond, 2010; Hamilton, 2000; Holtz-Eakin, Joulfaian, & Rosen, 1994; Kusmin, 2010; Moskowitz & Vissing-Jorgensen, 2002; Shane & Venkataraman, 2000; Benz & Frey, 2008; Block & Koellinger, 2009; Hurst & Pugsley, 2011; and Astebro & Thompson, 2011. A common limitation of these studies is that scant attention is paid to individual characteristics and local economic activity in explaining self-employed income. To this end and in contrast with these prior studies, this study examines the determinants of the individual self-employed income level within the context of: (i) entrepreneur personal attributes, (ii) resources available to the entrepreneur, (iii) characteristics of the industry in which the entrepreneur operates and, (iv) characteristics of the region's economy. Importantly and uniquely as well, this study introduces unconditional quantile analysis as a novel approach to examine determinants of entrepreneurial income and how the characteristics of entrepreneurs vary by their income level.

An examination of possible differences in returns to self-employment at different income level is important because policy makers, practitioners, and academics argue that self-employment is a way to provide opportunity for lower income households and less affluent areas to raise their status (Bruton, Ketchen, & Ireland, 2013; Chliova, Brinckmann, & Rosenbusch, 2015; Heemskerk, 2003; Karnani, 2007; London & Hart, 2011; Sutter, Bruton, & Chen,

¹Calculated as total county proprietor income divided by county proprietor employment using BEA-REIS data.



2019; Webb, Bruton, Tihanyi, & Ireland, 2013). Policy makers often institute programs aimed at easing poverty through self-employment education efforts (Laney, Bowles, & Hillard, 2013) or other means (Wolff & Nivorozhkin, 2012). Advocates of social entrepreneurship especially see it as a means of easing poverty (Barki, Comini, Cunliffe, Hart, & Rai, 2015). However, self-employment may affect household incomes in different ways with different impacts of key determinants. A better understanding of how self-employment influences returns to different levels of household income provides greater insight to the process of possible poverty alleviation and reduction in inequality of income. Accordingly, results of this paper could be used to better target efforts aimed at using self-employment to reduce social problems.

1.1 | Study Setting

The three southeastern states of Georgia, North Carolina, and South Carolina serve as the study area. Over the past decade, per capita income in each state has consistently been well below the national average. In 2016, South Carolina ranked 44th, Georgia 40th, and North Carolina 39th among the 50 states and District of Columbia in per capita income (U.S. Department of Commerce, 2018). The three-state percentage of self-employed income to total earnings² has remained relatively stable despite a significant increase in the share of entrepreneurial employment to total employment. In 1998, the percentage of self-employed income to total earnings was 9.9%; this value declined to a low of 9.7% in 2011 before increasing to 10.9% in 2016. Self-employment as a share of total employment, however, increased from 14.8% in 1998 to 22.4% in 2016 reflecting a 51.3% increase (U.S. Department of Commerce, 2018). Thus, between 1998 and 2016 in these states, per job entrepreneurial earnings decreased relative to per job wage and salary income. The decline in per entrepreneur earnings relative to wages is inconsistent with the argument that growth in entrepreneurship increases average wealth and highlights the need to examine the drivers of entrepreneurial income.^{3,4} The year 2008 is selected as the year of this analysis. This year was the first full year of the Great Recession and, due to this, was thought to offer a useful case year for analysis.⁵

2 | LITERATURE REVIEW

Entrepreneurship has been defined as “the process of creating or seizing an opportunity and pursuing it regardless of the resources currently controlled” (Fayolle, 2007, p.37). From this perspective, business owners can be viewed as entrepreneurs as they are the business decision makers and risk takers.⁶ Despite the role of self-employment as an agent of economic growth, and the three-decade increase in the share of national self-employment relative to

²Total earnings are defined as the sum of personal income-wage, salary disbursements, and proprietors' income (Regional Economic Information System 2018).

³It is worth noting that entrepreneurial activity in these states is generally representative of national entrepreneurship activity. A review of Kauffman Foundation (2019) statistics for 2008 indicates that these three states are representative of the US. Specifically, the data indicates small differences in rate of new entrepreneurs (0.33% for our three states versus 0.30% nationally), opportunity share of the new entrepreneurs (85.6% versus 81.4%), startup early job creation (5.81 versus 5.51) and startup early survival rate (77.7% versus 77.6%).

⁴This decline predated the national recession. Still, in 2016, U.S. per entrepreneurial real (2000 dollars) income was only \$22,520. The same variable for the three states in our analysis shows the same trend.

⁵Intuitively we had thought that the economic circumstances of 2008 would offer a particularly interesting time period for our case study, it turns out that this is not supported by literature and other evidence. The most pertinent literature in this regard is the relationship between self-employment and unemployment levels and provides mixed evidence (Block & Wagner, 2010; Halicioglu & Yolac, 2015; Schuetze, 2000). Quoting Blanchflower (2000), “there is some disagreement in the literature on whether high unemployment acts to discourage self-employment because of the lack of available opportunities or encourage it because of the lack of viable alternatives (P. 477).” We have undertaken some additional analyses to examine this issue further. More relevant, we have also analyzed US entrepreneurship data provided by the Kauffman Foundation (2019) which indicates that for the US the share of opportunity entrepreneurs was 80.7% in 2008 versus an average of 80.1% for 1998 through 2017. For several measures, data indicates that 2008 is not an atypical year. Specifically, across all states, the rate of new entrepreneurs (no difference), opportunity entrepreneur share (a 3.1% relative difference), startup job creation (a decline of 11.2%), and startup survival rates (a 2% difference), in general showed little change from 2008 to 2017.

⁶This is in contrast to the role of stockholders who must take investment risks but do not make day-to-day business decisions and hired managers, who make business decisions but do not take investment risk.



total employment, neoclassical economists continue to treat entrepreneurs as a black box when explaining regional growth. As noted by Goetz (2003, p.4), "there have been only scant attempts to develop formal theories of entrepreneurship and even fewer efforts to formally study proprietorship formations."

2.1 | Attributes of entrepreneurs

The entrepreneurial business literature has tended to focus on identifying individual and cultural attributes correlated with entrepreneurial success, or on teaching entrepreneurial skills. Prior work experience in an industry closely related to the entrepreneurial activity is frequently a key determinant of entrepreneurial success (Colombatto & Melnik, 2007). Why, when, and how entrepreneurship opportunities are recognized by some individuals and not others is influenced by idiosyncratic knowledge and skills acquired via various prior work experiences (Aldrich & Cliff, 2003; Shane & Venkataraman, 2000). This literature also suggests entrepreneur age is correlated with labor market experience and improves entrepreneurial decision-making (Holtz-Eakin et al., 1994). As such, age is frequently used as a proxy for individual work experience.

Other individual attributes such as education, gender, and ethnicity have been identified as important individual characteristics that influence self-employed income levels (Gurley-Calvez & Hammond, 2010; Kusmin, 2010). Additional education is believed to enhance one's ability to make profitable business decisions. Prior studies have found males generally have higher incomes than females, and whites tend to have higher incomes than non-whites, which may be attributable to labor market discrimination (Kusmin, 2010). Evans (1989) found ethnic entrepreneurs in concentrated ethnic markets often succeed because they understand ethnic preferences and their customers often prefer to do business with individuals sharing similar cultural experiences.

In addition, a number of studies have found that the entrepreneur's lifestyle goals are a major determinant in the decision to pursue self-employment. Entrepreneurs are often willing to trade income for non-pecuniary outcomes such as greater independence, the ability to "be one's own boss" (Benz & Frey, 2008; Blanchflower, 2000; Blanchflower & Oswald, 1998; Blanchflower, Oswald, & Stutzer, 2001), or a greater variety in work activities (Astebro & Thompson, 2011). In a survey of 290 small Western Australia business owners, Walker and Brown (2004) found non-financial objectives were often the primary motive for many small business start-ups. These authors report that personal satisfaction, pride in work, being one's own boss, and a flexible lifestyle were often more highly valued than earning additional income. Hurst and Pugsley (2011) found that factors such as age, education, individual wealth, and characteristics of the business affect the magnitude of the work/lifestyle tradeoff. By ignoring the varied goals of entrepreneurs, the literature may have overstated the importance of talent, luck, and access to capital in explaining the size distribution of entrepreneurial firms.

2.2 | Assets of entrepreneurs

Access to financial institutions is also important to successful self-employment. Evans and Jovanovic (1989) found that access to capital is a key determinant in starting a business. Goetz and Freshwater (2001) examined the role of regional financial institutions in explaining entrepreneurial activity. In examining all 50 states, these authors estimated a positive relationship between the concentration of regional financial services and entrepreneurial income that plateaued at high self-employment income. Glaeser and Kohlhase (2004) provide evidence of the strong association between the concentration of financial services and urban growth as an agglomerative effect.

Similarly, financial assets owned by the entrepreneur's family represent additional resources and increase the probability of entrepreneurial success (Aldrich & Cliff, 2003; Shane & Venkataraman, 2000). Goetz and Freshwater (2001) found that wealthier individuals are more likely to engage in entrepreneurial activities because their wealth provides easier access to additional capital. Walzer (2007) and Todorovic (2004) report that home ownership is an indicator of entrepreneur success because the skills needed to maintain a home, such as risk taking, being proactive,



and having a desire to succeed, parallel those of creating and maintaining a business. At the regional level, Fairlies and Krashinsky (2012) report that housing value appreciation is positively correlated with entrepreneurial growth, and Parker and Belghitar (2006) found that nascent entrepreneurs are much more likely to become permanently self-employed if they owned a home. However, Hurst and Lusardi (2004) found no relationship between regional entrepreneurial start rates and local housing appreciation.

Prior research has found that individuals lacking health insurance are less likely to be self-employed (Fairlie, Kapur, & Gates, 2011; Gumus & Regan, 2015; Holtz-Eakin, Penrod, & Rosen, 1996; Wellington, 2001). This finding has given support to the job lock hypothesis that posits the loss of employer provided health insurance inhibits potential entrepreneurial employment. Holtz-Eakin et al. (1996) found that wage and salary earners are less likely to become self-employed if they fear losing employer-provided health care coverage. Thus, it is likely that individuals with spouses who have health insurance are more likely to be self-employed all else equal.

2.3 | Strategies of entrepreneurs

Many new business start-ups focus on providing services to existing local markets, as opposed to forging new markets and, once established, often do not anticipate growing larger or innovating in any major way. These entrepreneurial characteristics tend to be associated with small business owners that specialize in either service provision (e.g., lawyers, physicians, restaurant owners) or retail sales.

On a related note, Moskowitz and Vissing-Jorgensen (2002) and Hamilton (2000), found full-time entrepreneurs earn less than comparable full-time wage and salary workers. Hamilton (2000) estimated that entrepreneurs in business for 10 years had a median annual income 35% lower than their salaried counterparts. This earning differential was found to be consistent across industries and he concluded the lower median entrepreneurial income level was related to the possibility that some entrepreneurs are partially influenced by non-pecuniary goals. Other researchers disagree with Hamilton's conclusion and postulate the lower income level may be attributable to overconfidence and excessive optimism by entrepreneurs regarding their potential entrepreneurial earnings relative to their skill level (Camerer & Lovallo, 1999; Koellinger, Minniti, & Schade, 2007).

2.4 | Macroeconomic and local characteristics affecting entrepreneurship

Business cycle phases have been found to influence the decision to become an entrepreneur. Those whose entrepreneurial start is influenced by the business cycle are commonly classified as either "necessity" or "opportunity" entrepreneurs. It has been observed that during periods of high unemployment, less-skilled individuals may opt for self-employment due to lost or reduced income (Koellinger & Thurik, 2012; Low & Weiler, 2012). In contrast, "opportunity" entrepreneurs are not forced-in by economic circumstances, but rather see an opportunity to increase earnings relative to their current employment situation. Somewhat counterintuitively, an economic downturn may increase the number of opportunity entrepreneurs due to lower costs of capital, materials and/or labor (Parker, 2009). During economic downturns, already established "opportunity" entrepreneurs focus on the adoption of new production technologies, and take advantage of depressed capital costs to reduce per-unit production costs (Bowen & De Clercq, 2008; Hessels, Gelderen, & Thurik, 2008).

In any particular year, regions with lagging economic growth are likely to have more necessity entrepreneurs than more prosperous regions, as individuals living in less prosperous regions start businesses due to asset fixity (Hite, 1997), or social capital considerations (Sabatini, 2008). In an analysis of returns to self-employment, Evans and Leighton (1989) found that entrepreneurs starting a new business, who had less formal education and a long period of unemployment prior to starting their business, were often less skilled than individuals doing the same job for either wage or salary income. Supporting this argument, Low and Weiler (2012) found that limited employment prospects increased the likelihood of individuals opting to become entrepreneurs within regional commuting zones.



Local economic structure tends to influence entrepreneurial success (Evans & Jovanovic, 1989; Goetz & Freshwater, 2001; Low & Weiler, 2012; Walzer, 2007). In particular Goetz and Freshwater (2001), and Walzer (2007) found regional self-employment is positively correlated with capital access as measured by the per capita number of regional financial institutions. Aggressive marketing of regional amenities designed to draw tourism can also attract entrepreneurship development. Walzer (2007, p.67) states, "tourism opportunities differentiated counties with respect to growth during the 1990s" and since then "there has been increased interest in amenities."

There is growing support for the hypothesis that agglomeration economies play a pivotal role in the growth of regional economies (Shaffer, Deller, & Marcouiller, 2004). Population density is a driver of Jacobs' type agglomerative economies.⁷ Glaeser and Kohlhase (2004) found a strong connection between worker productivity and population density; they argue that increases in population density accelerates the spread of knowledge, attracts skilled workers, increases social capital, and improves entrepreneurial opportunities. Moreover, central place theory suggests that the availability of financial resources and services increases with population density, and thus an entrepreneurs' chance to obtain outside financial resources should increase with population density (Shaffer et al., 2004). Higher population density also increases access to skilled employees with diverse skill sets, increase the size of the local market, and access to specialized business services (Fujita & Krugman, 2004). Thus, entrepreneurs located in metropolitan areas are more likely to benefit from agglomeration economies and have larger entrepreneurial income than those in non-metro areas.

2.5 | Approaches to the study of determinants of entrepreneurial income

In prior research ordinary least squares (OLS) regression has generally been used to estimate the relationship between the level of self-employment income and the determinants of self-employment income. A well-known limitation of the OLS estimator is the assumption that the relationship between self-employment income and its determinants is constant across the income distribution. Observation and, to some degree theory, however, suggest that these relationships may change over the income distribution.

Unconditional quantile regression (UQR; Firpo, Fortin, & Lemieux, 2009) provides a promising tool for relaxing assumption of fixed relationships over the income distribution. UQR allows for the marginal effect of an independent on the value of dependent variable to change over the distribution of the dependent variable. This research utilizes UQR to examine the impact of various explanatory factors on income at quantiles of the self-employed income distribution. We are unaware of any prior study that has used this approach to analyze the determinants of self-employed income. A traditional conditional quantile regression (CQR) could be used to estimate the differing impacts that sociodemographic factors have across income quantiles. CQR estimates, however, cannot be interpreted as marginal impacts because parameter estimates explicitly depend on the values of the other conditioning variables in each quantile (Firpo et al., 2009). In contrast, UQR parameter estimates can conveniently be interpreted in the same manner as OLS parameters. That is, the estimated quantile parameters capture the unconditional marginal effect of a change in each independent variable because the parameter estimates are independent of the values of the conditioning variables.

Traditional CQR estimates at each quantile are conditional on the values of other explanatory covariates in the quantile. Historically, the appeal of the CQR estimator over OLS estimator is that it provided a means to estimate *conditional* marginal effects at different points (quantiles) in the conditional distribution of the dependent variable (Koenker, 2005). However, policy makers are not typically interested in the conditional quantile marginal effect,

⁷These are the interactions derived from the "the cramming of individuals, occupations, and industries into close quarters" (Glaeser, Kallal, Scheinkman, & Shleifer, 1992) that generates ideas and innovations; the critical knowledge transfers coming from the variety and diversity of industries in the region as opposed to the core industry (Glaeser et al., 1992). Additional agglomeration economy theories include the Marshall-Arrow-Romer theory which suggests a core industry, similar to a local monopoly, drives knowledge spillovers within firms which, in turn, drives growth of the core industry and region (Glaeser et al., 1992). Porter (2000) proposes that growth is driven by a core industry, however, local competition drives firms to innovate; if firms do not maintain innovation parallel with other firms in the region, the firm will fail (Glaeser et al., 1992).



but rather want to know the effect of a change in an explanatory variable on the *unconditional* quantile distribution. The nonlinearity of the CQR estimator generates outcomes where the conditional quantile marginal effect is not equal to the unconditional quantile marginal effect (Borah & Basu, 2013; Firpo et al., 2009) because the dependent variable distribution is reshaped by the conditioning variables prior to estimating the conditional independent variable coefficients. Using CQR, control variables can redefine quantiles such that the lowest earning entrepreneurs are not necessarily in the lowest conditional quantiles. Instead, entrepreneurs in the lowest conditional quantiles are those whose income is lower than expected given the explanatory covariates in the model (Maclean, Webber, & Marti, 2014). Thus, the marginal effect of a specific explanatory variable is defined by the values of other covariates for a given quantile. Alternatively stated, the linearity of the OLS expectation operator that assures the conditional mean $E(Y|X) = X\beta$ equals the unconditional mean $E(Y) = E(X)\beta$ does not apply to nonlinear operators such as quantile estimators. Firpo et al. (2009) note that it is possible for CQR and UQR parameter estimates at a given quantile to be statistically significant but have opposite signs using the same data set. Thus, CQR is inappropriate for estimating the unconditional marginal effect of an explanatory variable on income at each quantile of the unconditional income distribution.

In contrast, the UQR estimator combines the statistically attractive interpretation of the OLS estimator with the ability to estimate unconditional marginal parameter effects at various quantiles of the dependent variable distribution. The UQR estimator allows the researcher to interpret parameter coefficients in a manner similar to OLS coefficients because the UQR estimator respects the law of total expectations (also referred to as the law of iterated expectation). Moreover, UQR defines quantiles *pre-estimation*; including additional explanatory variables helps to net out spurious associations between each independent variable and income, but does not affect which observations are assigned to a given income quantile.

3 | METHODOLOGICAL APPROACH AND DATA

3.1 | Conceptual model

This research posits a functional relationship between the self-employed income level and individual personal attributes, economic and social/institutional assets available to the entrepreneur, and the economic environment the entrepreneur operates within. The dependent variable is self-employment income for entrepreneur i (Y_i), and is defined by the following broad categories of variables:

$$Y_i = f(P_{in}, R_{ik}, S_{ij}, A_{ir}). \quad (1)$$

P_{in} is a vector of n personal and family attributes for entrepreneur i , R_{ik} is the k resources available to the i th entrepreneur, S_{ij} is a set of variables which characterize the industry j the entrepreneur operates in, and A_{ir} captures a set of regional agglomerative effects in geographic region r . Regions are defined as the PUMA region which is used by the U.S. Census Bureau in reporting economic and demographic data. The specific description of the variables included in this study, plus the construction of additional variables used is presented in the data section.

3.2 | Data

The 2008 American Community Survey (ACS) data contained in the Integrated Public Use Microdata Series (IPUMS) is used in this study. This data source was selected because it provides a large, unbiased sample of a selected population of the states of interest.⁸ The ACS is conducted annually by the U.S. Census Bureau and provides data on

⁸The annual ACS survey excludes areas (counties or cities of less than 65,000 in population (U.S. Census Bureau, 2018) and hence might be biased toward urban areas. However, our dataset included a sizeable number of observations outside urban areas (27.3% non-metropolitan residents) and we feel that it is representative. We would like to thank the reviewers for clarification of this point.



population and housing characteristics. In the IPUMS database, U.S. Census microdata is converted “into a single harmonized database with uniform documentation, without losing any significant information contained in the existing samples” (Ruggles et al., 2008, p.4). This database also includes constructed variables which use the original Census data to allow family member records to be linked (Ruggles et al., 2008).

Several selection criteria were used to identify entrepreneurs from this dataset. Individuals outside the ages of 25 and 65 were excluded as they are not likely to be fully active in the labor market. In addition, individuals active in the labor force were identified using IPUMS variables employment status and labor force status.⁹ The class of worker variable¹⁰ was used to identify individuals who were identified as “self-employed” as their primary labor market activity. Entrepreneurs who have a full-time wage or salary job, or who operate a secondary business, or who farm only on the weekends or as a hobby, are also excluded. The final data set contains 8,808 entrepreneurs in the three state region during the year of analysis (2008).

3.2.1 | Description of variables

The hypothesized relationships between entrepreneurial income and the variables in this analysis are summarized in Table 1 and are discussed below.

Dependent Variable (Y_i): The dependent variable is entrepreneur i 's income earned through self-employed activities. Data for this variable is drawn from the self-reported INCBUS00 variable in the annual ASC survey which reflects pre-tax self-employment income derived from sampled businesses or farms (Ruggles et al., 2008).

Personal and Family Characteristics (P_{in}): Factors which affect individual and family productivity are hypothesized to affect the self-employed income level. These variables include demographic characteristics such the entrepreneur's age, gender, race, educational level, and household type. Binary variables were used to identify gender and race (black, non-black), and education (beyond high school = 1). Consistent with literature, we hypothesize that education has a positive effect on the self-employed income, while being black and/or female will have a negative effect (Table 1). In particular, women may be more likely to combine household work (Hundley, 2001) and possibly other part-time salary based-employment with self-employment; hence, we would expect the negative value for female.¹¹ Prior research has often used age as a proxy for experience, and hypothesized age to be positively related to self-employment income. However, more recent research by Zwan, Thurik, Verheul, and Hessels (2016) found that opportunity entrepreneurs tend to be younger and more technically skilled and earn higher income than older entrepreneurs, thus we hypothesize a negative relationship between age and self-employment income.

Additional variables are used to characterize entrepreneurial and retirement households. An entrepreneurial household is defined as one in which at least fifty percent of total household income is derived from entrepreneurial activities. Self-employed income can be greater than total family income if the entrepreneur's spouse had a net negative income. In these few instances, self-employed income is set equal to household income (100%). A retirement household is one where at least fifty percent of total household income is from retirement funds. We hypothesize that entrepreneurial households have a stronger commitment to entrepreneurial activities and expect a strong positive relationship between self-employed income and entrepreneurial households. Conversely, a strong negative relationship is expected between self-employment income and retirement households all else being equal.

In the unconditional quantile analysis, the impact of being black is hypothesized to be negative in each income quantile, but that the marginal effect decreases at higher income quantiles. Thus, while race based income discrimination may still exist, its affects are expected to be less impactful for higher self-employed income earners. Zwan

⁹The IPUMS EMPSTATD and IPUMS LABFORCE variables, respectively.

¹⁰The IPUMS CLASSWKRD variable.

¹¹We would like to thank an anonymous reviewer for this important insight.



TABLE 1 Hypothesized relationship between log of self-employed income and independent variables for OLS and unconditional Quantile regressions

Category of variable	Variable	OLS sign	Quantile Sign ¹
Personal and family characteristics (P_{in})	Age	-	- and decreasing
	Gender (male = 1)	+	+ and increasing
	Race (black =1, non-black =0)	+	+ and decreasing
	Education (greater than H. S = 1)	+	+ and increasing
	Entrepreneurial HH (yes = 1)	+	+ and increasing
	Retirement HH (yes = 1)	-	-
Resource availability (R_{ik})	Mortgage (yes = 1)	+	+ and increasing
	Health insurance (yes =1)	+	+ and increasing
	Corporation (yes =1)	+	+ and increasing
Industry structure (S_{ij})	Retail (yes = 1)	-	-
	FIRE industry (yes = 1)	+	+
	Farm (yes = 1)	-	-
Regional economic structure (A_{ij})	Financial services % of PUMA income	+	+
	Per capita income in 2005	+	+ and increasing
	Metro PUMA (yes = 1)	+	+ and increasing
	PUMA workforce utilization	?	?

¹Increasing and decreasing refer to the change in the appropriate parameter value as the quantile increases.

et al. (2016) state that opportunity self-employed attend to be male, younger, and wealthier and as indicated by Block and Wagner (2010), opportunity self-employed tend to receive higher remunerations than necessity self-employed. (As indicated earlier, women are also more likely to have salaried employment and hold a part-time self-employed job.) Accordingly, we hypothesize that the marginal effect of being male increases at higher income quantiles. We further hypothesize the relationship between education and self-employed income is stronger for higher self-employed income earners (i.e., the marginal effect is more positive). Our hypothesis is based on the observation by Block and Wagner (2010) that opportunity entrepreneurs exploit opportunities due to better information flows based on life experience, social networks, and search processes. Absorptive capacity (Cohen and Levinthal (1990)), intelligence, and cognitive abilities (Sarasvathy, Simon, and Lave (1998)) are personality traits that facilitate use of information. We see education as positively correlated with these elements. On the other hand, based on Zwan et al. (2016) that opportunity entrepreneurs are younger, we expect the relationship between age and self-employed income to be negative and stronger (i.e., the marginal effect is more negative) at higher income quantiles. Based on observation by Zwan et al. (2016) that opportunity motivated self-employed individuals have a better understanding of available financial resources and potential markets we expect the entrepreneurial household coefficient to be positive and increasing across income quantiles. For retirement households, we have no *a priori* expectation regarding the change in the value of the coefficient estimate across quantiles except that the coefficient sign remains negative over the unconditional quantiles.

Resource Availability (R_{ik}): Entrepreneurs with greater access to resources or assets can use these resources as collateral to gain access to additional resources; as such, these entrepreneurs are expected to earn higher profits and have a lower rate of business failure. Capital is especially important for entrepreneurial starts-ups, as investment by owners is the major source of capital for these firms followed by personal debt (Renski & Wallace, 2012).

Direct measures of resource availability (R_{ik}) would ideally be used to provide information on an entrepreneur's resources and success in obtaining outside sources of financing. Unfortunately, this data is not available for the



entrepreneurs in this study so proxy variables are instead developed to control for resource availability. Specifically, entrepreneurs with access to health insurance, and those who have a mortgage or who own their own home, are hypothesized to have greater access to resources; these outcomes are, in turn, hypothesized to be positively correlated with self-employed income. In addition, as owners of incorporated businesses may have enhanced business skills and access to a greater resource base relative to those who opt to operate under alternative business forms, a dummy variable is used to identify these entrepreneurs. We hypothesize that entrepreneurs of incorporated businesses are likely to have higher income than those of non-incorporated businesses. This hypothesis is consistent with findings by Shane (2003) who found incorporated businesses start-ups are generally more successful than sole proprietorships.

For the unconditional quantile analysis, we hypothesize a stronger positive relationship for the resource availability variables (health insurance, mortgage/own-home, incorporation), at lower levels of self-employed income distribution because these resources may be more beneficial for individuals with constrained (as opposed to voluntary) lower levels of self-employed income. Parker (2009) suggests that such individuals are likely to be necessity entrepreneurs. As a corollary, Zwan et al. (2016) state that opportunity self-employed tend to be wealthier.

Industry Sector (S_{ij}): Entrepreneurs operating in the finance, insurance, and real estate (FIRE) industry sectors tend to have higher self-employed income than do entrepreneurs in other sectors of the economy, and those with retail businesses tend to earn below average self-employment income (Hurst & Pugsley, 2011). Consistent with this prior research, we hypothesize that self-employment in the FIRE sectors will have a positive effect on self-employed income and self-employment in the retail sector will generate below average self-employment income. Entrepreneurs in the farming sector are expected to have below average self-employment income at all income quantiles because most farm operations are small in the three-state region.¹²

Regional Economic Structure (A_{ij}): Characteristics of a region can also affect entrepreneurial income. Goetz and Freshwater (2001) and Walzer (2007), found the level of regional self-employment income is positively correlated with capital access. Further research by Glaeser and Kohlhase (2004), find that easy capital access is one characteristic of an agglomerative economy. Because disaggregated within-state information concerning capital access is not available, the percentage of wage and salary income earned in the banking and the insurance sector (NAICS 52) relative to total wage and salary income earned in each PUMA region is used to proxy for capital access.

Agglomeration economies are believed to play a pivotal role in the growth of regional economies (Fujita & Krugman, 2004; Glaeser & Kohlhase, 2004; Low & Weiler, 2012; Shaffer et al., 2004). An entrepreneur located in a metropolitan area should benefit from agglomeration economies and have higher income than one in a non-metropolitan area. Moreover, as the economic geography literature suggests, agglomeration plays an increasingly prominent role at higher self-employment income levels (Fujita & Krugman, 2004), thus we expect the agglomeration effect will be stronger at higher-income quantiles (Table 1). In the same vein, higher income levels imply fewer necessity entrepreneurs (Parker, 2009). Thus we expect fewer necessity entrepreneurs in higher income and agglomerative affected areas.

The relationship between self-employed income and the concentration of financial services in a PUMA is less clear over the entire income distribution. One could be tempted to hypothesize that a stronger positive relationship between the two variables exists at lower quantiles, because increased access to financial services may be more critical to the ability of low-income entrepreneurs to increase their income. However, financial services are typically associated with urbanization (Glaeser & Kohlhase, 2004), and often primarily serve higher income businesses. Thus, we advance no *a priori* expectation regarding changes in the magnitude of the expected positive relationship between the concentration of financial services and self-employed income at alternative quantiles (Table 1).

¹²Half of all U.S. crop farms have less than 45 acres in production (MacDonald, Korb, & Hoppe, 2013), and in our three-state region, our analysis of Census of Agriculture data (US Department of Agriculture, 2014) indicates that 53.7% of all farms have under \$5,000 in annual sales.



The PUMA workforce utilization variable is constructed as the percentage of 25 to 65 year-old individuals employed relative to the total population in that age range in a PUMA. Because the literature offers competing hypothesis, we offer no hypothesis concerning the relationship between labor market tightness and self-employed income. For example, as the workforce utilization rate increases, one might expect the number of necessity entrepreneurs to decline due to increased opportunity for wage and salary work. Given the well-established relationship between increases in necessity entrepreneurs and decreases in average earnings of self-employed individuals (Koellinger & Thurik, 2012; Low & Weiler, 2012), one could argue the relationship between workforce utilization and entrepreneurial income is positive because low-income entrepreneurs may shift into higher paying salaried opportunities causing average entrepreneurial income to increase. Alternatively, as high-income entrepreneurs often hire employees, an increase in the workforce utilization rate might require entrepreneurs to pay higher wages to compete for workers. In this case, a negative relationship between workforce utilization and self-employed income might be expected.

A region's income level may be related to the extent of opportunity and income-earning potential of entrepreneurs in a PUMA region. Given this, per capita PUMA income in 2005 is included as a control variable. We hypothesize a positive relationship exists between self-employment income and per capita income in the OLS analysis. We further hypothesize that the marginal impact of PUMA per capita income becomes larger at higher income quantiles in the UQR model based on research that opportunity entrepreneurs have higher incomes and that opportunities should be greater with higher local incomes.

3.3 | Estimation approach

This analysis assesses the effects of personal attributes (age, gender, race, education), and household type (primarily an entrepreneurial household or retirement household) on an entrepreneur's self-reported income. We, also test the role of assets (mortgage/own-home, health insurance, incorporation), type of business (retail, financial, or farm), and agglomerative effects of the regional economy (concentration of financial services in a PUMA, 2005 PUMA per capita income, and the importance of a PUMA being located in a metropolitan area). Stata statistical software was used to estimate all results. Firpo et al. (2009) RIF-REG UQR program (a Stata add-in) was used to estimate the UQR results.

The natural log of self-employed income is the dependent variable in all regressions. Thus, all reported regression parameters are semi-elasticities. Briefly, a regression model where the dependent variable is individual self-employed income (Y_i) consisting of n explanatory variables, estimated in semi-log form has the functional form. For the semi-log form, the marginal impact on the dependent variable for a change in explanatory x variable (say x_1), is calculated as $\Delta \ln(Y) = \beta_1 \Delta x_1$. Following Thornton and Innes (1989), the percentage change in predicted self-employment income for a one unit change in each explanatory variable is calculated as $\% \Delta Y = \exp(\beta_1) - 1$.

The UQR estimator is implemented using Recentered Influence Functions (RIF) to derive unconditional quantile estimates (see Firpo et al. (2009) for details). In the RIF-OLS estimation approach each unconditional quantile is evaluated marginally over the distribution of the vector of explanatory variables and is defined independently of the values of the covariates in the model. Thus, the RIF-OLS UQR procedure accurately measures the unconditional marginal effect of each explanatory variable on dependent variable at different quantiles of the unconditional dependent variable distribution (Park, 2015).¹³ Residuals of initial OLS estimates exhibited a significantly skewed heteroscedastic error distribution. Due to this, the natural log of self-employed income was used to create a homoscedastic error structure.

In addition to standard testing of the statistical significance of coefficient estimates, useful insights can also be gained by testing for differences in variable significance between quantiles. A significant difference in a specific parameter estimate between quantiles would provide evidence of a changing relationship between the dependent variable (natural log income) and the independent variable across the distribution of the dependent variable. To

¹³In quantile analysis, all observations are to estimate coefficient values at each quantile level. Thus in this analysis, all quantiles are estimated with 8,008 observations.



assess this differences between two quantiles, a confidence interval was constructed for each quantile at a given probability level. If the two confidence intervals do not overlap the null hypothesis that the parameter value is equal in both quantiles is rejected at the specified probability level.

4 | RESULTS AND DISCUSSION

Descriptive statistics for the explanatory variables used in the OLS and UQR models are presented in Table 2. The top and bottom portions of this table respectively summarize the data for the continuous and categorical variables. Self-employed income is highly varying, with a mean of \$58,015, and ranges from a low of \$50 to a high of \$673,000 with a standard deviation of \$79,755 for the 8,808 observations. The average age of the sampled self-employed is 47.0 with a standard deviation of 9.84. Other continuous variables reflect the nature of the economic region (the PUMA region) in which the self-employed individual operates. Average PUMA per capita income is \$24,312 but varies widely across the 148 PUMA regions in the three states. Although not reported in Table 2, population density also varies widely by PUMA region. Average population density is 354 individuals per square mile with a standard deviation of 408 individuals and reflect the heterogeneity of the environment in which entrepreneurs operate. The share of financial services in PUMA income ranges from 2.45% to 21.51% with a mean of 6.98% across all PUMA units.

Self-employment income varied considerably with the entrepreneur's gender; average self-employed male income (\$69,343) is almost twice the average self-employed female income (\$35,394). Similarly, average self-employed income for individuals with a mortgage or who own their own home (\$61,379) is nearly twice those who are not home owners (\$35,178). Having health insurance, an incorporated business, more than a high school education, and being of a race other than black are all associated with higher self-employed income. Self-employed individuals working in FIRE industries have higher average income than those in retail, farming and other industries. These outcomes are highly consistent with descriptive results found elsewhere in the literature.

4.1 | Regression results

The ordinary least squares (OLS) regression and unconditional quantile regression (UQR) results are presented in Table 3. The OLS results are consistent with the literature; the impact of all personal and family attributes on self-employed income have the expected sign. Being older, male, non-black, and better-educated all led to greater levels of self-employed income and are statistically significant ($p < 0.01$). UQR estimates are reported for the 0.10, 0.25, 0.50, 0.75, and 0.90 quantiles. The UQR coefficients for gender, race, and education are generally significant and consistent with the OLS results in that the coefficient for each quantile has the expected positive sign and is statistically significant. UQR results for age, however, reveal a more varied picture. The age coefficient is either insignificant, or negative and significant, for all quantiles equal to or below the 0.50 quantile, before turning positive and highly significant at all quantiles above the 0.50 quantile. Thus the UQR results do not support our premise that the impact of age is consistently negative over the entire income distribution.

We hypothesized that the advantages of being non-black would be positive throughout the income distribution but monotonically decrease at each subsequent higher quantile level. However, our hypothesis only holds through the 0.50 quantile. Above the 0.50 quantile, the estimated race coefficient unexpectedly increases at each successive higher quantile. As subsequently discussed, these results along with others speak to the disadvantage that some demographic groups may still have at higher income levels.

Table 4 translates our empirical estimates into percentage impacts for all OLS and reported quantile parameters. The UQR results support our contention that education has an increasingly positive effect on self-employed income at higher income quantiles. The marginal effect for the education parameter monotonically increases across the five-reported quantile groups. The impact of additional education on entrepreneurial income at the 0.10 quantile is 12.8%



TABLE 2 Summary statistics for continuous and categorical variables

Variable	Description	Self-employed income		% of observations
		Mean (Std. Dev.)	Range (min.- max.)	
Self-employed Income ^a	Dependent variable	\$58,015 (\$79,755)	\$50-\$673,000	
Age ^a		46.96 (9.84)	25-65	
Per capita Income ^a	Per capita income by PUMA, 2005	\$24,312 (7,238)	\$13,243-\$59,919	
Financial Services ^a	PUMA income derived from financial services (NAICS 52; %)	6.98% (3.82%)	2.45%-21.51%	
Workforce Utilization ^a	Workforce utilization by PUMA (%)	73.04% (5.32%)	55.20%-82.57%	
Race ^b	Black	\$40,393		10.7%
	Non-black	\$60,122		89.3%
Gender ^b	Female	\$35,394		33.4%
	Male	\$69,343		66.6%
Education ^b	Greater than high school	\$71,218		59.4%
	High school or less	\$38,696		40.6%
Ent. HH ^b	Self-employed share of household income >0.5	\$78,749		54.6%
Retire HH ^b	Retirement share of household income >0.5	\$15,430		1.2%
Industry-FIRE ^b	Employed in FIRE	\$74,050		9.8%
Industry-Retail ^b	Employed in retail	\$46,395		8.0%
Industry-Farm ^b	Employed in farming	\$64,337		2.2%
Industry-Other ^b	Employed in other Ind.	\$57,033		80.0%
Mortgage ^b	Has mortgage/own	\$61,379		87.2%

Note:

^aN = 148 for PUMA variables (SC = 27, NC = 58, GA = 63).

^bN = 8,808 for individual variables.



TABLE 3 OLS and select Quantile estimates and standard errors (0.10, 0.25, 0.50, 0.75, and 0.90)

Parameter	OLS	Quantile regression				
		0.10	0.25	0.50	0.75	0.90
Constant	8.655*** (0.184)	7.284*** (0.545)	8.162*** (0.318)	8.810*** (0.239)	9.296*** (0.223)	9.341*** (0.427)
Age	0.00218** (0.00107)	-0.00237 (0.00292)	-0.00499** (0.002)	0.000754 (0.00113)	0.00411*** (0.00136)	0.0114*** (0.00257)
Gender (male = 1)	0.372*** (0.0229)	0.554*** (0.0702)	0.486*** (0.0619)	0.299*** (0.0338)	0.221*** (0.0286)	0.351*** (0.0464)
Race (black = 1)	-0.146*** (0.0333)	-0.145 (0.0918)	-0.122** (0.0613)	-0.0576* (0.0309)	-0.0976*** (0.0373)	-0.213*** (0.0602)
Education (greater than H.S. = 1)	0.257*** (0.0217)	0.120* (0.0616)	0.173*** (0.0435)	0.249*** (0.0338)	0.346*** (0.0301)	0.462*** (0.0549)
Entrepreneurial HH (yes = 1)	1.099*** (0.0277)	1.489*** (0.182)	1.266*** (0.114)	0.916*** (0.0819)	0.943*** (0.0487)	1.069*** (0.0701)
Retirement HH (yes = 1)	-0.862*** (0.172)	-2.474*** (0.748)	-1.408*** (0.315)	-0.525*** (0.128)	-0.277** (0.109)	-0.355*** (0.0956)
Mortgage/own (yes = 1)	0.340*** (0.0322)	0.359*** (0.102)	0.399*** (0.0686)	0.243*** (0.0392)	0.278*** (0.0366)	0.391*** (0.0566)
Health insurance (yes = 1)	0.383*** (0.0250)	0.287*** (0.055)	0.412*** (0.0543)	0.383*** (0.0388)	0.431*** (0.0329)	0.449*** (0.0413)
Corporation (yes = 1)	0.485*** (0.0204)	0.675*** (0.073)	0.565*** (0.0606)	0.420*** (0.0393)	0.400*** (0.0329)	0.451*** (0.0611)
Ind. - retail (yes = 1)	-0.106*** (0.375)	-0.111 (0.0907)	-0.0168 (0.0583)	0.00029 (0.0386)	-0.109** (0.0425)	-0.279*** (0.0780)
Ind. - FIRE (yes = 1)	0.123*** (0.0340)	0.138 (0.0899)	0.110** (0.0533)	0.116*** (0.0316)	0.114*** (0.0441)	0.0345 (0.0826)
Ind. - farm (yes = 1)	0.180** (0.089)	0.358** (0.176)	0.318** (0.131)	0.168* (0.0919)	0.0458 (0.103)	0.141 (0.200)
Financial services % of PUMA Total	0.325 (0.228)	1.072* (0.614)	0.747* (0.399)	0.445* (0.237)	-0.331 (0.330)	-0.187 (0.581)
PUMA per capita income 2005 (1,000 \$)	0.0118*** (0.00213)	0.00325 (0.00486)	0.00503 (0.00344)	0.00443** (0.00213)	0.0142*** (0.00284)	0.0256*** (0.00646)
Metro PUMA (yes = 1)	0.0948*** (0.0277)	0.0839 (0.0825)	0.118** (0.0473)	0.0465* (0.0282)	0.0653* (0.0364)	0.151** (0.0590)
PUMA workforce utilization (%)	-0.906*** (0.282)	-0.998 (0.703)	-0.862* (0.465)	-0.521*** (0.261)	-0.682** (0.342)	-1.058* (0.627)

Note. N = 8,808 in all unconditional quantile regressions and the OLS regression.

*(**, ***) denotes significance at the 10 (5, 1) % level.

**TABLE 4** Change (%) and tests of differences in Quantile estimates of self-employment income

Variable	Quantile regression						Comparison of Quantile Results ¹		
	OLS	0.10	0.25	0.50	0.75	0.90	0.10 Vs. 0.50	0.50 Vs. 0.90	0.10 Vs. 0.90
Age	0.2%	-0.2%	-0.5%	0.1%	0.4%	1.2%	*	***	**
Gender (male = 1)	45.1%	74.0%	62.6%	34.8%	24.7%	42.0%	***	NS	*
Race (black = 1)	-13.6%	-13.5%	-11.5%	-5.6%	-9.3%	-19.2%	NS	*	NS
Education (> than H.S. = 1)	29.3%	12.8%	18.9%	28.3%	41.3%	58.7%	NS	***	***
Entrepreneurial HH (yes = 1)	200.1%	343.3%	254.7%	149.9%	156.8%	191.2%	***	*	*
Retirement HH (yes = 1)	-57.8%	-91.6%	-75.5%	-40.8%	-24.2%	-29.9%	***	*	***
Mortgage/own (yes = 1)	40.5%	43.2%	49.0%	27.5%	32.0%	47.8%	NS	***	NS
Health insurance (yes = 1)	46.7%	33.2%	51.0%	46.7%	53.9%	56.7%	NS	*	*
Corporation (yes =1)	62.4%	96.4%	75.9%	52.2%	49.2%	57.0%	***	NS	*
Industry - retail (yes = 1)	-10.1%	-10.5%	-1.7%	0.0%	-10.3%	-24.4%	NS	*	NS
Industry - FIRE (yes = 1)	13.1%	14.8%	11.6%	12.3%	12.1%	3.5%	NS	NS	NS
Industry - farm (yes = 1)	19.7%	43.0%	37.4%	18.3%	4.7%	15.1%	NS	NS	NS
PUMA-financial service (%)	0.4%	1.9%	1.1%	0.6%	-0.3%	-0.2%	NS	NS	NS
PUMA PCI 2005 (\$1,000 s)	1.2%	0.3%	0.5%	0.4%	1.4%	2.6%	NS	***	**
Metro PUMA (yes = 1)	9.9%	8.8%	12.5%	4.7%	6.8%	16.3%	NS	NS	*
Workforce utilization (%)	-0.6%	-0.6%	-0.6%	-0.4%	-0.5%	-0.6%	NS	NS	NS

Note. Bolded percentages are not statistically significant different from 0 at a 10% or higher level of significance.

¹ ***, **, and *denote statistical significance at the 0.001, 0.05, and 0.10 level respectively for a difference in the quantile parameter estimate at the tested quantile levels. NS = not statistically different between quantiles.

and monotonically increases to 58.7% at the 0.90 quantile. This reflects an increasingly strong interaction between education and income at higher income quantiles.

In the OLS analysis, the effect of the household type control variables for residing in either an entrepreneurial or a retirement household had the hypothesized signs (positive and negative, respectively). These results are not surprising and are consistent with the hypothesized relationships. From the UQR results we find the marginal entrepreneurial household impact on additional entrepreneurial income exhibited a “U-shaped” pattern over income quantiles. At quantiles less than or equal to 0.50, the marginal effect monotonically decreases with increases in the quantile before consistently increasing successively higher quantiles. However, the percentage effect on self-employment income is much larger for quantiles below 0.50 than above this level (Table 4). Conversely, as expected, the marginal effect of residing in a retirement household significantly decreased self-employment income across all quantiles. Not unexpectedly, however, in percentage terms, being in a “retirement household” has a smaller negative impact on self-employment earnings at higher than at lower income levels.

Variables that serve as proxies for resource availability (mortgage, health insurance, and corporation status) had the expected positive sign and were statistically significant ($P < 0.01$) in both the OLS and UQR analysis (Table 3). Moreover, the UQR results generally support our hypothesis that resource access increases in importance at higher quantiles. As reported in Table 4, the impact of having access to health insurance increased almost monotonically over the five reported quantiles.¹⁴ Incorporation status was statistically significant ($P < 0.01$) for all quantiles. The impact of business incorporation on entrepreneurial income followed a pattern somewhat similar to gender and race;

¹⁴At the 0.50 quantile, health insurance had a slightly lower percentage impact on self-employment income relative to the 0.25 quantile coefficient.



the effects of incorporation decline up to the 0.50 quantile (as expected) before increasing at higher quantiles. The greatest percentage impact of incorporation was found at quantiles less than or equal to 0.25, suggesting low income entrepreneurs that incorporate may have superior business management skills. The mortgage marginal effect pattern over quantiles also exhibits a general U-shaped pattern. The percentage impact is lowest at the 0.50 quantile (27.51%) before increasing to 47.85% at the 0.90 quantile. As discussed later, these results along with others speak to the advantage of resource availability at higher income quantiles.

The OLS results for the industry variables were somewhat consistent with our maintained hypotheses. FIRE was associated with higher, and retail was associated with lower self-employed income relative to the aggregated group of "other" industries. However, counter to our expectation, in the OLS analysis farming is associated with relatively higher self-employed income.¹⁵ The UQR results, however, offer a much more nuanced look at these results. Working in the retail sector had a significant negative impact on income only for income quantiles in excess of 0.50 (Table 3). Moreover, the positive impact of working in the FIRE sector of the economy only had a statistically significant positive income impact on quantiles between 0.25 and 0.75. Finally, the quantile analysis revealed the statistically significant positive income impact of working in the farming sector is limited to quantiles less than or equal to the 0.50 quantile. Moreover, the marginal effect of the farming sector on entrepreneurial income monotonically decreases at sequentially higher quantiles in this quantile range (10% to 50% quantiles).

The results for the regional economic structure parameter estimates (2005 per capita income, metropolitan status, relative size of the financial sector, and workforce utilization rate) are somewhat mixed in their ability to explain the variance in self-employed income. In the OLS analysis, the concentration of financial services on self-employed income was insignificant (Table 3). However, the UQR analysis tells a different story. The concentration of financial services has a significant positive relationship on all quantiles less than or equal to 0.50 (Table 3), but the percentage impact monotonically decreases over this quantile range (Table 4). This implies greater access to a robust financial services sector benefits lower-income entrepreneurs more than higher-income entrepreneurs and is consistent with Conroy, Low, and Weiler (2017).

In the OLS analysis, the workforce utilization rate parameter is negative and statistically significant ($P < 0.01$). Thus, tighter labor markets seem to reduce self-employment income. The UQR analysis refines this result; the estimated UQR parameters are statistically significant only for quantiles at or above the 0.25 quantile. One possible explanation may be that as labor markets tighten, individuals lacking the skills to compete for higher wage jobs become lower earning necessity entrepreneurs. As reported in Table 4, for each one percent increase in labor force utilization, entrepreneurial earnings decrease by about 0.50 percent in the upper income quantiles. Alternatively, the decrease in entrepreneurial earning may result from high-income entrepreneurs, who likely have hired employees, paying their employees higher wages in tight labor markets. The greatest percentage reduction in entrepreneurial income occurs at the 0.90 quantile.

This analysis provides some support for agglomerative type impacts on self-employed income. In the OLS results, both 2005 PUMA per capita income and metropolitan status are significant and positively related to 2008 self-employment income ($P < .01$). More detail is offered through the UQR results which support our contention that agglomerative type effects are stronger at higher income quantiles. The impact of lagged 2005 per capita income is significant only at the 0.50 quantile and higher quantiles ($P < .01$) and the impact of working in a metropolitan PUMA is significant at the 0.25 and higher quantiles (Table 3). Moreover, as reported in Table 4, the percentage impacts of these two variables is greatest in the 0.90 quantile.

4.2 | Discussion of results

Overall, the UQR estimates for the marginal effects of personal characteristics (male, black, education, and household type), access to resources (mortgage/own home and health insurance), and the nature of the regional economy

¹⁵As one reviewer noted, given the nature of the data used in this analysis, perhaps the result of farming should have been expected.



(workforce utilization, metropolitan status, 2005 per capita income) vary with the quantile level. Focusing on personal characteristics, the marginal benefit of being older, male, non-black, and better educated significantly increases with the income quantile. For example, an additional year of age increases self-employment income by 1.15% at the 0.90 quantile, versus 0.41% at the 0.75 quantile. Entrepreneurial income of black individuals is 19.18% less than those of other races at the 0.90 quantile but (only) 9.30% less at the 0.75 quantile. Males earn 42.05% more than females at the 0.90 quantile, compared to 24.73% more at the 0.75 quantile. Having greater than a high school education increases income by 58.72% at the 0.90 quantile, versus 41.34% at the 0.75 quantile. While the results for education and female are not surprising, the results concerning black entrepreneurs are somewhat contrary to our expectations; we expected lower income levels for black entrepreneurs but hypothesized the impact would decrease at higher income quantiles. Likewise, based on Zwan et al. (2016) our hypothesis that age would lead to relatively lower incomes in the higher quantile levels did not hold. Instead, this analysis offers support for the more traditional approach that age is a proxy for experience and is positively and increasingly important at higher income quantiles.

Resource access generally has the greatest impact at the highest income quantile. For example, entrepreneurs with a mortgage or who own a home had 47.85% more income at the 0.90 quantile, and 27.51% more at the 0.50 quantile. Having health insurance had a nearly monotonically increasing positive impact across quantiles, with the largest at the 0.90 quantile of 56.67%. These findings are consistent with our hypothesis that having access to these resources would have a greater percentage impact on high income entrepreneurs.

Several of the regional agglomeration variables also have their highest percentage impact at the 0.90 quantile. A \$1,000 increase in 2005 PUMA per capita income increases 2008 entrepreneurial income by 2.59% at the 0.90 quantile, but by no more than 0.50% at any quantile less than 0.75. Similarly, working in a metro region increases entrepreneurial income by 16.30% at the 0.90 quantile, by 4.76% at the 0.50 quantile and is insignificant at the 0.10 quantile. Collectively these results imply that regional agglomeration offers relatively more benefits to higher income entrepreneurs. As an exception to this general rule, the concentration of financial services within a PUMA is positive and statistically significant only at quantiles less than or equal to the 0.50 quantile, indicating that an increased availability of financial services primarily benefits lower income entrepreneurs as noted in recent research by Conroy et al. (2017).

4.3 | Comparing results across quantiles

The three rightmost columns of Table 3 contain significance tests for differences between quantile coefficient estimates at three quantile levels. Due to space limitations, the statistical tests are limited to testing for differences between the 0.10, 0.50, and 0.90 quantiles.¹⁶ Across these quantiles, three coefficients were found to be statistically different at the 0.10 significance level or higher. The coefficients for age, entrepreneurial household, and retirement household are significantly different from each other at all three quantiles at the 0.10 or higher level. The coefficient for age has the lowest statistical significance of a difference between the 0.10 versus the 0.50 quantiles. This outcome is driven by the 0.10 quantile age coefficient outcome which is not significantly different from zero and has a very high standard error. However, due to the generally increasing age coefficient over quantiles the age coefficients are statistically different at the 0.95 significance level when compared across the 0.10 versus 0.90 quantile level.¹⁷

In addition to the entrepreneurial household and retirement household coefficients being highly significant in each quantile regression ($P < 0.01$) with the appropriate sign, there are significant differences in the magnitude of their respective marginal effect between quantiles. The marginal effect for an entrepreneurial household is significantly greater, and for a retirement household is significantly lower on entrepreneurial income at the 0.90 quantile than at the 0.10 or 0.50 quantiles.

¹⁶These three quantiles were selected because they offer the starkest test of possible differences in coefficient estimates between quantiles.

¹⁷This is also the result of the smaller standard deviation of the age coefficient in the 0.90 than the 0.50 quantile.



Although all resource availability coefficients (mortgage/own home, health insurance, and corporation status) are positive and highly significant ($P < 0.01$) in each quantile regression, these coefficient estimates do not always significantly differ between quantiles. For example, the marginal effect of having health insurance on entrepreneurial income is significantly greater at the 0.90 quantile than at either the 0.50 or 0.10 quantiles, but there is no significant difference between the 0.10 and 0.50 quantiles. Conversely, corporation status has a much greater marginal impact at low income quantiles (0.10) than higher income (0.50, 0.90) quantiles.

There are also differences in the marginal effect of the agglomeration variables, lagged per capita income and metropolitan location, over quantiles. The coefficients for these agglomeration variables are significantly more positive at the 0.90 than the 0.10 quantile ($P < 0.05$). In summary, the marginal income effect of explanatory variables can significantly vary between income quantiles and this initial case analysis supports the use of unconditional quantile analysis in understanding entrepreneurial earnings.

5 | CONCLUSIONS

It has been claimed that entrepreneurship growth is one path to building and sustaining urban and rural regional economies (Edmiston, 2007; Henderson, 2002). Proponents argue that economic development practices that enhance and support entrepreneurship are essential because they cultivate innovation that, in turn, creates new jobs, new wealth, and a better quality of life. However, the income of self-employed workers, as opposed to just the number of self-employed, is a critical policy concern because economic development occurs through increases in income and not just employment. This distinction is important. Identifying and quantifying the personal, cultural, and regional economic factors that influence self-employed income provides policy makers with another tool to examine and better understand the mechanisms through which entrepreneurship can enhance regional economic development. This study represents an initial step in the analysis of a comprehensive set of determinants of individual self-employed income. Uniquely as well, this study employs an unconditional quantile regression approach to disentangle and separately examine the relationships between individual socio-economic factors and regional economic characteristics across different strata of the self-employed income distribution.

The OLS results generally met our *a priori* expectations. Being male, non-black, better educated, and having access to resources (mortgage/own-home, health insurance and incorporation) all led to higher income levels, and entrepreneurs living in retirement households had much lower self-employed income. However, in contrast to our expectation, age had a highly significant positive impact ($P < 0.01$), and not negative impact on income. As expected, entrepreneurs working in the retail sector had lower, and those working in FIRE sectors had higher self-employment income relative to those who derived entrepreneurial income from other industries. At the regional level, residing in a metropolitan area, or a location with higher than average lagged PUMA per capita income both increased self-employment income.

The UQR analysis provides insight into how the marginal effect of the explanatory variables vary over self-employed income distribution. The UQR results were generally consistent with our hypothesis for education and gender but not for age or race. We correctly hypothesized that the negative marginal effect of being a woman would increase with the quantile level. However, we incorrectly hypothesized that the positive marginal effect of being non-black would decrease at higher quantile levels. Our hypothesis that age would be negative and increasingly more negative across quantiles is rejected. Instead, age is significant and increasingly more positive across quantiles beginning at the 0.50 quantile. The most profound and, upon reflection, a not surprising outcome of this analysis is the clear advantage that more education, access to resources and, to a lesser extent, a more prosperous regional economy contributes to self-employment income across all income quantiles.

Using the UQR analysis offers additional insights into the impact of explanatory variables not evident through OLS regression. In the OLS analysis, the importance of the financial service sector in a PUMA was insignificant in explaining entrepreneurial income. However, in the UQR, the relative presence of the financial service sector was



found to be significant at or below the 0.50 quantile where it had a significant positive impact on self-employment earnings, suggesting that lower income earners benefit from increased access to financial services. Another interesting contrast between the OLS and UQR results is the impact of age on earnings. In the OLS results age is highly significant and positively related to income ($P < 0.01$), but the UQR results suggest a different story. At low quantiles, the estimated coefficient for age is either insignificant or negative before turning positive and highly significant at quantiles above 0.50 ($P < 0.01$). Several circumstances may account for this observation. This might, for example, reflect that when establishing their businesses, younger (new) entrepreneurs are drawn into a different set of (more profitable) industries than are older entrepreneurs, or that younger and older entrepreneurs differ in their strategies concerning income withdrawal from their business.¹⁸ Also, it may be that older entrepreneurs own more established businesses from which they can afford to draw a larger income. The agglomeration effect of working in a metropolitan area also varied across quantiles, and the percentage effect monotonically increased beginning with the 0.50 quantile.

5.1 | Opportunities for future research

The analytical approach used herein offers unique and nuanced insights into how the determinants of self-employed income vary across self-employed income strata. Implementing this approach to other settings and time periods is likely to reveal additional important information which could be useful in explaining both past entrepreneur success (or lack thereof), and offer guidance as to how entrepreneurs of different types can be better supported. Micro-level survey data would be particularly useful to more completely quantify the relationship between entrepreneurial access to resources and self-employment income. Using such data in analysis that examines the determinants of self-employed income, in general or for those in a particular industry, in a longitudinal manner could further reveal how the relative importance of determinants of entrepreneurial income change with an entrepreneur's experience or industry environment. Alternatively, an expended cross-section analysis which considers other time periods would be useful in gaining insights into the determinants of success for opportunity entrepreneurs who may be more prevalent during different phases of the business cycle. In a similar vein, the move to "gig economy" jobs such as driving rideshares and freelancing (Katz & Krueger, 2017) offers another potentially useful application of this analytical approach as this form of employment would potentially have a different set of factors affecting entrepreneur income and success. Future research could also include a better accounting for the motivation for self-employment, by for example better determining whether individuals are drawn into self-employment through opportunities or necessity. In this regard, Bunten et al. (2015) used business deaths and establishments to assess the impact of entrepreneurs on regional economies.

5.2 | Policy implications

An array of public policies are designed to support economic growth through generating new jobs and/or increasing the income of those who are already employed. Among these are programs geared toward current entrepreneurs, or those considering a switch to this form of employment. General entrepreneur support programs, however, are unlikely to close the equity gaps that, while previously known, have been further revealed through this analysis. Likewise, being non-white is a barrier to income growth in higher income quantiles. Designing programs that promote minorities as opportunity entrepreneurs could be an appropriate policy response. Results for the UQR demonstrate the important extent to which an entrepreneur's income is affected in statistically and economically significant ways by their personal attributes and resources, and characteristics of their industry and region. Attributes and circumstances faced by self-employed workers in high income versus low income quantiles appear to be bundled, allowing a multi-dimensional composite of these entrepreneurs to be developed. This information can be used to better tailor

¹⁸This suggestion is consistent with findings by Zwan et al. (2016) and Block and Wagner (2010).



and target entrepreneur training and support programs, investment opportunity funds, and other advisory services, to specific demographic groups and/or geographic areas.

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Resumen. El conocimiento de los determinantes de los ingresos del trabajo por cuenta propia es fundamental para las estrategias de desarrollo empresarial cuando el objetivo de desarrollo es aumentar los ingresos y no sólo el empleo. Se utiliza la regresión de cuantiles incondicionales con datos de la Encuesta de la Comunidad Estadounidense para investigar las diferencias en la relación entre los ingresos empresariales y una serie de características individuales, industriales y regionales de la distribución de los ingresos del empleo por cuenta propia. Los atributos personales, como la educación, la raza, la edad y el género, explican las diferencias en los ingresos del trabajo por cuenta propia y su importancia varía en toda la distribución de los ingresos. Los efectos de aglomeración regionales son significativamente positivos y más fuertes en el extremo superior de la distribución de los ingresos de los trabajadores por cuenta propia.

抄録: 成長目標が、雇用だけでなく所得も増加させることである場合、アントレプレナーの成長戦略では、個人事業主の所得の決定要因に関する知識が非常に重要となる。アメリカン・コミュニティ・サーベイ (American Community Survey) のデータを用いて、無条件分位点回帰法により、アントレプレナーの所得と、個人事業主の所得分布全体における個人、産業、地域の特性との関連性における相違を検討する。学歴や人種、年齢などの個人特性および性別のどちらによっても個人事業主の所得の差を説明することができ、所得分布全体ではこれらの重要性は様々である。地域における集積効果は、有意にプラスであり、個人事業主の所得分布の上位において強力である。