THE EFFECT OF INCOME ON QUALITY OF LIFE AND SURVIVAL EXPECTATION AMONG OLDER ADULTS IN AMERICA: EVIDENCE FROM THE SOCIAL SECURITY NOTCH

by

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(Under the Direction of Patryk Babiarz)

ABSTRACT

The Social Security retirement income program provides financial support for older adults in America and is the primary source of income for retirees. As the inflows into the Social Security Trust Fund become smaller than outflows, it is projected that the Social Security Trust Fund will become insolvent by 2035. A potential future reduction in retirement benefits may constitute a significant risk for quality of life of older adults. Previous studies examined the relationships between income, life satisfaction, well-being, and quality of life among older adults, but the causal pathways are not yet fully explained. The purpose of this study is to identify latent dimensions of the perceived quality of life of older Americans and to estimate the causal effect of Social Security retirement income on these aspects of life quality, as well as on a 10-year survival expectation. To overcome the problem of endogeneity of income, I adopt a two-stage estimation procedure which uses the Social Security "notch" as an instrument for retirement income. The term "notch" refers to variation in Social Security benefits paid to people born between 1917 and 1921 that resulted from the Social Security administration's unintended mistake in the formula for cost-of-living adjustment. The data is drawn upon the 1993 Asset and

Health Dynamics Among the Oldest Old, a supplement to the Health and Retirement Study. I find positive and statistically significant relationship between the amount of Social Security retirement income received and the perceived quality of life as measured by items that correspond to feelings of living a fulfilled life and being in control of one's life. At the same time, income does not appear to be a determinant of being forward-looking or hopeful among older adults in America. Similarly, I do not find convincing evidence that income significantly affects optimism regarding survival as measured by reports of one's expected longevity. Overall, my findings suggest that a potential reduction in future Social Security benefits may inflict damage on some aspects of perceived quality of life among older adults.

INDEX WORDS: Effect of income, Quality of life, Survival expectation, Older adults, Social Security notch, Two-stage least squares, Instrumental variable estimation

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DEDICATION

To my lifelong friends across the states and nations. To my friends, staffs, and faculties at the Department of Financial Planning, Housing, and Consumer Economics, and the Department Health Policy and Management at the University of Georgia. To my spiritual families at Servant Korean Evangelical Church of Atlanta. To my loving grandparents in Heaven. To my relatives in Korea. To my parents, who have passed on the greatest heritage one could ask for, the heritage of faith, unto my sister, my brother, and me. Mom and dad, I sincerely thank you for your unconditional love and all the sacrifices you have made for us. To my siblings and brother-in-law who always believe in me, and love and accept me just the way I am. I also dedicate this dissertation to all organizations and personnel who continue to commit their time, energy, and vision to improve the overall well-being of older adults with passionate heart. Above all, to my best friend, Jesus Christ, who died on the Cross for me, washed away all my sins with His Blood, and gave me true freedom, true peace, and true love. You are my life, my love, my way maker, my promise keeper, my good Shepherd, and my Strength when I am weak. I am who I am today because of Your grace. All the Glory to You, Father God! Forever. Amen.

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CHAPTER 1

INTRODUCTION

Background

Good health, economic stability, some sense of personal adequacy or usefulness, and social participation and interaction with family and friends are important mechanisms how the elderly can feel satisfied and live a high quality life (Gabriel & Bowling, 2004; Netuveli & Blane, 2008; Pinquart & Sörensen, 2000). Current income appears to be among the crucial determinants of several of the above mechanisms and thus an important antecedent for living a high quality of life. This dissertation examines how changes in the Social Security retirement income impact perceived quality of life and survival expectation of elderly U.S. population. The Social Security retirement program is a major source of income for most Americans 65 or older.[1] The program enrolls nearly 9 out of 10 age-eligible retirees (Social Security Fact Sheet, 2019). The analysis of data from three nationally representative surveys – the Current Population Survey, the Survey of Income and Program Participation, and the Health and Retirement Study – shows that about half of the older adults live in households that receive at least 50 percent of total family income from Social Security benefits (Dushi, Iams, & Trenkamp, 2017). Also, about one in four older adults live in households that receive at least 90 percent of total family income from Social Security benefits (Dushi, et al., 2017).

As millions of older Americans (64 million in 2019 according to Social Security fact sheet) rely on income from Social Security retirement, any reductions in such benefits could

[1] Social Security "is a social insurance program that provides inflation-indexed lifetime annuity to aged beneficiaries" (Dushi, Iams, & Trenkamp, 2017, p. 1).

significantly increase poverty rates among the elderly (Van de Water & Sherman, 2012). The U.S. Census projects that one in five Americans will be 65 or older by 2030, and that older adults will outnumber children in U.S. by 2035 (Vespa, Armstrong, & Medina, 2018). The U.S. citizens are also projected to experience a nearly two-fold increase in the old-age dependency ratio between 2010 and 2060, from 21 to 41, respectively.[2] Such a rise in the old age dependency ratio will certainly affect Social Security beneficiaries as the latest Social Security Trustee's report shows that Social Security will become insolvent and run out of funds by 2035 (Committee for a Responsible Federal Budget, 2019).

A possible reduction in Social Security benefits in response to the demographic trends described in the paragraph above calls for urgent attention as it might impact various aspects of well-being of older adults.[3] The Social Security retirement income is a key determinant of older adults' economic stability, which in turn is one of the crucial factors that determine the quality of life among older adults (American Psychological Association, n.d.). Social Security income, just like any other form of income, constitutes an important means of access to basic physiological and social needs for older adults – food, housing, health, transportation, social life, etc. In a national survey conducted to explore older peoples' definitions of, and priorities for, a high quality of life, when respondents were asked what would be the most important thing that would improve the quality of both their and their peers' lives, they chose "having enough money," followed by "better health," as the most common response (Bowling et al., 2003). Not surprisingly, past

[2] Old-age dependency ratio calculates how many older-adults are supported by 100 working-age individuals (Vespa, Armstrong, & Medina, 2018). For example, if the ratio is 41, it means there are 41 older adults for every 100 working-age adults, and it is calculated as $\left(\frac{Population\ aged\ 65\ and\ older}{Population\ aged\ 18\ to\ 65}\right) * 100$.

[3] For example, literature found that an additional Social Security income results in improved mental health for older women (Golberstein, 2015) and improvement in cognitive function of all older adults (Ayyagari & Frisvold, 2015).

literature reports that current income is positively associated with subjective well-being in retirement (e.g., Bender, 2011).

Given the above, gaining precise knowledge of links between income and older adults' quality of life is critical to designing policies or programs aiming to improve the overall well-being of the elderly. Although numerous previous studies have documented the associations between income and several measures of well-being among older adults, e.g., happiness or various measures of objective or subjective financial or life satisfaction (Bishop, Martin, MacDonald, & Poon, 2010; Bowling, Banister, Sutton, Evans, & Windsor, 2002; Cho, Martin, & Poon, 2015; Etxeberria, Etxebarria, & Urdaneta, 2018; Gabriel & Bowling, 2004; Hsieh, 2004; Tomas, Sancho, Gutierrez, & Galiana, 2013), there is still much to be learned about the detailed nature of the relationship of well-being and income among older adults. Many previous studies on the association between income and well-being focused on the national level or between-countries comparisons (e.g., Diener, Sandvik, Seidlitz, & Diener, 1993; Diener, Tay, & Oishi, 2013; Easterlin, 1974; Easterlin & Angelescu, 2009; Mikucka, Sarracino, & Dubrow, 2017; Sacks, Stevenson, & Wolfers, 2010; Stevenson & Wolfers, 2008).

A central theme in these studies was an investigation of 'Easterlin Paradox,' an observation that at any point in time subjective happiness varies directly with income both among and within nations, but over time happiness does not trend upward as the average income in the country grows. Studies of the link between income and well-being at the individual level are rather scarce (e.g., Frey & Stutzer, 2002; Tang, 2007, Zagorski, Evans, Kelley, & Piotrowska, 2014), and they are generally not specific to older populations. Moreover, most past studies looked at correlation rather than the causal effect of income on well-being, and scholars

recognize that future research should focus on producing estimates of causal pathways between income and well-being (Stevenson & Wolfers, 2008).

Policymakers, researchers, educators, and practitioners continue to place much emphasis on improving the well-being and quality of life of the nation, its communities, households, and individuals (Dolan, Layard, & Metcalfe, 2011). Given the multi-dimensional character of "well-being" and "quality of life," it is not enough to measure these constructs using objective indicators alone as different domains of wellbeing may be weighted differently to individuals. For example, older individuals may view their own well-being or quality of life differently than younger individuals. Such perceptions are often based on the life stage that they are in and influenced by age-specific cultural or social norms that define what each age group "needs to have" in order to fully enjoy the well-being or achieve the best quality of life. Due to "distinctiveness in comparison with younger generations" (p.3, Poon & Cohen-Mansfield, 2011), the oldest-old adults deserve their own concept of well-being. People have evolving prioritizations in different domains of life as they age, and they tend to rate their quality of life based on what is most important to themselves (Bowling & Windsor, 2001). For example, while apprising their well-being, retirees might use indicators such as the size of Social Security benefits they receive each month or their contribution to society through volunteering or social engagement. On the other hand, for those in the adult population who are still in the labor force and planning ahead for their retirement, the subjective measure of well-being might be defined by how much money they put aside for retirement.

Objectives and Contribution

Older adults are facing mental, physical, financial, economic, and social difficulties, and some of those are natural consequences of aging. The elderly are an especially vulnerable group

in terms of exposure to depression and suicide. Depression affects millions of Americans aged 65 and older and often precedes suicide (National Alliance on Mental Illness, 2009). Suicide rates for females and males aged 65 to 74 in 2016 were 6.2 per 100,000 females and 25.9 per 100,000 males, respectively. Moreover, males aged 75 and over had the highest suicide rate both in 2000 and 2016, 42.4 and 39.2 per 100,000 males, respectively, compared to other male age groups (Hedegaard, Curtin, & Warner, 2018). Subjective psychological wellbeing was documented to be negatively associated with suicidal intent, depression, and feelings of hopelessness (Sisask, Varnik, Kolves, Konstabel, & Wasserman, 2007). It seems quite plausible that financial distress both determines and exacerbates psychological stress. Older adults are often exposed to financial stresses and insecurity. More than one-fifth of older adults in America reported struggling financially in 2016 (Bureau of Consumer Financial Protection, 2018), and over 30% of them experienced major financial stress due to job loss, reduced income, and health issues in 2012 (Board of Governors of the Federal Reserve System, 2013). In sum, contributing knowledge on the cause-and-effect relationships between economic status and subjective wellbeing or quality of life seems both important and urgent.

The objective of this study is to identify and empirically examine the causal effect of income on well-being using measures based on quality of life items, and survival expectation of older adults in America. In terms of survival expectation, I specifically examine optimism regarding older adults' own survival as measured by reports of their expected longevity. Thus, the use of the word "optimism" throughout the study (particularly in Introduction, Methodology, Results, and Conclusion chapters) does not mean or represent the same "optimism" used, defined, or understood in psychological literature. In this study, the "optimism" simply captures

or represents a narrow element of optimism that only pertains to older adults' own survival expectation.

An important econometric problem in examining the effect of income on perceived quality of life and optimism regarding survival is that income itself is endogenous. Both perceived quality of life and survival expectation, but also income, are likely causally determined by unobserved variables, such as personality traits or preferences. Also, a more optimistic individual towards his/her own survival or an individual with higher perceived quality of life (or stronger desires for a higher quality of life) could have made life choices that lead to higher income. Similarly, lack of optimism towards survival or low perceived well-being could have affected other social, physical, mental, or psychological factors that, in turn, diminished productivity and income. For example, people who lack optimism and enthusiasm could be passed on for promotion relative to the more optimistic workers. All this implies that there might be reciprocal relationships going from the perceived quality of life and survival expectation to income.

Without properly controlling for the endogenous aspect of these relationships, the estimates of magnitudes and directions of causal effects of income on wellbeing and survival expectation may be biased. For this reason, I adopt an instrumental variable method to overcome the endogeneity issue. I use the Social Security "notch" as an instrumental variable. As explained in more detail in the literature review section of my dissertation, in 1970s the federal government made a mistake designing the formula for adjusting Social Security retirement benefits for inflation. This unintended mistake created variation in Social Security retirement income for recipients born in certain years, and the resultant variation in income was completely independent of people's choices or characteristics (other than the year of birth). Thus, the

"notch" allows one to examine the causal effect of income on various outcomes in a plausibly quasi-experimental setting.

The data for this study comes from the 1993 Asset and Health Dynamics Among the Oldest Old (AHEAD), a supplement to the Health and Retirement Study (HRS). I conduct two parallel analyses of the causal effect of income on: (1) the well-being using measures based on quality of life items, and (2) the survival expectation or optimism for survival. Toward the completion of the first analysis, I draw data from AHEAD's Quality of Life supplement, a battery of 14 questions covering the perceived quality of life. I use principal component analysis to reduce the data and construct variables measuring the latent domains of quality of life and run two-stage least squares estimation using the "notch" to instrument Social Security income. Toward the completion of the second objective, I obtain the two-stage least squares estimate of the partial effect of income on self-reported 10-year survival probability. In order to capture the impact of income on survival expectation or optimism regarding survival, the estimated effect is adjusted by objective survival probability (based on actuarial life tables) and other relevant covariates.

My study is not the first to use Social Security "notch" to identify the causal effects of income. Examples of previous work utilizing a similar approach include estimations of the effect of income on older adults' mental health (Golberstein, 2015), mortality (Snyder & Evans, 2006), body weight (Cawley, Moran, & Simon, 2010), bequests (Lee & Tan, 2017), cognitive function (Ayyagari & Frisvold, 2015), homeownership (Engelhardt, 2008), poverty (Engelhardt & Gruber, 2004), long-term care utilization (Goda, Golberstein, & Grabowski, 2011), labor supply (Krueger & Pischke, 1992), prescription medications (Moran & Simon, 2006), and formal and informal home care use (Tsai, 2015).

I find a significant and positive effect of Social Security income on one of the domains of quality of life. Increases in Social Security income result in a higher reported score for the "Fulfillment & Control" domain of quality of life. At the same time, it did not have any significant effect on the "Hopefulness" domain of quality of life. Similarly, I did not find convincing evidence of the effect of income on optimism regarding survival among older adults as measured by the subjective survival probability.

Steptoe, Deaton, and Stone (2015) assert that "the wellbeing of elderly people is an important objective for both economic and health policy" (p.640). Aging and retirement are inevitable predicaments of life, and detailed knowledge is needed on how wellbeing and survival expectation during the late stage of the life cycle are affected by economic policy. A growing number of scholars advocate for the use of subjective wellbeing measures to inform public policy (Diener, Lucas, Schimmack, and Helliwell, 2009). Since the Social Security income is an important source of support for older adults in America, this study adds to the existing literature on the effect of changes in Social Security income on the overall well-being and optimism regarding survival among older adults. I expect the findings of my study to be informative to both policymakers and practitioners such as consumer educators or financial planners. Understanding the specific effects that the potential future reduction in Social Security income may have on the wellbeing of older adults could inspire preventive policy measures or education aiming to prepare the elderly for challenges ahead better.

The OECD's *How's Life?* report (2017) uses quality of life as one of the key indicators of people's well-being and proposes that the main reason for measuring people's well-being is "to understand whether, where and how life is getting better for people" (OECD, 2017, p. 21).[4] The

[4] In the "How's Life" framework, the OECD (2017) conceptualized individual well-being as consisting of two dimensions: perceived quality of life and material living conditions.

National Research Council further asserts: “the supreme criterion by which the success of a government can be judged is the quality of life its citizens experience from birth to death” (National Research Council, 2011, p.13).

Dissertation Outline

The next chapter reviews the literature on the quality of life and perceived longevity among older adults in America, as well as background information on the Social Security “notch”. Chapter 3 discusses the methodology and analyses that I used in this study. This section also introduces the dataset, presents the variables used, and describes the sample. In Chapter 4, I interpret the results of my analyses. In Chapter 5, I present the conclusions and limitations of this study, and recommendations for future research.

CHAPTER 2

LITTERATURE REVIEW

Overview

The purpose of this study is to identify and measure the causal effect of income on the well-being using measures based on quality of life items, and optimism regarding the survival of older adults in America using the 1993 Asset and Health Dynamics Among the Oldest Old data. The literature review will begin with a general definition of quality of life (QOL)/subjective well-being (SWB). Next, I will provide background information on the relationship between income and QOL/SWB, background information on the link between income and survival expectation, and a detailed description of the Social Security notch. Finally, I will include a discussion of theoretical conceptualization of the effect of income on the wellbeing of oldest-old adults, followed by an outline of hypotheses, and a conclusive summary.

Quality of Life and Subjective Well-being

1. *Definition of Quality of Life and Subjective Well-being*

Defining the term quality of life or subjective well-being poses a lot of challenges to researchers because these concepts are inherently multidimensional, and different people apprise their well-being differently. Individuals may prioritize different domains of wellbeing and have their own definition of what constitutes "good" and "bad" quality of life. Moreover, they may have different goals or desire to achieve their own wellbeing. Quality of life and wellbeing can also be perceived differently among different social, cultural, and age groups. Studies on wellbeing or quality of life across different social science disciplines have used various related

terms or concepts, such as subjective wellbeing, happiness, quality of life, and life satisfaction, to name a few. Some studies use well-being and quality of life interchangeably, while other studies define sharp distinctions between these concepts. Pinto, Fumincelli, Mazzo, Caldeira, and Martins (2017) analyzed differences and similarities of the terms and defined wellbeing as a concept largely related to psycho-spiritual dimensions and quality of life as a concept that reflected person's perception of life satisfaction. They further concluded that such concepts were related to each other and shared common traits, but should not be used as synonyms. It is important to acknowledge that the literature's view of the concept of well-being is generally broader than that of the concept of quality of life, and that both concepts are very highly related to each other given the assumption that greater quality of life implies an improvement in wellbeing.

The World Health Organization Quality of Life group (the WHOQOL) defined quality of life as "individuals' perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns" (The WHOQOL Group, 1995). This definition explicitly acknowledges that the quality of life reflects how individuals subjectively evaluate or perceive their own lives. The WHOQOL further identified six domains of quality of life: physical health, psychological status, level of independence, social relationships, environment, and spirituality/religion/beliefs. The physical health domain includes energy and fatigue, pain and discomfort, and sleep and rest. The psychological domain includes facets such as body image, negative/positive feelings, self-esteem, and thinking and learning. Level of independence includes facets such as mobility, activities of daily living, dependence on medical aids/substances, and work capacity. Social relations include personal relationships, social support networks, and sexual activity. The

environment domain includes facets such as financial and material resources, safety and security, health and social care, recreation/leisure, physical environment, and transport. Lastly, spiritual/religion/beliefs include a single facet measuring religiosity, spiritual life, and personal beliefs.

The WHOQOL domains are similar to the PERMA model developed by Seligman (2011), a pioneer in the field of positive psychology. He identified the following five important building blocks of wellbeing and happiness: Positive emotion, Engagement, Relationships, Meaning, and Accomplishments. In yet another framework (known as HRQOL) focused on health dimensions of quality of life, the Center for Disease Control and Prevention (CDC) defines the quality of life concept as "an individual's or group's perceived physical and mental health over time" (Center for Disease Control and Prevention, 2000, p.8). With the goal of increasing the quality and years of healthy life of individuals and an acknowledgment that health is one of the important domains of overall quality of life, the CDC came up with 'healthy days' measures to assess individuals' perceived sense of wellbeing. These measures specifically ask individuals perceived sense of their own general health, and physical and mental health.

In sum, it is important to note that, depending on the objective, context, and methodology of a study, different instruments and measures of wellbeing or quality of life should be used. Further, it is acknowledged that the concept of quality of life is multidimensional and cannot usually be gauged with a single definition or measurement (Bowling & Windsor, 2001; Bowling, Banister, Sutton, Evans, & Windsor, 2002; Diener & Suh, 1997; Felce & Perry, 1995). Yet, some scholars do offer simple definitions of quality of life or wellbeing, and these definitions are useful as they help develop an intuitive understanding of the concept. For example, Eva, Elisa, Piera, Lyrakos, and Luca (2012) defined wellbeing as "the general satisfaction with life or its

components" (p.218), while Xiao (2015) explained general well-being as "the state of being healthy, happy, and wealthy…" (p.3). Notably, these researchers encompass positive emotions and satisfaction with life in their definitions of wellbeing. Further, in terms of explaining the experience of wellbeing by Americans, Campbell (1981) made important assumptions that emphasize how wellbeing starts from the way people feel about their lives. One of the assumptions is that "changes in sense of well-being follow either from changes in the individual's objective circumstances or in changes in the psychological perspective from which the individual perceives these circumstances" (p. 24). If Campbell's assumption can be extended and applied to the older population, then changes in income (objective circumstance) will affect their overall quality of life (due to changes in how they psychologically perceive such income change).

2. QOL/SBW from an Economics Perspective

The predominant way how economists measure the quality of life or well-being is by using dollar value indicators such as income or gross domestic product. Numerous studies examined relationships between economic development and national wellbeing. Although there is a correlation between economic development and national wellbeing (e.g., Diener & Diener, 1995), and governments often assume that a rise in family income and a reduction in the number of families suffering from poverty would increase national wellbeing (Campbell, 1981), becoming wealthy does not always equal becoming happier. Diener and Diener (1995) found that wealthier nations had higher air pollution and suicide rates. Such studies show that there are unobserved factors that mediate the role of economic indicators on wellbeing.

Diener and Seligman (2004) and Campbell (1981) mentioned that traditional economic indicators served the policymakers well in terms of measuring well-being but also had certain

limitations and may fail to capture the subjective portions of well-being. Diener and Seligman wrote, “although economics currently plays a central role in policy decisions because it is assumed that money increases well-being, we propose that well-being needs to be assessed more directly, because there are distressingly large, measurable slippages between economic indicators and well-being” (Diener & Seligman, 2004, p. 1). Further, they made an important point on the differences in how societies had perceived the meaning of well-being over time. During the early period of national economic development where meeting basic needs were the main issue, economic indicators, such as income and gross domestic product, played a critical role and contributed significantly to inform the course of policy. Yet, over time, the literature suggested changes in perception of wellbeing and the need for inclusion of individuals’ subjective wellbeing indicators to measure the society’s wellbeing.

Economists have recently expanded beyond objective measures of wellbeing and incorporated various subjective measures, including happiness and satisfaction, into their field of research. Frey and Stutzer (2002) outline the benefits and insights economists can gain from happiness research. Most importantly, happiness or wellbeing research is often applied to advance normative economic policies, but also to evaluate or justify government anti-poverty measures, expenditures, and taxes in terms of welfare impacts. Moreover, economists increasingly research how happiness or satisfaction influences various economic decision activities at the individual level. For example, Frey and Stutzer (2002) list behaviors related to consumption, work, investment, or politics, and their relationship to wellbeing. In a similar line of research, Puri and Robinson (2007) found that optimistic people worked harder, expected to work more, were more likely to remarry, invest in stocks, and save. Thus, studying quality of

life, well-being, satisfaction, or happiness is imperative as these factors have a significant influence on individuals' economic decisions.

3. QOL/SWB from Older Adults' Perspective

The meaning of quality of life among older adults has attracted a fair amount of researchers' attention. Past research tried to understand the quality of life from older adults' own perspectives – how they think, talk about, and perceive their quality of life or the overall wellbeing. A consistent theme described in this literature is that social well-being – specifically, social interaction, having healthy relationships with family and friends, and a good quality social support network – play a significant role in overall quality of life among older adults (Berg, Hassing, McClearn, & Johansson, 2006; Eva, Elisa, Piera, Lyrakos, & Luca, 2015; Farquhar, 1995; Netuveli, Wiggins, Hildon, Montgomery, & Blane, 2005; Rafnsson, Shankar, & Steptoe, 2015). These researchers and their studies show that, to older adults, the term 'quality of life' means more than health and physical ability.

Farquhar (1995) asked those aged 65 and older living at home to subjectively describe the quality of their lives and to list the important determinants of life quality. She found that there was more to quality of life than health status or functional ability, and pointed out the need to differentiate 'health-related quality of life' from 'quality of life'. Simply put, focusing on health-only aspects of quality of life among older adults seemed too restrictive to produce a holistic picture of their life satisfaction. When her respondents replied to quality of life inquiries, they talked about a variety of both good and bad things in their lives, and some also responded that their lives had little quality due to reasons that had little to do with age-related health status or functional limitations. This finding shows that the determinants of the very concept, value, and level of life quality vary among older adults. Farquhar (1995) suggested that, when it comes to

measuring the quality of life of older adults living at home, the measure needs to include not only health and functional ability, but also social and emotional well-being, material circumstances, and suitability of the environment. Moreover, Netuveli, Wiggins, Hildon, Montgomery, and Blane (2005) examined the determinants for both reducing and improving older adults' quality of life. They found that depression, financial hardships, and limitations in mobility and daily activities reduced quality of life whereas social contacts, living in a good neighborhood, and having material possessions improved quality of life.

The results cited above are somewhat consistent with the findings of Eva, Elisa, Piera, Lyrakos, and Luca's (2015) who reported that, when it comes to measuring the quality of life among the elderly, two different types of factors, protective and risk-related, played a key role. Specifically, having social support, high self-esteem, and high self-efficacy were found to be protective factors that correlated positively with quality of life, while psychological issues – depression, anxiety, and loneliness – were risk factors that correlated negatively with quality of life among older adults. Eva et al.'s (2015) study also confirmed findings from the literature that elderly need a good companion, family and friends, and some forms of social interaction to feel well and satisfied in their life (Gabriel & Bowling, 2004; Mitchell & Kemp, 2000; Pinquart & Sörensen, 2000). The past life events and satisfaction with their past lives had a particularly strong impact on the current level of subjective wellbeing among the oldest-old adults (Bishop, Martin, MacDonald, & Poon, 2010).

In a book titled "Understanding Well-Being in the Oldest Old" by Leonard Poon and Jiska Cohen-Mansfield (2011), the authors synthesized an invaluable and affluent portion of contemporary knowledge on the wellbeing of the oldest-old population. The book explains how life events (good, bad, or traumatic events), as well as resources, nutrition, cognitive functioning,

social relationships, spirituality, and leisure activity, impact the well-being of oldest-old adults. Later in the dissertation (see the theoretical framework section), I explain more extensively how lifetime events could be an important determinant of wellbeing for the older population.

Farquhar (1995) pointed out that quality of life among older adults varies by age groups, as well as geographic areas in that those living in semi-rural locations were more likely to report positive quality of life compared to those living in an inner-city area. Literature shows evidence of significant differences in access to services and programs provided by senior centers in urban and rural areas (Conrad, Hultman, Hughees, & Hanrahan, 1993; Krout, 1987), which could partially explain the observed geographical disparities in perceived quality of life. Income might play a mediating role in access to services and programs provided by the community and/or senior centers in different regions. There is evidence of the correlation between income or wealth and well-being among older adults. Bearden and Wilder (2007) examined the effect of household life-cycle variables on wealth and wellbeing and found that wealth at retirement age was a significant predictor of overall wellbeing. Also, having a higher income in old age was positively associated with reports of greater life satisfaction, happiness, and self-esteem (Pinquart & Sörenson, 2000). As explained in Gabriel and Bowling's (2004) study, having enough money or being financially secure is an important factor for the quality of life among older adults, in that it not only allows older adults to have basic needs met, but also enables them to enjoy themselves and be free from financial worries.

Income and QOL/SWB

Economists who examined wellbeing and life satisfaction had initially relied almost exclusively on the objective dollar-value indicators. However, Easterlin's (1974) groundbreaking and seminal contributions drew many economists' attention to the relationship between dollar

value measures of economic status, such as income or wealth, and subjectively expressed wellbeing, happiness, or satisfaction. Following his example, economists started to consider subjective measures in their work and examined such relationships across different countries, societies, and demographic groups. Although some researchers supported Easterlin's findings, many others debated them (Blanchflower & Oswald, 2004; Diener & Diener, 1995; Diener & Oishi, 2000; Diener, Sandvik, Seidlitz, & Diener, 1993; Diener, Tay, & Oishi, 2013; Di Tella & MacCulloch, 2008; Easterlin, 1995; Easterlin & Angelescu, 2009; Fereer-i-Carbonell, 2005; Hagerty & Veenhoven, 2003; Oswald, 1997; Paul & Guilbert, 2013; Stevenson & Wolfers, 2008; Veenhoven & Hagerty, 2006; Zagorski, Evans, Kelley, & Piotrowska, 2013).

Easterlin (1974) tried to find an answer to question of whether or not there was a positive association between income and happiness by using survey data from 1946 to 1970. He found robust evidence of positive correlations between income and happiness within countries using time-static data, yet in the United States (and also in other countries), higher income or economic growth over time was not followed by gains in life satisfaction or happiness. This finding became known as the 'Easterlin Paradox', which refers to the happiness-income paradox in which raising level of income of all individuals does not increase average happiness (Easterlin, 1974, 1995). Using data that covers the time period from the 1970s to the 1990s in United States and Great Britain, Blanchflower and Oswald (2004) confirmed Easterlin's early findings that levels of happiness did not increase despite the economic and income growth. Moreover, despite a significant increase in wealth after World War II, Diener and Oishi (2000) found that some industrialized countries have not experienced an increase in wellbeing in this era. There is a large and growing body of academic research that confirm Easterlin's observations on the link between income and subjective wellbeing using survey data at the individual level. For example,

Ackerman and Paolucci (1983) examined both objective and subjective income adequacy and their association with life quality indicators. The objective income adequacy measure was developed from the standard budget for a moderate level of living as defined by the Bureau of Labor Statistics. The subjective measure was a direct personal assessment which reflected the respondents' feeling whether or not their income allowed them to "live as comfortably as they would like". Both measures of income adequacy contributed positively to life quality, and the subjective measure captured more variation in life quality then the objective measure.

In an attempt to explain the paradox, Easterlin (1974) postulated that social comparisons within nations lead to a "hedonic treadmill" where people's standards for what constitutes satisfactory incomes rise when the income of others in their society rise. Therefore, there could be no net gain in life satisfaction as average societal incomes increase. This, and various other aspects of the paradox were debated extensively by follow-up studies (e.g., Diener, Tay, & Oishi, 2013; Hagerty & Veenhoven, 2003; Stevenson & Wolfers, 2008). Stevenson and Wolfers (2008) stated that the paradox resulted from "Easterlin's failure to isolate statistically significant relationships between average levels of happiness and economic growth through time". Diener, Tay, and Oishi (2013) focused on three psychological mechanisms that mediate the relationship between income and subjective wellbeing: material possessions, financial satisfaction, and optimism. They found that all of these mechanisms significantly mediated the relationship in question. They further found that "people were not necessarily on a hedonic treadmill when it comes to income" (p.275), as they failed to adapt to income increases during the period of several years that they studied, i.e., people reacted positively to income increases over time but failed to retract back to their former levels of perceived wellbeing in the ensuing years. The evidence on adaptation-to-income behavior, however, is mixed throughout the literature in that

some studies found that individuals do not adapt to changes in income (Guilbert & Paul, 2009; Paul & Guilbert, 2013), individuals adapt to changes in income (Wolbring, Keuschnigg, & Negele, 2013), or individuals only partially adapt (Ferrer-i-Carbonell & Van Praag, 2008).

Numerous studies on the relationship between income and wellbeing explained their findings in the context of social comparison theory. This framework postulates the importance of relative income on the individual's subjective wellbeing (Ball & Chernova, 2008; Boodoo, Gomez, & Gunderson, 2014; Ferrer-i-Carbonell, 2005; Luttmer, 2005; McBride, 2001) in that people tend to compare their income or standards of living with others and judge their own subjective wellbeing depending on whether they are 'better off' or 'worse off' than others. Studies found that an increase in the average income of the individual's reference group negatively affected this individual's perceived wellbeing or life satisfaction (Ferrer-i-Carbonell, 2005; Paul & Guilbert, 2013). One of the most influential psychologists who contributed a significant amount to the research of happiness or subjective wellbeing, Ed Diener (2009), suggested that, if an individual perceived that a current event was better than his/her own standard, he/she would be happy. He added that the adaptation theory "predicts that changes in income and so forth are much more important to happiness than is the average level of the events" (p.45).[5]

Ball and Chernova (2008) and Boodoo, Gomez, and Gunderson (2014) found that both absolute and relative income affect life satisfaction/happiness, but relative income has a stronger effect relative to absolute income. Boodoo et al. (2014), in particular, focused on the association

[5] Adaptation-level theory, first developed by a psychologist Harry Helson (1964), has been used by many researchers in subjective well-being research. The basic notion behind adaptation theory or hedonic treadmill is that when events occur, either good or bad, they can have direct influence on a person's well-being but only up to certain time period. Over time, the events lose their influential power because the person adapts to the events in the long-run, and the person returns to his or her original level of well-being.

between life satisfaction and relative income of older adults in Canada and emphasized that relative income mattered more than absolute income even for older adults. Brickman, Coates, and Janoff-Bulman (1978) also contributed to the literature by examining whether happiness was relative. They found that, due to adaptation, lottery winners were not significantly happier or more satisfied than control groups. Such findings reveal that people generally want more than what they possess, are insatiable, and continue to compare with their own past history or with others around them. As Easterlin (1995) argued, "judgments of personal well-being are made by comparing one's objective status with a subjective living level norm, which is significantly influenced by the average level of living of the society as a whole" (p.36).

Comparison with others is also a relevant determinants of financial wellbeing. Hsu, Tam, and Howell (2016) suggested that relative debt was a significant predictor of financial wellbeing. Individuals not only compared what they have to what others possessed, but also compared their debt load to how much debt other people had, and formed less/more of a guilty feeling based on whether that had less/more debt than those around them. The concept of comparison is important to consider in this study. Those who knew and realized that they received significantly less/more Social Security retirement relative to members of neighboring cohorts might have responded more negatively/positively to questions about subjective quality of life. Since policy created a discrepancy in the Social Security income in comparison to others, relative income might be important determinant of quality of life among older adults in addition to absolute income. The United States General Accounting Office's reports on Social Security notch that "while those in the transition group received lower relative benefits, they often *compare* their benefits to those of other individuals in the cohorts immediately prior to the transition who received much higher benefits than ever were anticipated" (General Accounting Office, 1988, p.88).

Income and Survival Expectation

1. Optimism and Future Expectations

Optimism and expectations regarding future have been studied heavily in the context of savings, investing, and risk taking behavior (Balasuriya, Muradoglu, & Ayton, 2010; Bella & Grigoli, 2019; Brown & Taylor, 2006; Brunnermeier & Parker, 2005; Hoffmann & Post, 2013; Lim, Hanna, & Montalto, 2015; Puri & Robinson, 2007). These studies confirmed the influence of personal beliefs and expectations on people's financial behaviors and decisions under uncertainty. Warshaw and Davis (1985) defined behavior expectation as "the individual's estimation of the likelihood that he or she actually will perform some specified future behavior" (p.215). Based on one's positive/negative expectation of future life outlook, he/she can predict what will most likely happen and what kind of decision he/she will make. Based on one's expectation towards the future and life in general, one can be defined as an optimist or a pessimist. Scheier and Carver (1985) define dispositional optimism in terms of "generalized expectations of the occurrence of good outcomes in one's life" (p.239).

Individuals who expect that brighter, better, and greater outcomes will happen or come into life can be classified as optimists. Brunnermeier and Parker (2005) defined the concept of optimal expectation as "the set of beliefs that maximize well-being in the initial period". Expectation and optimism/pessimism cannot be separated, they are closely related to each other since expectation reflects individuals' psychological trait of being optimistic, pessimistic, or neutral. A study by Brown and Taylor (2006) examined the determinants of individuals' financial expectations in which they suggested that both individuals' life cycles and business cycles affected their financial expectations. As such, past life experiences, either positive or

negative, play a significant role in forming current expectations as investors' past return experiences positively influence return expectations (Hoffman & Post, 2017).

How expectations are formed differs depending on which specific expectations are referenced. Economists have invested a lot of effort into research on expectation formation in order to understand individuals' financial-related behaviors, such as saving, spending, and investing (Simon, 1959). In their paper, Oliver and Winer (1987) discuss the concept, formation, and structure of consumer expectations from consumer economic, and consumer behavior and psychology perspective. Moreover, scholars in the academic field of marketing have also done substantial amount of work to understand how consumers form expectations and receive satisfaction (Cardozo, 1965; Licata, Chakraborty, & Krishnan, 2008). For example, de Bruin, Vanderklaauw, Downs, Fischhoff, Topa, and Armantier (2010) investigated the role of demographic variables and financial literacy on inflation expectation formation. They found that those who were nonwhite, single, low income, less educated, and older were more likely to report higher inflation expectation. When forming inflation expectations, these individuals focused relatively more on the ways to cover future expenses and personal experiences on prices they pay, and had lower financial literacy levels.

These results suggest that respondents' personal financial experiences, rather than the actual national inflation rate, play an important role in forming their inflation expectations. The similar mechanisms could explain the appraisal of individuals' perceived longevity. In terms of survival expectation, different studies used parents' mortality history to examine respondents' survival expectation. For example, Hurd and McGarry (1995) used Health and Retirement Survey data to evaluate the subjective probabilities of survival of adults aged 51-65. Their study showed that parents' mortality experience influences respondents' survival probabilities of living

to ages 75 and 85. If the parents were alive at the time respondents took the survey, respondents gave higher survival probabilities compared to those respondents whose parents have died. Parents' mortality experience is not of respondents' own experiences per se, but by indirectly experiencing their parents' mortality experience, the respondents could directly observe and learn what their future survival would look like and take it into the consideration when they form their future survival expectation.

Likewise, when forming expectations, personal experience and information individuals gather may also play a role. Manski (2004) suggested that understanding how people form expectations will require "intensive probing of persons to learn how they perceive their environments and how they process such new information as they may receive" (p.1369). A study by Bernheim (1987) found that individuals form expectations on the basis of selective rather than all available information, that they do not ignore or forget information collected or used in the past. Rather, they recycle the same information for future decision-making. Bernheim's study specifically focused on expectations regarding future social security benefits, with an interesting finding that individuals become more serious about forming expectations as they approach their retirement.

While reviewing different models of expectations, effort, and utility as possible explanations for the formation of expectations, Foster and Frijters (2014) examined undergraduate students' actual and expected final course grades. Using a dataset that includes information on the students' final course grades, demographic and psychological factors, academic background, effort levels, and happiness, they found a positive relationship between a belief about students' own ability (in mathematical and verbal skills) and happiness. Further, they found that psychological factors, such as 'savoring the future' and self-esteem may affect

the relationship between students' efforts and expectations. Among the students who had a high or inflated self-esteem tended to over predict their grade, meaning that they expected to get higher grades and it led them to put more effort. These findings suggest that psychological factors play a role in the expectation formation, which supports Katona's (1980) argument that expectation formation is a psychological process, that people receive direct utility from expectations, explaining that "expectations are set higher by people who obtain more pleasure from contemplating good future events than they feel pain from being disappointed" (p. 76).

The literature about optimism and financial behavior cautions about individuals being too optimistic or 'overconfident'. One of the common examples of overconfidence is found among investors who are too optimistic and overestimate their return (Brunnermeier & Parker, 2005). Another example from finance is the relationship between CEO's overconfidence and managerial and corporate decision making. Puri and Robinson's (2007) study compares moderate and extreme optimists and examines how the level of optimism affects and varies according to different types of economic decisions (this will be discussed in greater depth in the next sub-section).

A relatively simple way to understand the difference between a realistic-optimist and an unrealistic-optimist can be found in Hong, Zarit, and Malmberg's (2004). They defined four different groups including pessimists, poor health realists, optimists, and good health realists. Both poor and good health realists are those individuals whose subjective and objective health are aligned. On the other hand, both pessimists and optimists are the ones who experience a disparity between reported subjective and objective health. In other words, pessimists reported their own subjective health lower than their actual health, whereas optimists reported own subjective health better than their actual health. Literature reports that individuals' expectations

toward future behavior or decision making are affected by their demographic characteristics or socioeconomic status. Studies found that individuals with higher income and/or higher educational level were more likely to be optimistic about the future economy or economic behaviors (Balasuriya, Muradoglu, & Ayton, 2010; Boehm, Chen, Williams, Ryff, & Kubzansky, 2015; Das, Kuhnen, & Nagel, 2017).

Using data from 1978 to 2014, Das, Kuhnen, and Nagel (2017) examined whether individuals' socioeconomic status, specifically income and educational level, had a significant impact on their macroeconomic expectations – unemployment rate, returns for stock, and business conditions. Those in the high socioeconomic status group were found to be more optimistic about the macroeconomic future relative to those in the low socioeconomic status group. Even among the respondents with high education level, those earning higher income were found to be more optimistic compared to their peers earning lower income. Interestingly, their study did not show that there was a difference in macroeconomic expectations between the two socioeconomic status groups during recessions in the United States. However, the difference was large and evident when the economy was performing well.

Studies on the interactions of optimism and economic status addressed situations where optimism was both a predictor of economic outcomes or decisions, and where optimism was an outcome itself. For example, Puri and Robinson (2007) measured the impact of optimism on work and life choices by stating and testing hypotheses that optimism drives individuals' decisions such as whether to marry, when to retire, or how much money to save. Das, Kuhnen, and Nagel (2017), on the other hand, emphasized the causal relationship of income and education on expectations. Das et al. (2017) also considered possible reverse causality, yet, they explained that capturing the effect of belief changes (changes in expectations/optimism) would require a

longer time period than available in their data. They further found a positive association between changes in income and changes in macroeconomic expectations. In other words, increases in income led to a more optimistic view. This finding may be due to greater accessibility and affordability of goods and services, or the fact that investments in stocks lead to more income that individuals have. Boehm, Chen, Williams, Ryff, and Kubzansky (2015)'s finding of strong social disparities in optimism and how optimism is shaped by opportunities that come with individuals' social standing might support Das et al.'s findings.

In my study, as elaborated more in detail later in this chapter, I test the hypothesis that higher or additional income leads to more optimistic survival expectation. Although Das, Kuhnen, and Nagel (2017)'s study used different expectation outcomes, based on Das et al.'s findings, changes in income of older adults in my study might change their expectations toward perceived longevity conditions. If Das et al.'s findings can also be applied to oldest-old adults in this study, then those who received more than expected in Social Security income will be more likely to report higher expectations towards future survival, while those who experienced a reduction in Social Security benefits due to notch will be more likely to report lower expectations towards survival.

Moreover, Chopik, Kim, and Smith (2015) examined whether optimism increases with age, and found a positive relationship between optimism and subjective health response among older adults. Also, they found an interesting result that optimism tends to increase from the age of 50 to around 70, but then it decreases after the age of 70. Their result was consistent with You, Fung, and Issacowitz's (2009) finding that the average Americans become more optimistic as they age. It is also somewhat consistent with a finding that older adults tend to report higher wellbeing. Subjective well-being has also been associated with optimism both in medical

contexts as well as other life-event settings (Carver, Scheier, & Segerstrom, 2010; Forgeard & Seligman, 2012), and such an association also applies to older adults (Ferguson & Goodwin, 2010; Olson, Fanning, Awick, Chung, & McAuley, 2014). According to Carver, Scheier, and Segerstrom (2010), there is also a significant association between optimism and emotional wellbeing, socioeconomic resources, social resources, and health. Optimism is related to better emotional and subjective wellbeing, better social network and close relationship quality, and better perform proactive efforts in protecting one's health. When facing difficulties, optimistic people still feel hopeful and positive and are less distressed compared to pessimists. One of the differences between optimists and pessimists is coping strategies, where optimists are likely to be engaged in and approach coping while pessimists are likely to avoid coping (Carver et al., 2010).

A previous study found that optimists were more likely to perform problem-focused coping, seek social support, and focus on positive aspects of stressful circumstances, while pessimists were more likely to refuse to believe stressful things happened, disengage, and emphasize stressful feelings (Scheier, Weintraub, & Carver, 1986). Thus, among those in notch cohort who still report relatively higher expectation towards perceived longevity, even with reductions in Social Security benefits, can be considered as longevity-optimists. Such individuals might have effective coping strategies that help them to see the bright future amidst adversity from sudden income shock. On the other hand, those who were in the windfall cohort and received relatively higher Social Security benefits compared to notch babies but still reported relatively lower expectations can be considered as longevity-pessimists.[6] Furthermore, a similar

[6] The terms "notch cohort" and "notch babies" refer to the same group of individuals who were born between 1917 and 1921. As explained more in detail later in the methodology section, there are four different cohorts in this study. The prewindfall cohort includes individuals who were born between 1901 and 1909; the windfall cohort includes individuals who were born between 1910 and 1916; the notch cohort includes individuals who were born between 1917 and 1921; and postnotch cohort includes individuals who were born between 1922 and 1930.

concept to Hong, Zarit, and Malmberg's (2004) study, among those in the notch cohort who report relatively lower expectation towards perceived longevity with reductions in Social Security benefits, and those in the windfall cohort who report relatively higher expectation towards perceived longevity with higher Social Security benefits can be considered as poor longevity-realists and good longevity-realists, respectively.

2. *Expectation and Economic Choices/Income*

In general, the higher the income, the greater one's expectation regarding survival. Higher income gives a person's access to good housing conditions, safe and clean neighborhoods, healthier foods and diet behaviors, and good health care. These factors ultimately increase longevity. Under the Demand for Health Model, health is an investment good and investing in health increases the times and number of healthy days available to work and for nonmarket activities (Grossman, 1972). Income and human capital are associated with increased investments in health, which ultimately increases the living horizon. Also, as mentioned earlier, higher income might lead to more optimistic outlook towards future (Das, Kuhnen, and Nagel, 2017). Yet, this might or might not be the case with older adults. Brown and Taylor (2006) found that older adults are less likely to be financially optimistic. Brown and Taylor's study showed that younger respondents (aged 18 to 30), compared to older adults aged 50 and over, had a 22 percent higher probability of being financially optimistic. Thus, it is important to investigate how the relationship between expectation and economic choices differs, if at all, for older adults compared to a general population. There is, however, a lack of research examining how expectation/optimism affects economic choices, or reverse causality, among older adults. Thus, I present a review of this topic as it relates to general population.

A study that thoroughly examines the association between optimism and different types of economic choices was conducted by Puri and Robinson (2007). To measure optimism, they used life expectancy miscalibration, which compares individuals' subjective life expectancy to the actuarial life expectancy. By examining the relationship between optimism and different economic and life decisions, they found that optimistic people work harder, expect to retire later, are more likely to remarry, invest more, and save more. These results indicate that optimism plays a critical role in economic-related decision making. They further investigated differences in decision making between moderate and extreme optimists, and found that compared to moderate optimists, extreme optimists display behaviors that are not generally beneficial – they save less, have short planning horizons, have a smaller portion of wealth in liquid assets, and are more likely to smoke. Although one's optimistic thoughts and mind help in making healthy choices in different aspects of life, Puri and Robinson's study shows that being too optimistic might lead to more irrational decisions and behaviors by neglecting the reality, "thinking instead that the future will take care of itself" (p.97). To understand and explain their findings about the relationship between optimism and different economic decisions, they tested different hypotheses and the findings were best explained by the hypothesis that optimism drives economic choices.

A study by Lim, Hanna, and Montalto (2011) used a modified version of Puri and Robinson's (2007) discrepancy in life expectancy to measure optimism and found that those who are optimistic about future income, economy, and life expectancy are more likely to be savers. Yet, Brown and Taylor (2006) found a somewhat different result in that financial optimism was inversely associated with savings. Those who were more financially optimistic had lower amount of savings. In other words, compared to financially optimistic individuals, relatively less

optimistic individuals saved more if they expect negative changes to their financial situation. Moreover, studies found a significant relationship between optimism and risk-taking behavior (Balasuriya, Muradoglu, & Ayton, 2010; Hoffman & Post, 2013), and a positive association between optimism and the probability of stock ownership (Angelini & Cavapozzi, 2017). Bella and Grigoli (2019) specifically investigated today's consumption and investing behavior of those individuals who were expecting higher future potential output growth. Their overall finding was that changes in expectations for long-term income affected the direction of change in expectations, meaning that if individuals expected long-term income growth to be high(low), then their consumption and investment increased(decreased) in the short term. Likewise, I hypothesize that both the notch cohort's and windfall cohort's expectation towards perceived longevity condition will likely be influenced by the changes in long-term income reduction/growth through Social Security benefits.

3. Subjective Longevity

Different studies have examined subjective longevity as expectations about survival are critical for different economic decisions (Groneck, Ludwig, & Zimper, 2014). Such studies examined the association between subjective life expectancy (SLE) and retirement planning (Griffin, Hesketh, & Loh, 2012; Hurd, Smith, & Zissimopoulos, 2004; Khan, Rutledge, & Wu, 2014), SLE and saving behavior (Post & Hanewald, 2013), SLE and wealth (Bloom, Canning, Moore, & Song, 2006), SLE and bequests (Gan, Gong, Hurd, & McFadden, 2015), and SLE and income (Chetty et al., 2016). The majority of studies listed above have used a subjective survival belief questionnaire in Health and Retirement Study (HRS) data, which asks respondents to report a probability of survival up to age 75 or to 85.

To examine the validity of subjective probabilities of the survival questionnaire in HRS data, Hurd and McGarry (1995, 2002), and Hurd, McFadden, and Gan (1998) investigated responses to the question. Hurd and McGarry's study (1995) found that responses of survival probabilities are close to those in life tables, and later they found that in HRS, respondents changed their survival probabilities in response to new information, such as the onset of a new health condition (2002). Moreover, Hurd et al. (1998) used the Asset and Health Dynamics among the Oldest Old (AHEAD) data, where they found a problem of focal point responses (where respondents respond 0, 0.5, or 1). They suggested that such responses for subjective survival probability in AHEAD cannot represent respondents' true probabilities. This is further supported by Gan, Hurd, and McFadden's (2005) study where they also examined AHEAD data, and in Wave 1 of the data only half of respondents gave continuous responses, and a fourth gave focal point responses. Thus, in order to estimate respondents' true probabilities, a prevalence of such responses should be taken into account. To solve this issue, Bloom, Canning, Moore, and Song (2006) used information on current age or the age of death of respondents' parents as instruments, and Gan et al. (2005) estimated an "optimism" index to correct focal responses.[7]

Gan, Hurd, and McFadden (2005) further found that younger respondents in AHEAD data have subjective probabilities that are closely similar to life tables, while older respondents have probabilities that are much higher compared to life tables. Future life expectancy varies by different employment status, income categories, and education (Rogot, Sorlie, & Johnson, 1992), where individuals with higher socioeconomic status report higher survival probabilities (Delavande & Rohwedder, 2011; Hurd & McGarry, 1995), and increased survival probabilities increased household wealth among couples (Bloom, Canning, Moore, & Song, 2006). Subjective

[7] For detailed information and model equation about the "optimism" index, please refer to Gan, Hurd, and McFadden's (2005) paper.

survival expectations are important not only for consumption and savings decisions (Gan, Gong, Hurd, & McFadden, 2015) but also for retirement planning in that those who have high survival probabilities retire later and claim later than those with low probabilities (Hurd, Smith, & Zissimopoulos, 2004; Khan, Rutledge, & Wu, 2014). Moreover, Chetty et al. (2016) found that between 2001 and 2014 in the United States, income was positively associated with longevity, and that the gap between life expectancy and income increased across different income groups. They further found that the association between income and longevity differed significantly across geographic areas, and that differences in longevity across areas were significantly correlated with health behaviors as well as local area characteristics.[8] Longevity between individuals in the top and bottom 1% of income distribution also differed by gender, which resulted in a difference of 15 years for male and 10 years for female. Such studies show that there is evidence of bi-directional relationship between life expectancy and socioeconomic resources.

Furthermore, looking at a life cycle model with survival beliefs among older adults, Groneck, Ludwig, and Zimper (2014) used a survival probabilities questionnaire in HRS data and found younger-old respondents underestimate their survival chances, whereas older-old adults overestimate their survival chances by 15-20 percentage points. One of the key predictors of survival among older adults seems to be having a positive outlook. Using the Danish cohort survey, Engberg, Jeune, Andersen-Ranberg, Martinussen, Vaupel, and Christensen (2013) followed-up oldest-old Danish adults for twelve years to examine the effect of subjective measure, such as optimism, on survival. Their study found a significant association between

[8] Their local area characteristics included: health care factors, environmental factors, inequality and social cohesion, labor market conditions, and other factors such as immigrant population, house value, government expenditure, population density, and percent of those who graduated from college.

optimism and survival among oldest-old Danish adults, where optimistic adults lived longer than their neutral counterparts.[9] On the other hand, those who answered pessimistically to a question asking how they feel about their own future showed a higher risk of death compared to the neutral counterparts.

Such studies show that there is evidence of a bi-directional relationship between life expectancy and socioeconomic resources. Having a higher socioeconomic status positively influences perceived longevity, and also having a positive view on perceived longevity affects individuals' decisions through a psychologically optimistic mindset as a mechanism that helps the individuals to achieve what they expect to do or obtain what they expect to have. There is an evidence across studies that among those who have chronic diseases, those who have hopeful minds and greater optimism seek to engage in healthy behaviors (Schiavon, Marchetti, Gurgel, Busnello, & Reppold, 2017). Additionally, optimistic individuals are also found to think, work, and plan harder in their lives (Puri & Robinson, 2007).

Furthermore, previous studies have examined the relationship between income and life expectancy, and found a positive association (Chetty et al., 2016). It is widely known that socioeconomic status is an important determinant for an individual's health and wellbeing. Arno, House, Viola, and Schechter (2011) investigated whether the income support program, Social Security, reduces mortality among older adults. Trying to examine whether Social Security has a beneficial impact on health consequences of older adults, they found Social Security improved the health and living conditions of the elderly in the United States. Using the Social Security "notch" as an instrumental variable, Snyder and Evans (2006) also examined the impact of Social Security benefits on mortality. However, their result was somewhat contradictory of the

[9] Neutral counterparts in their study were those who were neither 'optimistic' nor 'pessimistic', and served as reference group in analyses.

literature. They found that those beneficiaries with lower payments were more likely to work and had lower mortality rates and concluded that the time spent working decreased social isolation, which is a co-factor in mortality. Using the same Social Security "notch", I examine the effect of Social Security income on perceived longevity. Although perceived longevity is not the actual mortality but respondents' expectations regarding their longevity per se, based on previous studies' findings and a basic assumption of the Demand for Health Model, I expect to find a positive effect of income on perceived longevity. Detailed hypotheses will be provided at the end of this literature review section.

Background on the Social Security notch

This section provides a brief overview of the Social Security "notch", a variation in retirement income that is used in the instrumental variable approach in this study.[10] The term "notch" refers to the difference between Social Security benefit amounts payable to beneficiaries born after 1916 and amounts payable to those who were born in 1916 and earlier. The graph below shows the mean benefit amounts for average wage earners retiring at age 65 in 2007 dollars (Figure 1). The yellow-colored v-shaped dip represents reduced benefits received by beneficiaries born between 1917 and 1921 known as "notch babies". As shown in the figure, the windfall cohort (those born between 1911-1916) received higher benefits compared to notch babies (born between 1917-1921). This difference in benefits resulted from the 1972 and 1977 amendments to the Social Security Act and was independent of individual characteristics

[10] The historical background and information on the notch are described in detail in a report titled 'Social Security: The Notch Issue' by the United States General Accounting Office (General Accounting Office, 1988), 'Historical Background And Development Of Social Security' page from the Social Security Administration (n.d.a) website (https://www.ssa.gov/history/briefhistory3.html), and publications from the Social Security Administration (1988, 2004).

(other than birth year).[11]

To keep the Social Security benefits at pace with inflation, the cost-of-living adjustments (COLAs) provide increases in the benefits for recipients. Such increases in the benefit are based on the changes captured by the Consumer Price Index. After the Social Security program was created, however, the increases in the benefits were put in effect only when the Congress explicitly enacted legislation for the benefit increase. In 1972, Congress made some changes in the Social Security Act to provide an automatic COLAs for benefits. However, the formula for calculating the automatic adjustment was erroneous, and the unusually high inflation and unemployment in the 1970s generated an unintended increase in Social Security benefits to those in the windfall cohort (those born between 1911 and 1916). Realizing that the indexation for inflation would lead to benefit payments higher than average workers' earnings before retirement, Congress came up with a new formula for benefit computation in the 1977 amendments to the Social Security Act. In revising the benefit computation, Congress did not reduce benefits for individuals already receiving the windfall benefits. Policymakers wanted to provide a smooth transition to the new benefit levels for those approaching retirement age at that time. Thus, they implemented a five-year transition period which affected those born between 1917 and 1921 (the notch cohort). Basically, two computations were used for the notch cohort – one using a special transition formula and another one based on the new corrected formula from the 1977 amendment. The benefits of those born between 1917 and 1921 were based on a computation method that pays a higher benefit amount, and those born after 1922 had their benefits calculated under the new computation, which gradually resulted in lower benefit levels.

[11] Rubin, White-Means, and Daniel (2000) found that, while the data from 1967 to 1997 revealed a significant decrease in income inequality, income inequality started to increase from 1977, the period when the notch issue originated.

Since the sizes and variation in retirement benefits created by this policy were grandfathered, they resulted in permanent difference in benefits received by different cohorts. The income variation caused by the Social Security adjustment is independent of personal characteristics or choices, and will be used in this study as an instrument . The variation in Social Security income comes from the year in which a respondent was born. Thus, using the Social Security "notch" as an instrument will allow me to examine the causal effect of income on quality of life and survival expectation among older adults in America in a quasi-experimental setting. Detailed information about the instrumental variable method is provided in the methods section below.

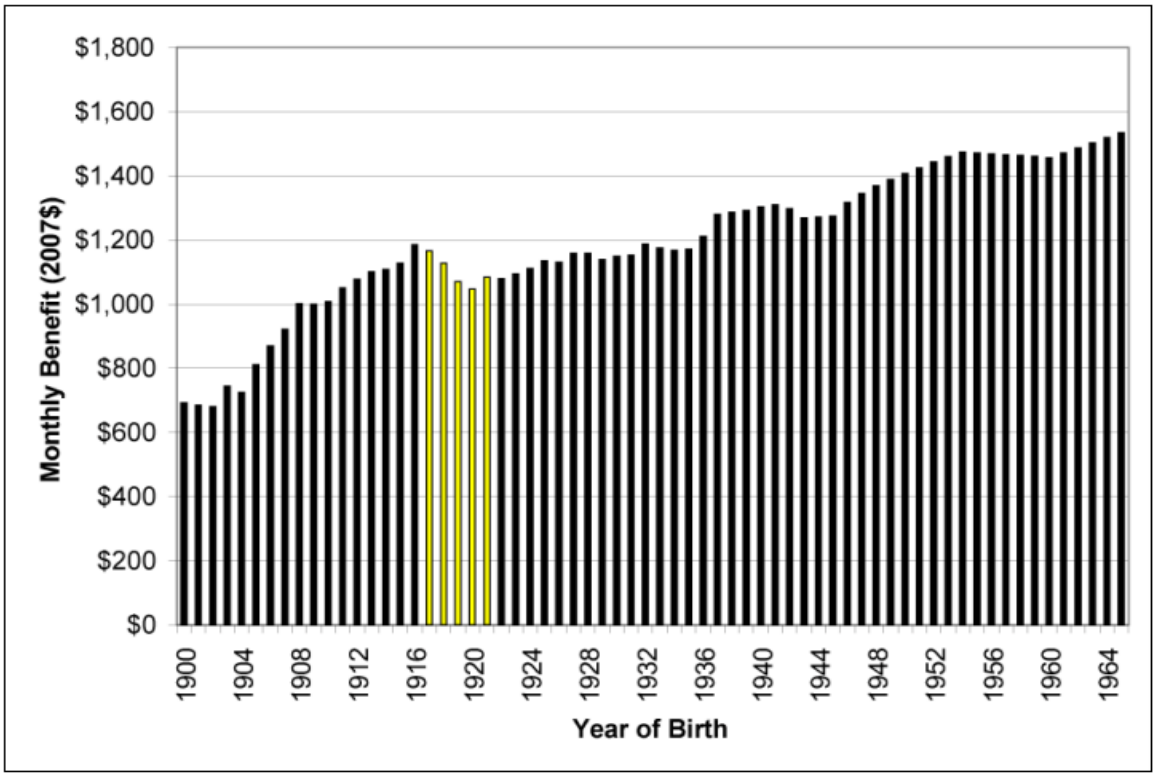

Figure 1 Retirement Benefit Amounts for Average Wage Earners Retiring at Age 65 in 2007. **Source:** 2007 Social Security *Trustees Report*, Table VI.F10. Retrieved from the Congressional Research Service report (2011).

Theoretical Conceptualization of the Effect of Income on Well-being & Hypotheses

1. Adaptation Theory and Prospect Theory

The hypothesis that income should increase perceived well-being appears reasonable and common-sense. All else equal, greater income implies expanded opportunities for consumption of economic goods, leisure, and social interactions, all of which should make people happier. However, the effect of income on subjective well-being, especially in the long-term, might be greatly diminished. When income increases, people's perceived quality of life might increase in the short run, but the actual quality of life might be the same in the long run due to adaptation – the fact that higher income also elevates expectations and aspirations. Previous studies that examined the relationship between income and life satisfaction, happiness, subjective well-being or quality of life, observed evidence of adaptation mechanism (Ferrer-i-Carbonell & Van Praag, 2008; Paul & Guilbert, 2013; Di Tella & MacCulloch, 2008; Di Tella, New, & MacCulloch, 2010; Vendrik, 2013; Clark, 2016).

Adaptation-level theory, first developed by psychologist Harry Helson (1964), has been used by many researchers in subjective well-being research. A basic notion behind adaptation theory (also called a hedonic treadmill or hedonic adaptation) is that when events occur, either good or bad, they have an initial influence on a person's well-being but only up to a certain time period. Over time, the events lose their influential power because the person adapts to these events in the long-run, and the person may return to his or her original level of well-being. One of the most influential psychologist who contributed a significant amount to research on happiness and subjective well-being, Ed Diener (2009), stated that "adaptation theory is based on a standard derived from an individual's own experience" (p.45) further suggesting that if an individual perceives that a current outcome is better than his/her own standard, he/she will be

happy and vice versa. He adds, “this theory predicts that changes in income and so forth are much more important to happiness than is the average level of the events” (p.45).

For a simple portrayal of the association between changes in income and well-being in the context of adaptation mechanism, I present a graph from Clark’s (2016) (Figure 3). The top line in the figure shows happiness level whereas the bottom line denotes level of income. An increase in income positively influence one’s happiness, but the effect is lost in time. Therefore, despite the permanent increase in income leading to an initial spike in happiness, the level of happiness comes back to original level.

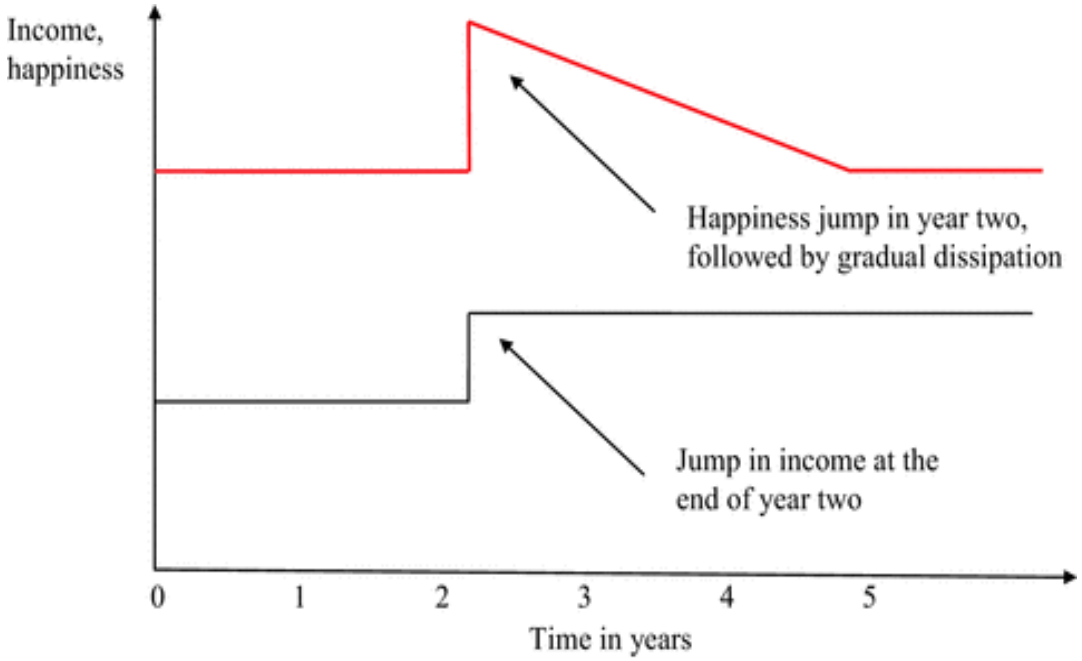

Figure 2 Happiness adaptation following an income shock (source: Clark, 2016)

It is unclear, however, how such a hedonic adaptation would affect the link between Social Security income and perceived well-being or optimism regarding future survival. While abrupt changes in retirement benefits would likely lead to noticeable variation in happiness, the changes in income in my study are only identified between cohorts of respondents. When Congress legislated the new benefit indexation formula in 1972, the members of windfall cohort

(born between 1910 and 1916) were still on the cusp of retirement, and the change in actual benefit paid at that time was experienced only by respondents born in the pre-windfall years. Moreover, when the Congress fixed its mistake in benefit indexation in 1977, it adopted a solution that diminished the magnitude of difference in benefits between those from the "notch" cohort who were about to retire and those in the windfall cohort. Still, given that the average benefits of "notch babies" were lower, and assuming that those in "notch" group use members of windfall group as reference while forming perceptions and aspirations regarding their own well-being, they might report lower happiness and quality of life.

Kahneman and Tversky's (1979) seminal prospect theory provides another framework that could help conceptualize the expected effect of income on well-being. One of the basic tenets of the theory is that individuals value gains and losses differently, weighing their losses more heavily than equivalent gains. Thus, individuals will tend to weigh negative life events more heavily than positive life events when evaluating their overall well-being. Applying this asymmetric valuation in the context of my study, a decrease in income experienced by members of the notch cohort would have more pronounced negative effect on overall well-being than the positive effect of increase in income experienced by the windfall cohort.

2. Hypotheses

Despite some theoretical ambiguities regarding the expectation of the presence of significant effect of income on well-being and longevity-related optimism, the evidence from literature described above appears to suggest that some positive effects should be observed. I introduce the following formal hypotheses:

[A] Effect of income change on the well-being measured by quality of life items:

[1] Those who receive higher Social Security retirement benefits will report a higher quality of life compared to those who receive lower Social Security retirement benefits.

[B] Effect of income change on survival expectation:

[2] Those who receive higher Social Security retirement benefits will report more optimistic estimates of survival expectation compared to those who receive lower Social Security retirement benefits.

CHAPTER 3

METHODOLOGY

The objective of this study is to identify and measure the causal effect of income on overall well-being measured by quality of life items, and survival expectation of older adults in America using an instrumental variable approach. Towards this goal, the rest of this chapter is organized into three sub-sections that lay out: (1) the examples of previous studies that identified a causal effect of income among older adults using the method of instrumental variables, (2) the discussion of data, sample, and main outcome variables, and (3) the description of statistical analyses conducted in this study.

Examples of Previous Relevant Studies on the Causal Effect of Income

The method of instrumental variables (IV) is frequently used to estimate causal relationships when controlled experiments are not feasible, and several studies on causal effects of income on happiness, subjective well-being or other outcomes used this technique to address endogeneity issues. For example, Lachowska (2015) isolated exogenous variation in income using the timing of 2008 economic stimulus tax rebate payments in order to estimate the effect of income on three measures of well-being: life satisfaction, health satisfaction, and affect. The rebate payments were one-time lump-sum transfers ($1,000 on average) sent to more than one hundred million households, and were found to have a positive and significant impact on affect or emotional well-being. To examine the causal effect of income on happiness, Powdthavee (2010) also adopted the IV approach, using a proportion of household members with payslip as an instrument.

Moreover, several studies used the Social Security "notch" as an instrument to examine the effect of income on various outcomes among older adults. Examples include studies of the effect of income on mental health (Golberstein, 2015), mortality (Snyder & Evans, 2006), body weight (Cawley, Moran, & Simon, 2010), bequests (Lee & Tan, 2017), cognitive function (Ayyagari & Frisvold, 2015), homeownership (Engelhardt, 2008), poverty (Engelhardt & Gruber, 2004), long-term care utilization (Goda, Golberstein, & Grabowski, 2011), labor supply (Krueger & Pischke, 1992), prescription medications (Moran & Simon, 2006), living arrangements (Engelhardt, Gruber, & Perry, 2005), and formal and informal home care use (Tsai, 2015) among older adults. These studies suggested that the increase in Social Security income resulted in a decrease in depressive symptoms or improvement in mental health (Golberstein, 2015) and cognitive health outcomes (Ayyagari & Frisvold, 2015), rise in elderly homeownership (Engelhardt, 2008), decline in elderly poverty (Engelhardt & Gruber, 2004), and increase in the use of paid home care services(Goda et al., 2011).

Data, Sample, and Key Variables

I used data from the Asset and Health Dynamics Among the Oldest Old (AHEAD) survey, a supplement to the Health and Retirement Study (HRS). The AHEAD is a longitudinal survey that includes a cohort of Americans born before 1924. By the time the AHEAD cohort was first interviewed in 1993, everyone in that cohort was 70 years old or older (HRS, 1994). The same individuals were interviewed again in 1995 and in the following HRS waves. However, since the questions that were used to code the key variables in this analysis were not asked after 1993, I only used data from the 1993 wave. The AHEAD data provides rich information on the older population's health, family, and the economic status during their post-retirement period.

Several characteristics of the 1993 AHEAD data make it particularly well-suited for this study. First, the survey was designed to "understand the impacts and interrelationships of changes and transitions for older Americans" (HRS, 1994, pg. 3) in health, finance, and family relationships, which aligns it well with the objectives of this research project. Second, the variation in birth dates of respondents allows me to use the Social Security "notch" to isolate the plausibly exogenous variation in income and identify the causal effect of income on older Americans' quality of life and perceived longevity. Third, the dataset provides a rich 14-question measurement of the quality of life, which allows me to examine the impact of income on various dimensions of subjective well-being in old age.

The observations in my analyses are individuals, implying that the outcome variables are measured at the individual level. However, the Social Security retirement income in the 1993 AHEAD data is measured at the household level, and respondents in this study are individuals living in households where the primary recipient of Social Security retirement benefit was born between 1901 and 1930. When identifying the primary beneficiary, prior studies that utilize the Social Security "notch" for the purpose of effect identification restrict the analysis samples to those Social Security beneficiaries who were born between 1901 and 1930 (Ayyagari & Frisvold, 2015; Cawley, Moran, & Simon, 2009; Goda, Golberstein, & Grabowski, 2011; Golberstein, 2016).[12] As shown in Table 1, I also restrict my analysis sample to those beneficiaries who were born between 1901 and 1930 and classify respondents into four different groups: [1] pre-windfall cohort – individuals born between 1901 – 1910; [2] windfall cohort – individuals born between 1911-1916 and thus receiving higher benefits than individuals in the notch cohort; [3] notch

[12] Previous studies used the years 1915 to 1917 as the notch cohort definition (Ayyagari & Frisvold, 2015; Goda, Golberstein, & Grabowski, 2011; Golberstein, 2015; Moran & Simon, 2006) because these years show the strongest F-statistics. Yet, Vere (2011) suggested that "the actual variation in the Social Security rules is too complex to be fully captured – or even mostly captured – by a binary instrument" (p.680).

cohort – individuals born between 1917 – 1921 and thus receiving significantly smaller Social Security retirement income compared to the previous cohort; and [4] post-notch cohort – individuals born after the notch cohort (1922-1930). In the subsequent estimations, the members of the windfall cohort are considered the treatment group due to the fact that those individuals were "treated" by policymakers to receive higher benefits. The notch cohort serves as the primary control group, while pre-windfall and post-notch cohorts serve as additional control groups.

Table 1 Definitions of Birth Cohort Groups

Cohort Groups	Primary Beneficiary's Year of Birth
Prewindfall	1901-1909
Windfall	1910-1916
Notch	1917-1921
Postnotch	1922-1930

Identifying the primary beneficiary of Social Security income is critical as the benefit amount differs by birth year and work history of the beneficiary. My method of identifying the primary beneficiary in different household structures closely follows the methods adopted by prior studies (Cawley, Moran, & Simon, 2009; Engelhardt, Gruber, & Perry, 2005; Goda, Golberstein, & Grabowski, 2011; Golberstein, 2015; Moran & Simon, 2006). If the AHEAD respondent is married, both the respondent and spouse are interviewed. One of the spouses, presumably the one that is more knowledgeable about the couple's finances, is designated as the "financial respondent" who answers questions pertaining to household income and assets. The question regarding the quality of life is asked of both spouses. Following the literature, in two-person households, I designate the male household member to be the primary beneficiary, and my classification of this household into one of the birth cohorts is based on this individual's date of birth. It is appropriate to assign the male member as the primary beneficiary because the

majority of female members in married households qualify for benefits based on their husband's earning history.

There are three types of households with no male member present: never-married female household, widowed female household, and divorced female household. For never-married female household, the female respondent is the primary beneficiary, and her year of birth is used to assign the respondent into one of the control groups or the treatment group. For widowed and divorced female households, I assume either the deceased or the former male spouse to be the primary beneficiary. Since the AHEAD data do not provide information about the ex-spouse, prior studies generated the birth year for the formal male spouse by subtracting three years from the widowed/divorced female's birth year.[13] Overall, I include four different types of households: married, divorced, widowed, and never-married.

The key independent variable in this study is income from Social Security Retirement. The AHEAD survey measures the Social Security retirement income at the household level, implying that for married couples, income is reported jointly as the sum of individual incomes. In the subsequent analyses, income is expressed in nominal terms and is rescaled to be measured in $1,000s.

Outcome Variables

Quality of Life

The AHEAD survey includes a separate module that contains a 14-item quality of life questionnaire intended to measure the psycho-social condition of respondents. The questions are adopted from unpublished work of Lawton (1993), the purpose-in-life subscale of Ryff's (1989) Subjective Well-Being Scale, and Pearlin and Schooler's (1978) mastery and personal control

[13] Engelhardt and Gruber (2004) suggested that three years was the median age difference for male and female spouses in these age cohorts.

items scale. The quality of life questionnaire was fielded with a sub-sample of AHEAD respondents. A total of 1,031 individuals were randomly selected to answer the module questions, and 858 provided valid responses. Among those who responded, 805 are members of the study cohorts. Further, among those 805 respondents, 131 (16.27%) are in the prewindfall cohort, 282 (35.03%) in the windfall cohort, 276 (34.29%) in the notch cohort, and 116 (14.41%) in the postnotch cohort. The quality of life module contains the following 14 questions:

1. “How often do you feel hopeful?”
2. “How often do you feel that you have much to look forward to?”
3. “How often do you feel that you have very few goals?”
4. “How often do you feel that you are just putting in time for the rest of your life?”
5. “How often do you feel that real enjoyments for your life are in the past?”
6. “How often do you feel that you would not be bothered if your life ended soon?”
7. “How often do your daily activities seem unimportant to you?”
8. “How often do you feel as if you have done all there is to do in life?”
9. “How often do you feel that you have little control over the things that happen to you?”
10. “How often do you feel that there is really no way that you can solve some of the problems you have?”
11. “How often do you feel that there is little you can do to change many of the important things in your life?”
12. “How often do you feel that you are being pushed around in your life?”
13. “How often do you feel that what happens to you in the future mostly depends on you?
14. “How often do you feel that you can do just anything you really set your minds to do?”

For each question, there are five available responses: (1) most of the time, (2) some of the time, (3) hardly ever, (4) DK – don't know, and (5) RF – refused by the respondent. I eliminated from the sample those respondents who refused to respond or did not know how to respond. In the subsequent analyses, I code 'mostly (all) of the time' responses as 1, 'some of the time' responses as 2, and 'hardly ever' responses as 3 for questions 3-12. For questions 1-2 and 13-14, I reverse-code 'most of the time' responses as 3, and hardly ever is '1'. Table 2 shows the response distribution for the quality of life items.

To analyze the quality of life, one could create an index variable that summarizes the information from the quality of life battery questions. However, such a simple index would "artificially reinforce" the measurement of quality of life if respondents tend to answer some or most of the questions in a similar way. Therefore, I conduct a principal component analysis of all responses in order to both eliminate this problem of redundancy in measurement and to identify any latent dimensions of the quality of life captured with this set of questions. The principal component analysis reduces the scale to a more valid index variable(s) that measure the quality of life without the "reinforcement" effect of redundancy in answers. Since responses to the quality of life items are categorical rather than continuous variables, I conduct the polychoric principal component analysis rather than the traditional type of analysis designed for continuous and normally distributed variables. As explained in detail in the next section, I decided to retain two principal components representing two latent dimensions of the perceived quality of life. The first principal represents the latent dimension that I labeled "Fulfillment & Control", and second principal component represents the latent construct labeled "Hopefulness". In order to assign scores to individuals in my sample to indicate where they stand on the retained latent dimensions of perceived quality of life, I calculate component scores for each individual for both

retained principal components. Each respondent's estimated scores are linear composites of the optimally weighted observed values of the quality of life scale items.[14]

Table 2 Quality of Life (QOL) Items

QOL Items	Question	Response Distribution (%)		
		Most of the time	**Some of the time**	**Hardly ever**
QOL1	**Feel Hopeful** "How often do you feel hopeful; most of the time, some of the time, or hardly ever?"	75.53	18.19	6.27
QOL2	**Look Forward** "How often do you feel that you have much to look forward to; most of the time, some of the time, or hardly ever?"	65.04	27.07	7.89
QOL3	**Feel Very Few Goals** "How often do you feel that you have very few goals; most of the time, some of the time, or hardly ever?"	21.82	33.17	45.02
QOL4	**Feel Putting in Time** "How often do you feel that you are just putting in time for the rest of your life; most of the time, some of the time, or hardly ever?"	17.83	19.85	62.33
QOL5	**Feel Enjoyment in Past** "How often do you feel that real enjoyments for your life are in the past; most of the time, some of the time, or hardly ever?"	24.75	25.88	49.38
QOL6	**Feel Ok If Life Ended Soon** "How often do you feel that you would not be bothered if your life ended soon; most of the time, some of the time, or hardly ever?"	15.75	17.16	67.09
QOL7	**Feel Activities Seem Unimportant** "How often do your daily activities seem unimportant to you; most of the time, some of the time, or hardly ever?"	13.71	23.65	62.64
QOL8	**Feel Done All There Is** "How often do you feel as if you have done all there is to do in life; most of the time, some of the time, or hardly ever?"	14.61	18.01	67.38
QOL9	**Feel Little Control** "How often do you feel that you have little control over the things that happen to you; most of the time, some of the time, or hardly ever?"	26.01	29.17	44.82
QOL10	**Feel No Way to Solve Problems** "How often do you feel that there is really no way that you can solve some of the problems you have; most of the time, some of the time, or hardly ever?"	16.10	29.06	54.84

[14] I use the "proc factor" and "proc score" commands in SAS software to conduct the factor analysis and obtain the factor scores.

QOL11	**Feel Little Can Change** "How often do you feel that there is little you can do to change many of the important things in your life; most of the time, some of the time, or hardly ever?"	20.56	32.31	47.13
QOL12	**Feel Pushed Around** "How often do you feel that you are being pushed around in life; most of the time, some of the time, or hardly ever?"	2.63	13.64	83.73
QOL13	**Feel Future Depends on Self** "How often do you feel that what happens to you in the future mostly depends on you; most of the time, some of the time, or hardly ever?"	68.82	18.00	13.18
QOL14	**Feel Mind Power** "How often do you feel that you can do just anything you really set your mind to do; most of the time, some of the time, or hardly ever?"	62.14	27.55	10.31

Note: **N=805.** The sample includes everyone in the study cohort groups [prewindfall, windfall, notch, and postnotch] who responded to the Quality of Life module of the HRS - AHEAD 1993 (Wave 1). The codebook documentation can be found here: http://hrsonline.isr.umich.edu/modules/meta/1993/ core/codebook/ codb-modtxt.htm#V2122. For the purpose of analysis presented in this dissertation, the responses were coded 1 'mostly (all) of the time', 2 'some of the time', and 3 'hardly ever', but QOL1, QOL2, QOL13, and QOL14 scores are reverse coded – as 1 being 'hardly ever' and 3 being 'mostly (all) of the time'. Thus, higher values are associated with higher quality of life. More detailed response distribution across different birth cohort groups are provided in the Appendix.

Survival Expectation

In this study, I use survival expectation, or optimism regarding survival as measured by reports of one's expected longevity, and it is modeled after Puri and Robinson's (2007) paper. In their study, Puri and Robinson use life expectancy miscalibration as a measure of optimism by taking a difference between a respondent's self-reported subjective life expectancy and life expectancy taken from the official life tables.[15] Similarly, I take the difference between subjective and objective survival expectations. The AHEAD survey asks several questions regarding expectations of the respondent's future. Among these questions, the survey asks respondents to evaluate their chances of living to a specified age subjectively. Responses are

[15] Optimism in Puri and Robinson's (2007) paper is calculated as follows: $Optimism_i = E_r(l|x) - E_a(l|x)$. $E_r(l|x)$ is the expected value of a respondent's remaining life *l* conditional on a set of personal characteristics denoted by *x*. This is then taken under the respondent's subjective probability distribution, which is denoted by $E_r(.)$. $E_a(l|x)$, on the other hand, is the conditional expectation of the respondent's remaining life *l* taken from the actuarial tables. Thus, *Optimism regarding survival = Self-reported subjective life expectancy – Life expectancy from actuarial tables.*

recorded on a 0 to 100 percent scale. The question specifically asks: “What do you think are the chances that you will live to be at least (born 1904-1908:100; born 1909-1913: 95; born 1914-1918: 90; born 1919-1923: 85; born 1924 or after: 80)?” This self-reported probability of living for about another 10 years from the year the respondents took the survey serves as the measure of subjective survival expectation. A total of 5,868 respondents are included in the survival expectation analysis. Further, among those 5,868 respondents, 953 (16.24%) are in the prewindfall cohort, 2,066 (35.21%) in the windfall cohort, 1,984 (33.81%) in the notch cohort, and 865 (14.74%).

Also, the RAND version of AHEAD provides information on the respondents’ 10-year probability of survival calculated from life tables, which serves as the measure of objective survival expectation in my study. Thus, taking the difference between the objective survival expectation and the self-reported subjective survival expectation results in a measure of level of optimism regarding future survival. Puri and Robinson (2007) calculated the life expectancy in months and years, however, since the AHEAD data asks respondents about the probability, the optimism level in my study will be in probability scores instead of months and years. Using the objective survival expectation as a baseline allows me to examine whether individuals are more or less optimistic towards their own survival than they should be relative to what the objective statistics from the life tables reveal about their survival probability. A summary of optimism calculation with summary statistics broken down by gender, cohort groups, and race/ethnicity is provided in the results section. The summary shows that the optimism level for survival differs between genders, cohort groups (age), and race/ethnicity groups in the AHEAD sample. Further, to examine the effect of income on survival expectation (a proxy for optimism), I run analyses

using the subjective survival expectation as a dependent variable and the objective survival expectation as one of the control variables.

Data Analysis

1. Ordinary Least Squares

My empirical strategy is similar to the methodology employed by Ayyagari and Frisvold (2015) and Golberstein (2015) who investigate the causal effect of income on cognition and mental health, respectively. First, I measure the association between Social Security income and the outcome variables by estimating the reduced form equations using ordinary least squares. Although these estimations are merely capable of capturing correlations rather than causal effects, it is informative to learn how the Social Security income is associated with the outcomes of interests. The estimated equations are of the following form:

$$Y_{ih} = \alpha_1 + \alpha_2 SSIncome_h + \alpha_3 X_{ih} + \varepsilon_{ih} \quad (1)$$

where the dependent variable Y is operationalized to measure the quality of life (or survival expectation) for individual i residing in household h. $SSIncome_h$ represents household's annual Social Security income. Covariate set X includes socioeconomic and demographic characteristics of both individuals and households, and ε is the error term assumed to be normally distributed with mean zero. Following the literature that examines the causal effect of income on various outcomes (see, e.g., Goda, Golberstein, & Grabowski, 2011), the set of controls X includes the following variables that are assumed to be exogenous: age of the head of the household, a binary indicator for gender (female), marital status (never-married, married, divorced, and widowed), race/ethnicity (white, black, Hispanic, and other race), number of children, education level (less than high school, high school, some college, and college and higher), a binary indicator for residing in a Metropolitan Statistical Area (urban/rural), and census region of residence

(Northeast, Midwest, South, and West).[16] Detailed information on those control variables is provided in Appendix A. I also estimate a set of similar equations of the following form:

$$Y_{ih} = \alpha_1 + \alpha_2 Cohort_i + \alpha_3 X_{ih} + \varepsilon_{ih} \quad (2)$$

in which $Cohort$ is a set of birth cohort indicators and other variables are defined as in Equation (1) above. Regressing the outcome variables on the notch cohort dummy and other cohort indicators (with windfall cohort serving as the comparison group) is expected to reveal the overall effect of being treated by policymakers to higher retirement income due to birth year on the outcomes of interest.

The ordinary least squares generate estimates of parameters in Equation (1) that indicate whether an increase in income has a positive/negative relationship with the quality of life. However, unobserved factors may be correlated with both income and these outcome variables, which may create the problem of omitted variable bias. To address this problem, I estimate the instrumental variable models in which the birth cohort indicators are used as instruments for Social Security retirement income. To the extent that the birth cohorts affect outcome variables only indirectly through retirement income benefit received from Social Security, the results from these estimations isolate exogenous variation in retirement income and thus reveal the true causal effect of income on quality of life. Moreover, the advantage of the instrumental variable approach relative to Equation (2) above is the fact that it allows for a heterogeneous effect of membership in the notch or other cohorts on outcome variables. Several studies have previously used the Social Security "notch" as an instrument for income, and my methodology closely follows these examples (e.g., Golberstein, 2015).

[16] For survival expectation model, the objective survival expectation is added as one of the control variables.

2. Instrumental Variable Approach

Estimating the effect of income on well-being using a reduced form equation may lead to endogeneity bias primarily for two reasons. First, both income and perceived well-being are likely causally affected by unobserved variables such as personality traits or preferences. Second, individual with higher perceived quality of life (or stronger aspirations for a higher quality of life) could have made life choices that would lead to higher income. Moreover, low perceived well-being could have affected social, physical, mental, or psychological factors that would diminish productivity and income, implying that there might be a reciprocal relationship going from the perceived quality of life to income. I address these endogeneity issues by adopting the instrumental variable estimation method.

The instrumental variable approach requires a two-stage least squares estimation (2SLS). In the first stage, the Social Security income is regressed on birth cohort indicators and control variables:

$$SSIncome_{ih} = \delta Cohort_h + \theta X_{ih} + \lambda Age_i + \eta_{ih} \quad (3)$$

In this equation, the Social Security income is regressed on the set of birth cohort indicators ($Cohort$) that serve as an instrument. Since the instrument variables vary by the household primary beneficiary's birth year, it is important to reiterate that I include a linear function of the primary beneficiary's age in the equation. The second stage equation is as follows:

$$Y_{ih} = \beta \widehat{SSInc}_h + \gamma X_{ih} + \rho Age_i + \mu_{ih} \quad (4)$$

Under the standard assumption of the instrumental variable approach, the coefficient estimate β reveals the true causal effect of Social Security income on the outcome variable. In order to achieve precise effect identification, the instrumental variables should be sufficiently

correlated with the instrumented regressors, i.e.; the instruments should display sufficient strength. A traditional rule of thumb for the instruments to be considered sufficiently strong is that the F-statistic in the first-stage is larger than 10. Since my instrumental variables narrowly miss that threshold, I use the technique described by Lewbel (2012) to enhance the instruments' strength in all subsequent estimations.[17]

Lewbel (2012) proposed an IV approach similar to the conventional 2SLS method that relies on internally generated instruments and could be useful in applications where conventional instrumental variables are not available or in cases where instruments are weak.[18] In Lewbel's approach, the internal instruments are created from the residuals of auxiliary regressions multiplied by the included exogenous variables (X) in the mean-centered ($\bar{X}$) form. Specifically, the constructed instruments are defined as $Z_i = (X_i - \bar{X})\varepsilon$, where ε represents a vector of first-stage regression residuals of the endogenous regressor on all exogenous variables, and is assumed to have zero covariance with exogenous regressors. The mean of each internally generated instrument is by design zero. The identification is realized given the precondition of some heteroscedasticity in the errors from the first-stage regression, which is certainly satisfied in my study.[19]

I combine the conventional instrumental variables (birth cohort dummies) with the generated heteroscedasticity-based instruments in order to achieve the desired value of the first-

[17] The first stage F-statistic in the conventional IV approach varies within 6-8 range depending on the definition of birth cohorts. I implement the Lewbel's IV estimation in Stata software with the command *ivreg2h* (Baum & Schaffer, 2012).
[18] Results for the conventional 2SLS on different dimensions of quality of life are shown in Appendix D and E. Yet, the results show a weak first-stage relationship using notch as an instrument ($F > 10$).
[19] Baum and Lewbel (2019) note that it is preferable to use external instruments rather than using heteroskedasticity-based instruments, but also mention that Lewbel's constructed instruments approach can be useful if no outside instruments are available or conventional instruments are weak.

stage F-statistic.[20] Lewbel's IV method has been used extensively in the literature, including studies on subjective well-being. Specifically, researchers have applied this technique to examine relationships between smoking behavior and subjective welfare including happiness and depression (Churchill & Farrell, 2017a), alcohol consumption and depression (Churchill & Farrell, 2017b), trust, social network and subjective well-being in China (Churchill & Mishra, 2017), aggregate political trust and individual happiness in China (Fu, 2018), transport poverty and subjective well-being (Churchill & Smyth, 2019), optimism and mortality (O'Connor & Graham, 2019), and fuel poverty and subjective well-being in Australia (Churchill, Smyth, & Farrell, 2020). These studies all encountered the endogeneity issue and applied Lewbel's estimation technique to examine their research questions. Also, as the literature itself proves that more and more scholars are applying Lewbel's techniques in subjective well-being research, my study will contribute knowledge about the relationship between income and quality of life (and survival expectancy) among the elderly using the same technique. Among studies that have examined the effect of income on outcome variables using "notch" as an instrument, this is the first study that used Lewbel's two-stage least square technique.

[20] Previous studies that used the Social Security "notch" as an instrument also found a weak first-stage relationship (F statistic < 10) but relied on sample manipulation to boost the strength of instruments. For example, they dropped individuals where the primary Social Security beneficiary had higher than high school education (Golberstein, 2015; Moran & Simon, 2006). Replicating such a strategy would be prohibitively costly in terms of the sample size in this study.

CHAPTER 4

RESULTS

Description of Sample

Table 3 presents selected descriptive characteristics for the full sample of respondents, as well as the breakdown of statistics separately for each cohort group. About 19% of respondents belong to the prewindfall group, 35% belong to the windfall group, 32% are in notch group, and nearly 14% are in the postnotch group. The mean household's income from earnings in the full sample is $2,308, the total non-social security income is $15,330 and the total Social Security income is $10,663. All dollar values are in 1993 dollars. The comparison of mean household earnings and non-Social Security income across birth cohorts reveals that these categories of income decrease in importance in the expected way as households get older. The univariate analysis of the mean Social Security income separately for the respondent and spouse shows that individuals in the windfall cohort enjoy visibly higher income than those in the adjacent cohorts.

This pattern reveals the magnitude of effect that the "notch" had on retirement benefits, as explained earlier in the background on the Social Security notch. Interestingly, this trend is obscured when the individual retirement benefits are aggregated into the household level, as the mean Social Security retirement income of households in the windfall cohort is no longer greater than the average benefits received by households in younger cohorts. It must be acknowledged, however, that these univariate statistics do not adjust for household characteristics, especially household composition and age of the spouse, which could explain why the "notch" is not easily identifiable in the mean household-level retirement income received from Social Security.

Table 3 Selected Characteristics of Full Sample and Different Cohort Groups

Selected Characteristics	Full Sample (N=7,572)	Cohort Groups: Prewindfall Group[a] (N=1,433)	Windfall Group[b] (N=2,673)	Notch Group[c] (N=2,425)	Postnotch Group[d] (N=1,041)
Percent of sample	100	18.92	35.30	32.03	13.75
	Mean ($)	Mean ($)	Mean ($)	Mean ($)	Mean ($)
Earnings Income (R)	$2,308	$466	$2,335	$2,718	$3,816
Total Non-Social Security Household Income	$15,330	$7,288	$14,437	$17,778	$22,993
Social Security Income (R)	$6,947	$6,994	$7,235	$6,913	$6,220
Social Security Income (S)	$6,473	$6,300	$6,776	$6,567	$5,966
Total Household Social Security Income	$10,663	$9,030	$10,670	$11,203	$11,636
	%	%	%	%	%
Age (average)	76.03	84.41	77.62	72.17	69.44
Gender					
Male	37.69	25.89	38.90	41.65	53.51
Female	62.31	74.11	61.10	58.35	46.49
Marital Status					
Married	56.90	32.10	50.51	64.76	89.37
Divorced	3.57	2.30	3.89	4.84	1.55
Widowed	35.54	61.83	41.86	25.97	5.22
Never-Married	2.70	2.79	2.43	2.81	3.00
Race					
White	85.46	83.81	84.77	86.27	87.60
Black	12.76	14.24	13.43	12.21	10.29
Other Race	1.28	1.95	1.80	1.53	2.12
Hispanic	5.24	4.61	4.38	5.98	6.63
Number of Children (average)	2.78	2.28	2.63	3.01	3.26
Self-rated Health Status					
Health Excellent	10.92	8.53	9.06	13.07	13.94
Health Very Good	23.20	20.84	21.56	24.95	26.54
Health Good	30.44	29.51	30.81	30.19	31.35
Health Fair	22.96	23.92	25.20	21.57	19.13
Health Poor	12.49	17.20	13.37	10.23	9.04
Education					
Less than High School	41.43	53.18	44.48	34.31	34.01
High School	45.62	34.40	44.86	51.26	49.86
Some College	1.77	2.02	1.57	1.94	1.54
College Graduate	11.19	10.40	9.09	12.49	14.60
Metropolitan Statistical Area					

Rural	24.64	25.96	25.40	23.63	23.63
Urban	75.36	74.04	74.60	76.37	76.37
Census Region					
Northeast	19.00	18.14	20.61	18.68	16.81
Midwest	24.79	23.87	25.51	23.88	26.32
South	39.91	43.82	39.02	40.49	35.45
West	16.30	14.17	14.85	16.95	21.42
Objective Survival Expectation	34.56	13.43	30.30	45.56	47.78

Note. The number of observations varies by variable because the descriptive statistics are provided for all cases with valid non-missing response. [a]Refers to respondents in the household where the primary Social Security beneficiary was born in 1901-1909. [b]Refers to respondents in the household where the primary Social Security beneficiary was born in 1910-1916. [c]Refers to respondents in the household where the primary Social Security beneficiary was born in 1917-1921. [d]Refers to respondents in the household where the primary Social Security beneficiary was born in 1922-1930. All the dollar values are in 1993 dollars.

The trends in income are portrayed graphically in Figures 3 and 4 below. Figure 3 shows trends of earnings income, total non-Social Security household income, and total household Social Security income. Figure 4 shows Social Security income of respondents and spouses by cohort group. In both figures, (R) represents respondent and (S) represents spouse.

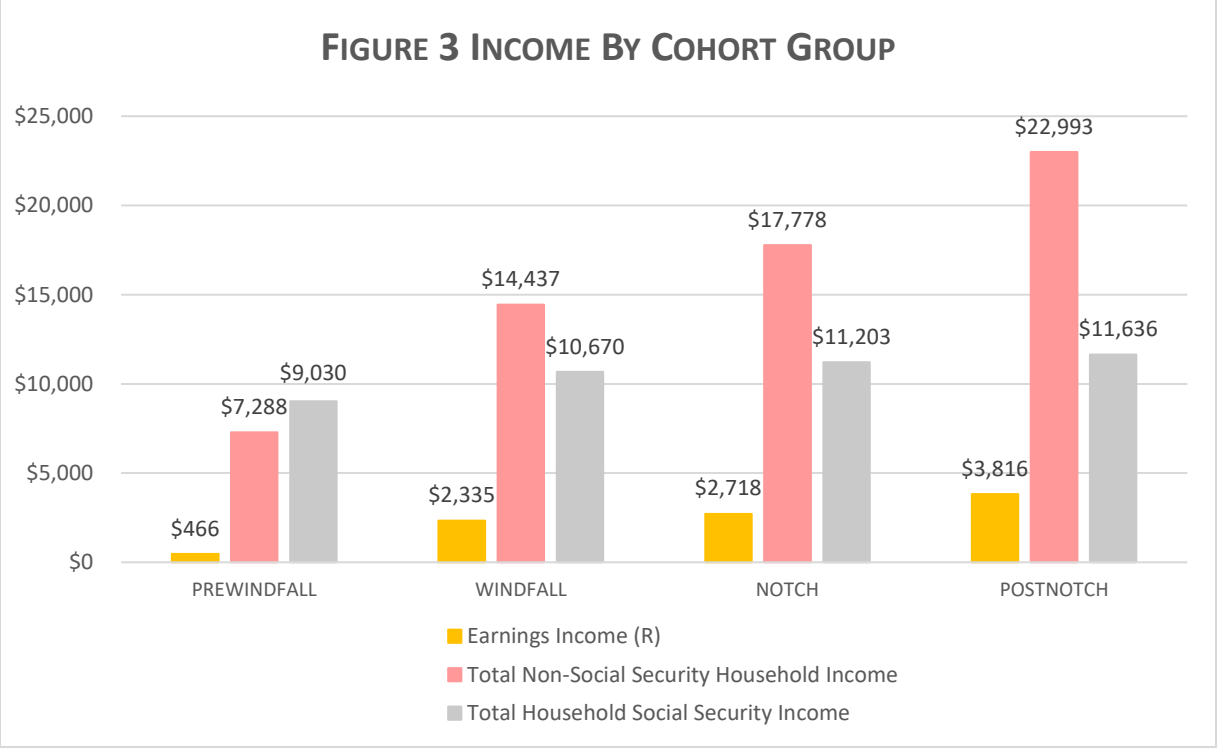

Figure 3 Income by Cohort Groups (*in 1993 dollars*)

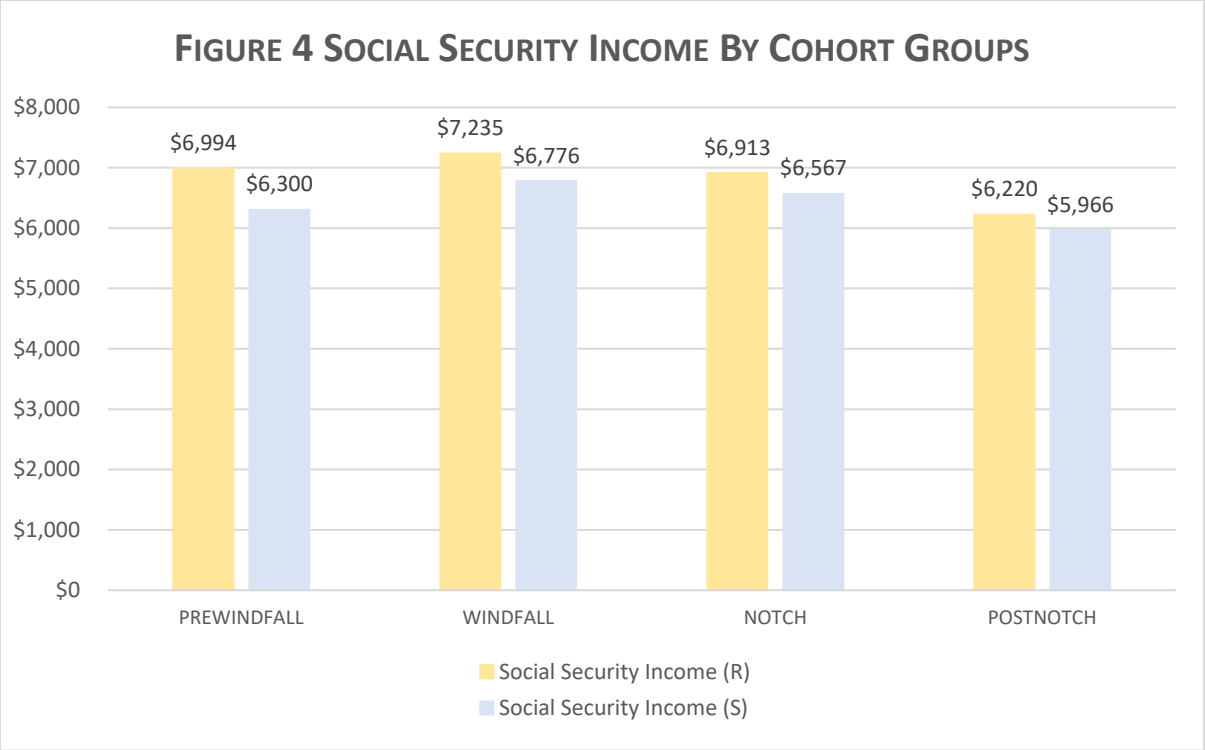

Figure 4 Social Security Income by Cohort Groups (*in 1993 dollars*)

Overall, there are far more White respondents than Black, Hispanic, and other race respondents in the sample. Yet, compared to the oldest cohort (prewindfall), the rates of Hispanic, White, and other race respondents are higher in the younger groups, while the rates of Black respondents are slightly lower in younger cohorts.

The respondents in the prewindfall cohort in 1993 were over 80 years old. The average age in the windfall cohort was 77, 72 for those in the notch cohort, and 69 for those in the postnotch cohort. For those who were born in 1937 or earlier, the age eligibility threshold for full social security benefits was 65 (Congressional Research Service, 2019a), and everyone in the sample met the age requirement for full retirement when they participated in the survey in 1993. I excluded observations of households that did not report any Social Security retirement income. The average number of children across the groups fluctuates around 3, and more than half of the

sample (64%) are female. Interestingly, male respondents dominate among younger cohorts, but females are more likely to be respondents among older cohorts. This observation is consistent with the longer living horizons of females.

About three-quarters of the sampled households live in urban areas, and this statistic is similar across all cohort groups. Census regions appear to be somewhat equally represented, with the highest percentage of respondents residing in the Southern United States. This observation might indicate the fact that many individuals move south for retirement. In terms of education, about 41% of the sample has less than high school education, about 46% attained a high school diploma, and 11% have a college degree. There are some notable differences in attributes, mainly education and marital status, across the cohort groups. For example, compared to prewindfall cohort, postnotch households have significantly fewer respondents with less than high school, but more respondents with high school and college degrees. Figure 5A clearly shows that each consecutive generation in my sample is better educated relative to the older cohorts.

In terms of marital status, summary statistics show an expected yet interesting pattern. Looking at Figure 6A, from the prewindfall to the postnotch cohort, ‘married’ and ‘widowed’ categories show a steady increase and decrease pattern, respectively. The rate of divorced individuals steadily increases up to the notch cohort, and then falls quickly for the postnotch cohort (Figure 6B).

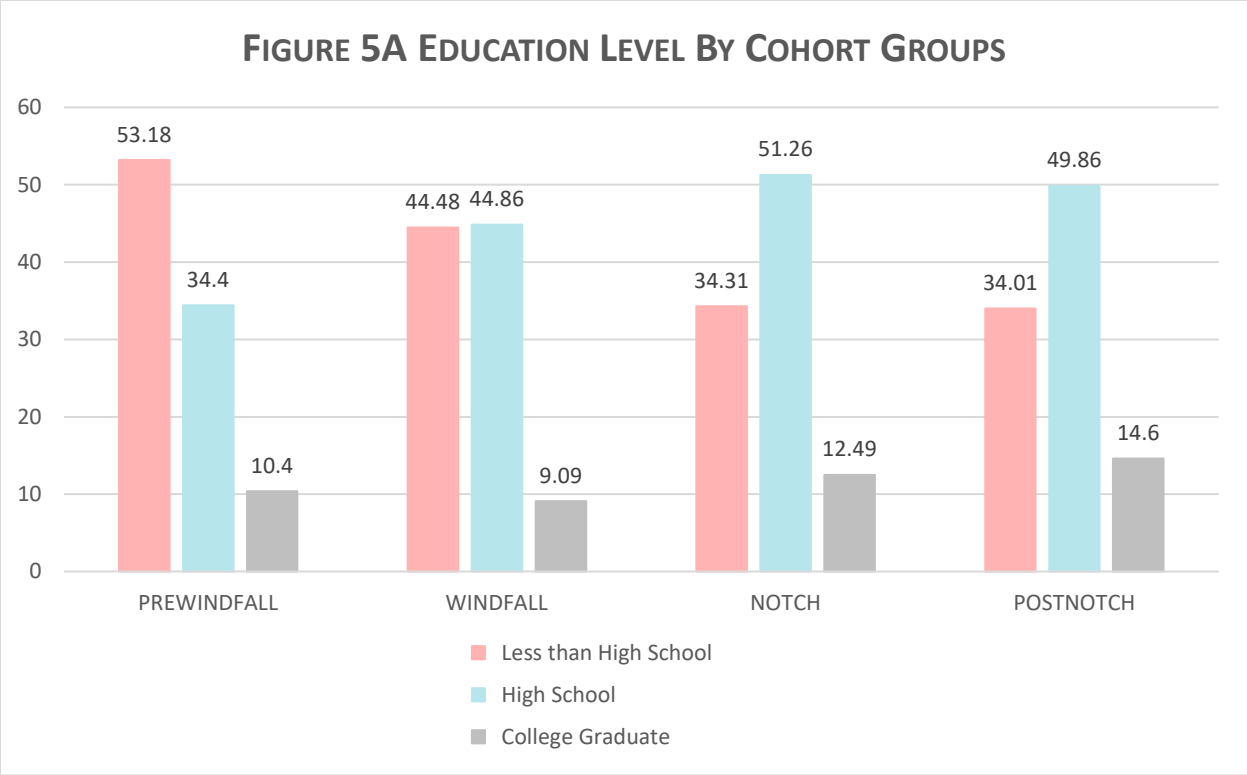

Figure 5A Education Level by Cohort Groups (*in percentage %*)

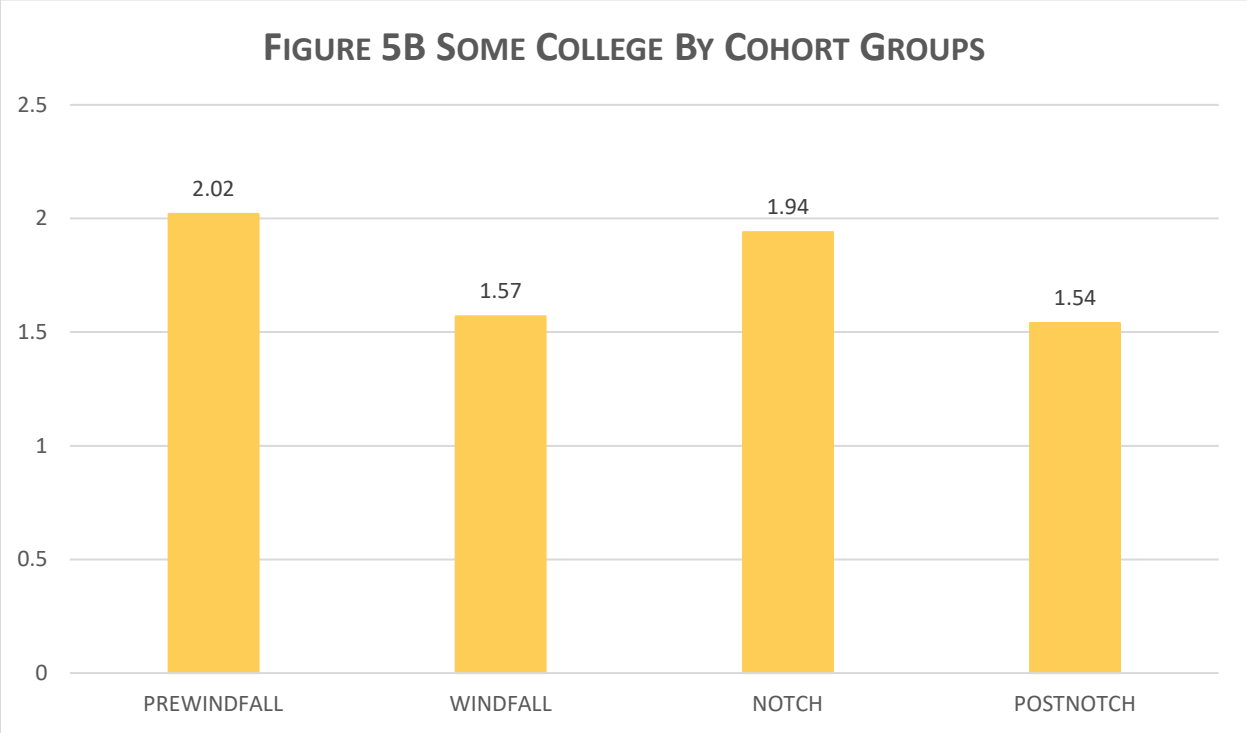

Figure 5B Some College Education Level by Cohort Groups (*in percentage %*)

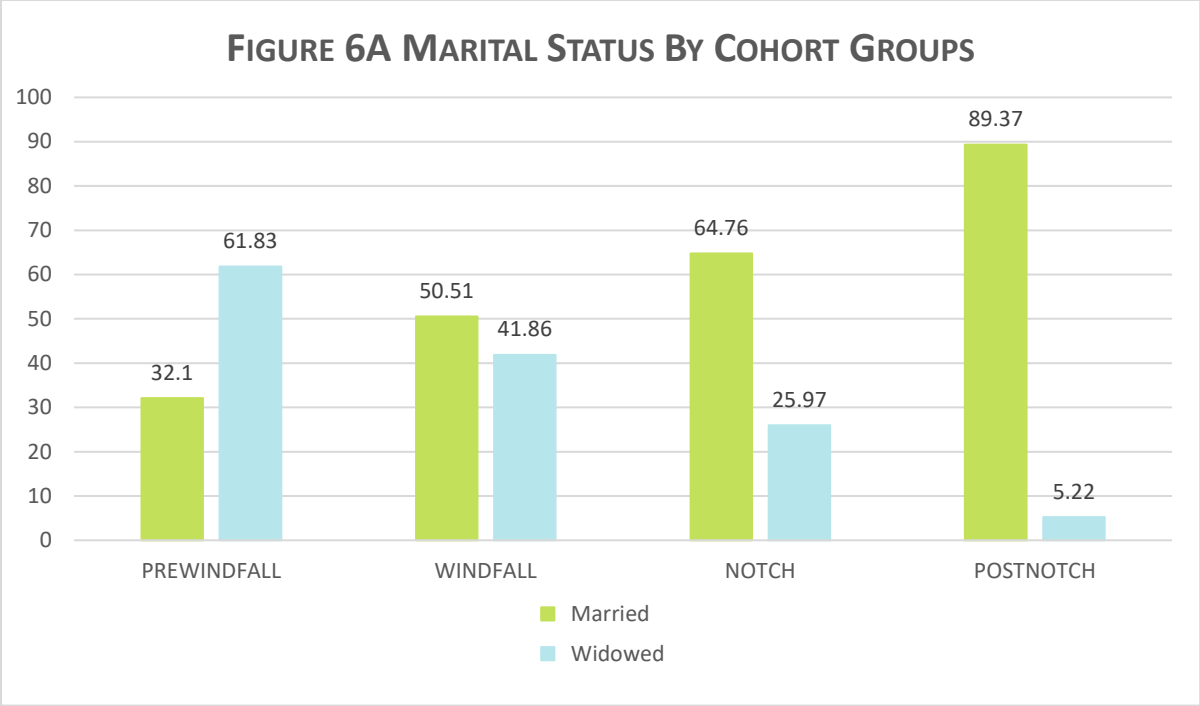

Figure 6A Marital Status by Cohort Groups (*in percentage %*)

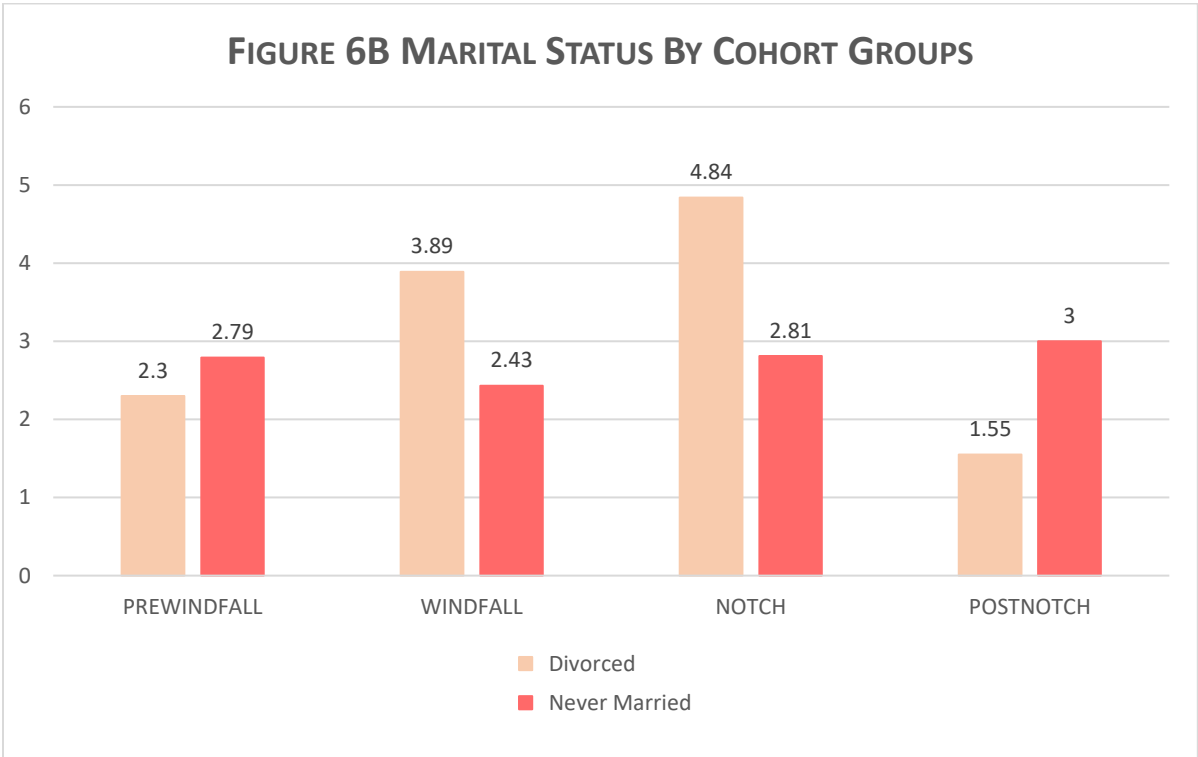

Figure 6B Marital Status by Cohort Groups (*in percentage %*)

To identify potential differences in the characteristics of respondents who answered the quality of life questions compared to the characteristics of the full AHEAD study sample, I provide a separate table of descriptive statistics specifically for this sub-sample (Table 4). Compared to the full AHEAD sample, those who responded to the quality of life module show slightly higher unearned income. However, the earnings of respondents who answered the quality of life questions are, on average, lower than the earnings of those in the full AHEAD dataset. Similar to the full AHEAD sample and cohort groups, among those who answered the quality of life questionnaires, there are more Whites than Black or other race respondents. Also, the distribution of other characteristics of respondents are similar between respondents to the quality of life module and the full sample.

Table 4 Selected Characteristics for the Sample of Respondents to Quality of Life survey

		Cohort Groups			
Selected Characteristics	**Full Sample (N=805)**	**Prewindfall Group[a] (N=131)**	**Windfall Group[b] (N=282)**	**Notch Group[c] (N=276)**	**Postnotch Group[d] (N=116)**
Percent of sample	100	16.27	35.03	34.29	14.41
	Mean ($)	Mean ($)	Mean ($)	Mean ($)	Mean ($)
Earnings Income (R)	$1878	$890	$1,317	$2,376	$3,171
Total Non-Social Security Household Income	$19,672	$8,096	$24,141	$18,215	$25,348
Social Security Income (R)	$7,041	$7,350	$7,205	$6,922	$6,576
Social Security Income (S)	$6,648	$6,528	$7,345	$6,792	$5,612
Total Household Social Security Income	$10,815	$9,493	$10,487	$11,425	$11,656
	%	%	%	%	%
Age (average)	75.37	84.66	77.03	71.89	69.15
Gender					
Male	36.27	27.48	29.08	39.86	55.17
Female	63.73	72.52	70.92	60.14	44.83
Marital Status					
Married	56.48	32.82	44.48	66.18	89.57
Divorced	3.37	2.29	4.63	3.64	0.87
Widowed	35.66	62.60	45.55	25.82	4.35
Never-Married	2.99	2.29	2.85	2.55	5.22
Race					
White	86.83	86.26	83.33	89.86	88.79

Black	11.93	12.21	15.60	8.70	10.34
Other Race	1.24	1.53	1.06	1.45	0.86
Hispanic	4.47	3.05	4.96	4.35	5.17
Number of Children (average)	2.84	2.16	2.77	3.03	3.34
Self-rated Health Status					
Health Excellent	11.46	8.40	12.10	14.49	6.09
Health Very Good	27.52	26.72	23.84	30.80	29.57
Health Good	31.01	30.53	30.60	28.99	37.39
Health Fair	20.55	21.37	23.84	19.20	14.78
Health Poor	9.46	12.98	9.61	6.52	12.17
Education					
Less than High School	39.01	51.15	42.20	33.33	31.03
High School	47.08	29.77	48.23	52.90	50.00
Some College	1.49	3.82	1.06	1.45	0.00
College Graduate	12.42	15.27	8.51	12.32	18.97
Metropolitan Statistical Area					
Rural	23.98	27.48	25.18	23.55	18.10
Urban	76.02	72.52	74.82	76.45	81.90
Census Region					
Northeast	18.14	16.79	18.44	18.48	18.10
Midwest	25.47	25.19	25.89	26.45	22.41
South	41.61	47.33	42.55	38.04	41.38
West	14.78	10.69	13.12	17.03	18.10
Objective Survival Expectation	36.00	11.59	32.15	46.24	47.94

[a]Refers to respondents in the household where the primary Social Security beneficiary was born in 1901-1909.
[b]Refers to respondents in the household where the primary Social Security beneficiary was born in 1910-1916.
[c]Refers to respondents in the household where the primary Social Security beneficiary was born in 1917-1921.
[d]Refers to respondents in the household where the primary Social Security beneficiary was born in 1922-1930. All the dollar values are in 1993 dollars.

Following Puri and Robinson's (2007) paper, I calculated life expectancy miscalibration (or optimism for survival), and report descriptive results in Table 5. Puri and Robinson relied on subjective and objective measures of life expectancy in months and years. However, since the AHEAD data asks respondents about the self-reported probability of living for about another 10 years from the time of interview, I measure survival expectancy in percentages. My measure of survival optimism (column 4 in Table 5) is as the difference between 10-year probability of

survival from the life table and the respondents' self-reported probability. Based on this calculation, on average, females' reports of survival likelihood are about 3 percentage points more optimistic than their objective baseline, whereas the males' reports exceed the objective baseline by about 18 percentage points.

These results seem to suggest that males tend to be more optimistic than females. Also, comparing the optimism level for different cohort groups and race/ethnicity suggests some interesting findings. From prewindfall to postnotch cohort, the optimism level for survival decreases, which suggests that as people age, their self-reported survival probability tends to diverge further away from the probability reported in life tables. Thus, as people age, there seems to be a greater gap in the optimism level (as shown in column (5) in the table). Moreover, as suggested in the literature, Black respondents' optimism level for survival is the highest among all race/ethnicity groups.

Table 5 Calculating Life Expectancy Miscalibration (Optimism for Survival)

		Life expectancy, based on age and gender:			
	Age	**Self-reported** (R2LIV10)	**Life table** (R2LIV10P)	**Optimism** = R2LIV10 – R2LIV10P	
Female	76.28	43.65	40.56	3.09	
Male	76.81	42.49	24.58	17.91	
Prewindfall	84.41	31.10	13.43	17.67	17.67 – 8.73 = **8.94**
Windfall	77.62	39.03	30.30	8.73	8.73 – 4.05 = **4.68**
Notch	72.17	49.61	45.56	4.05	4.05 – 3.78 = **0.27**
Postnotch	69.44	51.56	47.78	3.78	
Black	76.64	50.15	34.32	15.83	
White	76.47	42.47	34.68	7.79	
Other race	75.91	39.76	33.16	6.6	
Hispanic	75.11	42.67	37.71	4.96	

Note: Following Puri and Robinson's (2007) paper, I calculated life expectancy miscalibration (or Optimism for Survival).

Key Outcome Variables

Table 6 shows the distributional characteristics of outcome variables (quality of life items – QOL, and survival expectation probability). The respondents to quality of life questions

constitute a random sub-sample of the overall AHEAD survey. After eliminating observations with missing values, I ended up with a sample of 805 respondents for the quality of life analysis, and 5,868 respondents for the survival expectation analysis.

Most responses to QOL items are coded as 1 - 'mostly (all) of the time', 2 - 'some of the time', and 3 - 'hardly ever'. Notable exceptions include items number 1, 2, 13, and 14, where I reverse code the response so that 1 is 'hardly ever' and 3 signifies 'mostly (all) of the time'. Items are recoded this way so that the higher score implies higher quality of life. For example, QOL item 1 asks how often respondents feel hopeful. Having the mean score closer to 3 would signify that most respondents in the sample sometimes to mostly all the time feel hopeful.

The descriptive analysis of responses to the quality of life items reveals that, out of all 14 QOL items, QOL item 12, which asks "How often do you feel that you are being pushed around in your life?", consistently shows the highest mean score, both overall (2.81) and across different cohort groups. Moreover, all average responses to QOL items are quite high (above 2) implying rather positive and optimistic overall outlooks in the studied sample. Finally, most items reveal a monotonic trend of optimism declining with age.

Similarly, and expectedly, people who are older are less likely to provide positive or optimistic response to a question about the likelihood of survival over the next 10 years. On average, respondents in the prewindfall group responded there was 31% chance that they would live 10 more years from the age when they were asked the question. Those in the postnotch cohort, however, evaluated their chance to survive for 10 more years as better than 50%.

Table 6 Descriptive Characteristics of Outcome Variables

Variable	Full Sample (N=805) (100%)	Cohort Group: Prewindfall Group[a] (N=131) (16.27%)	Windfall Group[b] (N=282) (35.03%)	Notch Group[c] (N=276) (34.29%)	Postnotch Group[d] (N=116) (14.41%)
14-Quality of Life Items	Mean score	Mean score	Mean score	Mean score	Mean score
QOL1: Feel Hopeful	2.69	2.53	2.69	2.73	2.78
QOL2: Look Forward	2.57	2.47	2.53	2.64	2.62
QOL3: Feel Very Few Goals	2.23	2.22	2.25	2.27	2.11
QOL4: Feel Putting in Time	2.45	2.24	2.42	2.49	2.62
QOL5: Feel Enjoyment in Past	2.25	2.06	2.21	2.34	2.31
QOL6: Feel OK if Life Ended Soon	2.51	2.36	2.46	2.58	2.63
QOL7: Feel Activities Seem Unimportant	2.49	2.36	2.42	2.59	2.56
QOL8: Feel Done All There Is	2.53	2.42	2.49	2.57	2.65
QOL9: Feel Little Control	2.19	2.05	2.13	2.30	2.23
QOL10: Feel No Way to Solve Problems	2.39	2.27	2.36	2.46	2.42
QOL11: Feel Little Can Change	2.27	2.24	2.23	2.32	2.24
QOL12: Feel Pushed Around	2.81	2.84	2.80	2.80	2.84
QOL13: Feel Future Depends on Self	2.56	2.61	2.52	2.55	2.60
QOL14: Feel Mind Power	2.52	2.43	2.51	2.52	2.65
	Full Sample (N=5,868) (100%)	**Prewindfall Group[a] (N=953)** (16.24%)	**Windfall Group[b] (N=2,066)** (35.21%)	**Notch Group[c] (N=1,984)** (33.81%)	**Postnotch Group[d] (N=865)** (14.74%)
Survival Expectation Probability (0-100 range)	43.17	31.10	39.03	49.61	51.56

[a]Refers to respondents in the household where the primary Social Security beneficiary was born in 1901-1909.
[b]Refers to respondents in the household where the primary Social Security beneficiary was born in 1910-1916.
[c]Refers to respondents in the household where the primary Social Security beneficiary was born in 1917-1921.
[d]Refers to respondents in the household where the primary Social Security beneficiary was born in 1922-1930.
Responses were coded 1 'mostly (all) of the time', 2 'some of the time', and 3 'hardly ever', but QOL1, QOL2, QOL13, and QOL14 scores are reverse coded – as 1 being 'hardly ever' and 3 being 'mostly (all) of the time'. Thus, the more means better or higher quality of life. Mean score for each quality of life items range 1-3.

Principal Component Analysis

I conducted the principal component analysis in order to reduce the number of variables measuring quality of life and identify any latent dimensions or common factors measured by these items. Given the ordinal nature of items in this survey module, I use the polychoric rather

than Pearson correlation coefficients as input into the principal component analysis. Polychoric correlation is a technique of estimating correlation between variables that are ordinal rather than normally distributed continuous as assumed in the traditional factor analysis. The basic rule of thumb for the minimal sample size in principal component analysis is that the number of respondents is greater than 100 (Soldo, Hurd, Rodgers, & Wallace, 1997) or that there are at least 10 respondents per variable (Floyd & Widaman, 1995). My sample comprises 805 respondents, which easily satisfies this requirement.

Tables 7B and 7B report the polychoric correlation coefficients between quality of life (QOL) items. For example, QOL1 and QOL2 shows a strong and significant correlation (0.68). Except for the correlations between QOL1 and QOL3, QOL2 and QOL3, QOL3 and QOL12, QOL3 and QOL13, QOL3 and QOL14, QOL6 and QOL13, QOL7 and QOL13, QOL7 and QOL14, QOL10 and QOL13, and QOL11 and QOL13, all QOL items show statistically significant correlation with each other.

Table 7A Polychoric Correlations (**N=805**)

QOL Item	With QOL Item	Correlation
QOL1	**QOL2**	0.68796***
QOL1	**QOL3**	-0.05179
QOL1	**QOL4**	0.34272***
QOL1	**QOL5**	0.34841***
QOL1	**QOL6**	0.27491***
QOL1	**QOL7**	0.32669***
QOL1	**QOL8**	0.40768***
QOL1	**QOL9**	0.25804***
QOL1	**QOL10**	0.23998***
QOL1	**QOL11**	0.20961***
QOL1	**QOL12**	0.31868***
QOL1	**QOL13**	0.21168***
QOL1	**QOL14**	0.37770***
QOL2	**QOL3**	-0.00269
QOL2	**QOL4**	0.51738***
QOL2	**QOL5**	0.44724***
QOL2	**QOL6**	0.36792***
QOL2	**QOL7**	0.32646***
QOL2	**QOL8**	0.38670***
QOL2	**QOL9**	0.33472***
QOL2	**QOL10**	0.33527***
QOL2	**QOL11**	0.26423***
QOL2	**QOL12**	0.32003***
QOL2	**QOL13**	0.18201***
QOL2	**QOL14**	0.40155***
QOL3	**QOL4**	0.15635***
QOL3	**QOL5**	0.17240***
QOL3	**QOL6**	0.09110*
QOL3	**QOL7**	0.14567***
QOL3	**QOL8**	0.13942***
QOL3	**QOL9**	0.18034***
QOL3	**QOL10**	0.13161***
QOL3	**QOL11**	0.15713***
QOL3	**QOL12**	0.08302
QOL3	**QOL13**	0.03065
QOL3	**QOL14**	-0.02750
QOL4	**QOL5**	0.62297***
QOL4	**QOL6**	0.51217***
QOL4	**QOL7**	0.51601***
QOL4	**QOL8**	0.59450***
QOL4	**QOL9**	0.48428***
QOL4	**QOL10**	0.40970***
QOL4	**QOL11**	0.39980***
QOL4	**QOL12**	0.41235***
QOL4	**QOL13**	0.12198**
QOL4	**QOL14**	0.25360***

Table 7B Polychoric Correlations (**N=805**) *continued*

QOL Item	With QOL Item	Correlation
QOL5	**QOL6**	0.51142***
QOL5	**QOL7**	0.46593***
QOL5	**QOL8**	0.57846***
QOL5	**QOL9**	0.35842***
QOL5	**QOL10**	0.42504***
QOL5	**QOL11**	0.42420***
QOL5	**QOL12**	0.29933***
QOL5	**QOL13**	0.14248***
QOL5	**QOL14**	0.25161***
QOL6	**QOL7**	0.44667***
QOL6	**QOL8**	0.48087***
QOL6	**QOL9**	0.39282***
QOL6	**QOL10**	0.36205***
QOL6	**QOL11**	0.42351***
QOL6	**QOL12**	0.27228***
QOL6	**QOL13**	0.01965
QOL6	**QOL14**	0.17649***
QOL7	**QOL8**	0.43145***
QOL7	**QOL9**	0.47256***
QOL7	**QOL10**	0.42518***
QOL7	**QOL11**	0.44797***
QOL7	**QOL12**	0.31476***
QOL7	**QOL13**	0.06632
QOL7	**QOL14**	0.26705
QOL8	**QOL9**	0.40876***
QOL8	**QOL10**	0.43947***
QOL8	**QOL11**	0.45264***
QOL8	**QOL12**	0.31360***
QOL8	**QOL13**	0.15826***
QOL8	**QOL14**	0.30073***
QOL9	**QOL10**	0.60104***
QOL9	**QOL11**	0.59240***
QOL9	**QOL12**	0.37046***
QOL9	**QOL13**	0.11481**
QOL9	**QOL14**	0.31040***
QOL10	**QOL11**	0.64253***
QOL10	**QOL12**	0.35388***
QOL10	**QOL13**	0.04501
QOL10	**QOL14**	0.35732***
QOL11	**QOL12**	0.34158***
QOL11	**QOL13**	0.03894
QOL11	**QOL14**	0.31933***
QOL12	**QOL13**	0.14218**
QOL12	**QOL14**	0.25407***
QOL13	**QOL14**	0.36250***

Note: *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$

An important feature of principal component analysis is that the axes on which the components/factors are defined can be rotated within the multidimensional variable space. Rotation simplifies the component structure and allows for an easier and more meaningful interpretation of the latent constructs measured by principal components. There are two main types of rotation and the important difference between them is that they create components that are either correlated (oblique rotations) or uncorrelated (orthogonal rotations) with each other. Given that the potential latent dimensions of quality of life are likely to correlate with each other, for the purpose of my study, I used promax/oblique rotation. As expected (and explained later), the components retained by the analysis show some correlation with each other.

The decision regarding how many components to retain in a principal component analysis is necessarily subjective and no single best criterion could guide this decision. Usually, it is suggested to use the eigenvalue of 1 as a cutoff point (Kaiser, 1960), meaning that only those components that have eigenvalue greater than 1 should be retained. This logic relies on the fact that components with eigenvalue of 1 account for as much variance as a single variable. Hence, only components that explain at least the same amount of variance as a single variable are worth keeping. Another option is to use a scree plot, a plot that shows the eigenvalues on the y-axis and the number of components on the x-axis, and to retain the number of components identified by the point where the slope of the curve is clearly leveling off. Figure 7 reveals that the scree plot levels off after two components are extracted. Component 1 has eigenvalue of 5.46, Component 2 has 1.51, and Component 3 has 1.12. Given that the third component's eigenvalue barely exceeds 1, I decided to retain two principal components. This decision is also supported by the

ease of component interpretation as the patters of factor loadings with two components retained appear to make much more sense than the alternative solutions.[21]

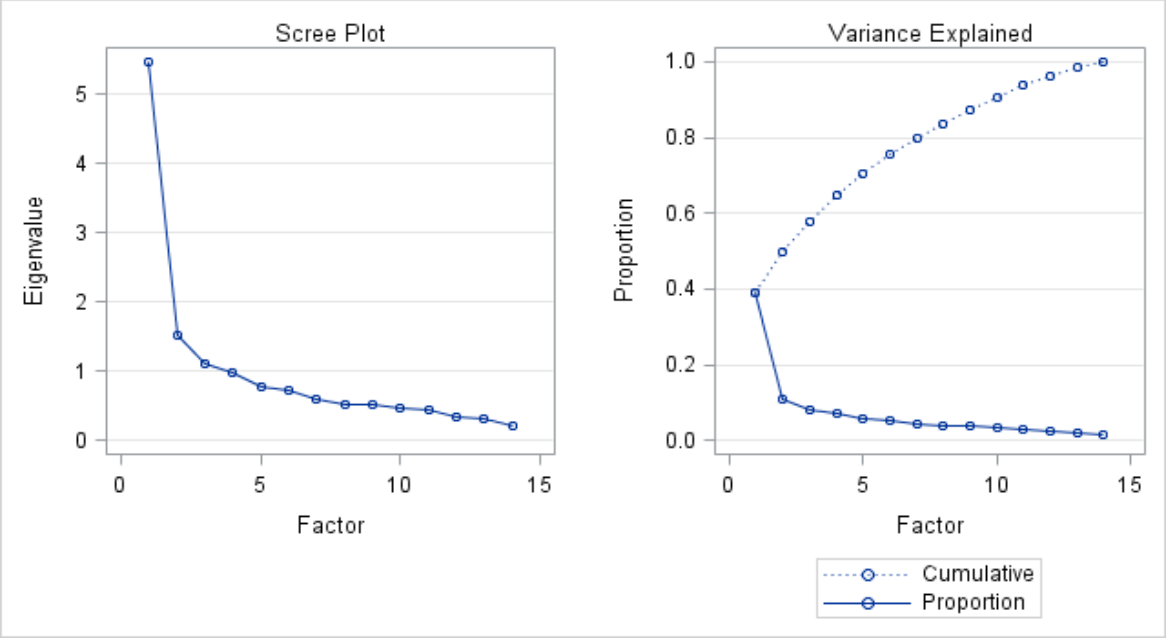

Figure 7 Polychoric Principal Component Analysis Scree Plot

The summary of the polychoric principal component analysis results is provided in Table 7 and the component loadings over .40 appear in bold font. The two retained factors explain a cumulative variance of roughly 50% of QOL items. Items QOL3-QOL12 load significantly on Component 1, while QOL1-QOL3, QOL13, and QOL14 load significantly on Component 2. Costello and Osborne (2005) suggest a solid component/factor to be the one that has five or more items with significant loading of .50 or higher. As suggested, both Component 1 and Component

[21] Component/factor loading in factor analysis or principal component analysis represents correlation coefficients between a variable/item and its latent factor or principal component (O'Rourke & Hatcher, 2013). When I retained three components, QOL item 12 did not show any significant loadings on any of the components. It is common to drop a variable/item that does not have any significant loading on any of the retained components. When I removed the item from the analysis, all the remaining items had a significant loading on one of the three components. However, only 2 items had a significant loading on Component 3. O'Rourke and Hatcher (2013) suggest a retained component/factor with at least three variables/items with significant loadings. Moreover, the latent dimensions with three retained components were difficult to interpret in a meaningful way.

2 have five or more items with factor loading of .50 or higher. Notably, QOL item 3 'Feel Very Few Goals' has a high loading on both factors as it loads positively on Component 1 and negatively on Component 2. Following a conceptual analysis of the loading patterns, I label the first principal component "Fulfillment & Control" and the second principal component "Hopefulness".

In the final step, I calculated the estimated factor scores for each respondent. Each factor score is an optimally weighted linear combination of items that allows me to asses where the sampled respondents stand on these respective latent dimensions of the perceived quality of life. Moreover, I use these factor scores in the subsequent analysis of the causal effect of income on the quality of life.

Table 8 Summary of Polychoric Principal Component Analysis Results for Quality of Life

QOL Items	Factor Loadings	
	Factor 1	**Factor 2**
1. Feel Hopeful	7	**77**
2. Look Forward	21	**69**
3. Feel Very Few Goals	**47**	**-40**
4. Feel Putting in Time	**69**	17
5. Feel Enjoyment in Past	**65**	15
6. Feel Ok If Life Ended Soon	**68**	0
7. Feel Activities Seem Unimportant	**69**	2
8. Feel Done All There Is	**63**	19
9. Feel Little Control	**77**	-5
10. Feel No Way to Solve Problems	**77**	-6
11. Feel Little Can Change	**82**	-15
12. Feel Pushed Around	**42**	23
13. Feel Future Depends on Self	-20	**64**
14. Feel Mind Power	10	**63**
Eigenvalues	5.46	1.51
% of Variance	39	10.79

Note: **N=805**. Component loadings are multiplied by 100 and rounded to the nearest integer, and factor loadings over .40 appear in bold. Components extracted by Polychoric principal component analysis with Promax rotation. Three components originally emerged with eigenvalues greater than 1, however, for better interpretation I chose to retain two principal components. Polychoric principal component analysis captures [(5.46+1.51)/14]] = 49.79% of the variance in the 14 QOL items. It is calculated by adding variance explained by Component 1 (5.46) and explained by Component 2 (1.51), and divide that by the number of QOL items, which is 14.

The Effect of Income on Quality of Life

Table 9 reports the OLS and 2SLS estimation results for the first principal component, Fulfillment & Control. In both models, I find positive and statistically significant relationship between the amount of Social Security retirement income received and the perceived quality of life as measured by items that correspond to feelings of living a fulfilled life and being in control of one's life. The magnitudes of estimates are similar between the OLS estimation and the IV estimation that isolates exogenous variation in income, implying that the bias to OLS coefficients due to the omitted variables and potential reciprocal causation is small. In fact, OLS appears to just slightly attenuate the magnitude of the causal effect of income on the feelings of being fulfilled and in control.

The first stage IV estimation reveals that, relative to the windfall cohort, members of all other cohorts experience lower Social Security income, and the difference is statistically significant for the postnotch cohort. Expectedly, Social Security income is also higher among married households (relative to singles) and white households (relative to all minority groups). Moreover, higher educational attainment generally implies higher Social Security retirement benefits as does living in an urban area. The F-statistic in the first stage of IV estimation is above 12 which implies sufficient strength on the instrumentation.

In order to understand better which of the quality of life items are casually affected by the variation in Social Security retirement income, I ran the 2SLS estimations separately for each of the quality of life items as dependent variables. The results (coefficients and standard errors on Social Security income) are presented in Appendix C and reveal that, among the items with significant loadings on factor Fulfillment & Control (items 3-12), QQL 4, 5, 8 and 9 are causally and positively affected by variation in income. Items 5 (feeling that enjoyment is in the past) and

9 (feeling in control) exhibit the strongest magnitude of the positive effect of income. The magnitudes of the effect of income on items 4 (feeling of just putting in time) and 8 (feeling of having done all there is to do in life) are slightly lower, yet they too are statistically meaningful.

Table 10 reports the estimation results for the second principal component, Hopefulness. The OLS results, again, point to a positive and statistically significant effect of the Social Security income on this latent dimension of the perceived life quality. However, unlike in the case of principal component 1, this effect is not supported in the more rigorous 2SLS test.

In terms of control variables, age, education, and race appear to exert a significant effect on the perceived well-being as measured by both the Fulfillment & Control and Hopefulness dimensions of quality of life.[22] Expectedly, controlling for other covariates, older age implies a lower perceived quality of life, and attaining high school or better education implies a higher perceived quality of life relative to those with lower than high school education. This result is consistent with evidence from the literature that income and education are strongly associated with self-realization (Cramer, Torgensen, & Kringlen, 2004), as well as that higher educational attainment is associated with higher levels of self-esteem and psychological well-being among older adults (Butkovic, Brkovic, & Bratko, 2012). The literature also reports that better-educated individuals experience higher social functioning, and the effect is noted to be stronger among elderly (Baernholdt, Hinton, Yan, Rose, & Mattos, 2012).[23] Social functioning is an important contributing factor of 'aging well' among the older adults. In Bowling's (2008) study the most

[22] Gender is not found to be a significant factor, yet, when I ran analysis separately by gender (male/female), coefficient on income was significant for Fulfillment & Control, but not for Hopefulness for females. Interestingly, income was significant predictor of both dimensions of quality of life for males. This suggests the presence of gender moderation effect of income on Hopefulness.

[23] Baernholdt, Hinton, Yan, Rose, & Mattos's (2012) measure social functioning as the number of close friends and frequency of attending church or religious services.

common perceptions of active ageing for older adults include having physical health, leisure and social activities, mental functioning, and social relationships.

Although Bowling (2008) did not find a significant relationship between the older adults' positive self-ratings of active ageing and socioeconomic factors including education, there seems to be a connection between education and overall quality of life among older adults through psychological and personality aspects of well-being.

Table 9 OLS and Lewbel's IV-2SLS Models of "Fulfillment & Control" (Factor 1)

		2SLS (Lewbel's)	
	OLS	*2nd Stage*	*1st Stage*
Social Security Income in $1,000s	0.022***	0.026**	-
	(0.008)	(0.012)	
Age of Head	-0.014***	-0.015***	0.054
	(0.005)	(0.005)	(0.033)
Female	0.107	0.101	-0.234
	(0.069)	(0.067)	(0.266)
Marital Status (ref: Never-Married)			
Married	0.019	-0.012	6.064***
	(0.167)	(0.161)	(0.620)
Divorced	0.025	0.004	0.959
	(0.229)	(0.207)	(0.903)
Widowed	0.035	0.039	0.861
	(0.164)	(0.149)	(0.667)
Race/Ethnicity (ref: White)			
Black	0.245**	0.252**	-1.188***
	(0.104)	(0.104)	(0.384)
Other Race	-0.095	-0.268	-4.391**
	(0.283)	(0.353)	(2.031)
Hispanic	-0.046	-0.003	-1.450*
	(0.176)	(0.196)	(0.864)
Number of Children (average)	0.011	0.012	-0.021
	(0.015)	(0.015)	(0.061)
Education (ref: Less than High School)			
High School	0.319***	0.332***	1.460***
	(0.074)	(0.079)	(0.295)
Some College	0.527**	0.523***	4.545***
	(0.247)	(0.196)	(1.219)
College	0.402***	0.404***	2.469***
	(0.108)	(0.110)	(0.376)
Urban	-0.007	0.000	1.021***

	(0.077)	(0.076)	(0.322)
Region of Residence (ref: Northeast)			
Midwest	0.097	0.102	0.209
	(0.096)	(0.093)	(0.375)
South	0.014	0.013	-0.658*
	(0.090)	(0.090)	(0.375)
West	0.012	0.004	-0.332
	(0.111)	(0.106)	(0.436)
Cohort Group (ref: Windfall)			
Prewindfall	-	-	-0.611
			(0.494)
Notch	-	-	-0.177
			(0.336)
Postnotch	-	-	-0.805*
			(0.449)
Constant	0.485	0.479	2.194
	(0.463)	(0.470)	(2.809)
R^2	0.090		
F-statistic	4.22***		12.16***

Note: **N=746**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors.

Relative to White respondents, being Black implies a higher perceived quality of life in terms of living a fulfilled life and being in control of one's life, while being Hispanic implies a lower score on the Hopefulness dimension of quality of life. This result might be related to the underlying cultural effect or difference in perceptions of quality of life among older adults of different races. Guralnik, Land, Blazer, Fillenbaum, and Branch (1993) reported that Black adults aged 75 and older had higher total life expectancy and active life expectancy compared to Whites in the same age category, and the differences were larger after stratification for education. Another study found that, among low-income respondents, Blacks and Hispanics were the most optimistic, had higher life satisfaction, and experienced lower stress (Graham & Pinto, 2018) relative to White individuals. Yet, evidence on the role of race on subjective well-being and optimism is somewhat inconsistent. For example, a study by Sörensen, Hirsch, and Lyness's

(2014) revealed that among older adults, for Whites higher optimism, but for Blacks lower optimism was associated with more planning for future care needs. Baernholdt, Hinton, Yan, Rose, and Mattos (2012) found social functioning was higher in Black respondents, but emotional well-being was lower among Black and Hispanics. The findings in my study that Blacks have higher score on the Fulfillment & Control dimension and Hispanics having lower score on the Hopefulness, somewhat supports Baernholdt et al.'s (2012) results. As mentioned earlier, the Fulfillment & Control dimension includes questions related to having goals, enjoyment, activities, control in life, etc., all of which are related to social functioning. Also, Hopefulness includes questions related to being hopeful, looking forward, as well as feeling mindpower, which are related to emotional well-being in Baernholdt et al.'s study.[24]

Table 10 OLS and Lewbel's IV-2SLS Models of "Hopefulness" (Factor 2)

		2SLS (Lewbel's)	
	OLS	*2nd Stage*	*1st Stage*
Social Security Income in $1,000s	0.022***	0.011	-
	(0.008)	(0.012)	
Age of Head	-0.021***	-0.017***	0.054
	(0.005)	(0.006)	(0.033)
Female	-0.003	0.015	-0.234
	(0.071)	(0.069)	(0.266)
Marital Status (ref: Never-Married)			
Married	-0.266	-0.192	6.064***
	(0.171)	(0.178)	(0.620)
Divorced	0.102	0.115	0.959
	(0.235)	(0.213)	(0.903)
Widowed	-0.004	0.021	0.861
	(0.168)	(0.160)	(0.667)
Race/Ethnicity (ref: White)			
Black	-0.111	-0.145	-1.188***

[24] Baernholdt, Hinton, Yan, Rose, and Mattos's (2012) measured emotional well-being based on responses to two questions: whether there was anyone to provide emotional support to the respondent, and whether more emotional support had been needed in the last year. Thus, emotional well-being in their study was more related to getting emotional support, and not directly measuring respondents' mental or psychological state. However, the Hopefulness dimension of quality of life, which includes being hopeful, looking forward, having goals, and feeling mind power, still appears to be related to having emotional support and well-being as discussed in Baernholdt et al. (2012). Just to note, their study also measures depression which includes whether one feels down, depressed, or hopeless.

	(0.107)	(0.113)	(0.384)
Other Race	0.003	-0.165	-4.391**
	(0.291)	(0.344)	(2.031)
Hispanic	-0.733***	-0.735***	-1.450*
	(0.181)	(0.267)	(0.864)
Number of Children (average)	0.025	0.029*	-0.021
	(0.015)	(0.016)	(0.061)
Education (ref: Less than High School)			
High School	0.234***	0.261***	1.460***
	(0.076)	(0.080)	(0.295)
Some College	0.735***	0.788***	4.545***
	(0.254)	(0.124)	(1.219)
College	0.227**	0.251**	2.469***
	(0.111)	(0.105)	(0.376)
Urban	-0.046	-0.007	1.021***
	(0.079)	(0.083)	(0.322)
Region of Residence (ref: Northeast)			
Midwest	-0.096	-0.080	0.209
	(0.098)	(0.085)	(0.375)
South	-0.114	-0.136	-0.658*
	(0.092)	(0.083)	(0.375)
West	-0.044	-0.065	-0.332
	(0.113)	(0.107)	(0.436)
Cohort Group (ref: Windfall)			
Prewindfall	-	-	-0.611
			(0.494)
Notch	-	-	-0.177
			(0.336)
Postnotch	-	-	-0.805*
			(0.449)
Constant	1.443***	1.148**	2.194
	(0.475)	(0.520)	(2.809)
R^2	0.105		
F-statistic	5.01***		12.16***

Note: **N=746**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors.

The examination of effects of income individually on each of the quality of life items that load significantly on factor 2 (items 1-3 and 13-14) reveals that income is significantly impacting QQL14 only (feeling of being able to do anything the mind is set to do). The lack of evidence of

statistically significant causal effect of Social Security retirement income on items 1-3 appears to be somewhat puzzling. These items measure the feeling of being hopeful (item 1), having much to look forward to (item 2) and having future goals (item 3). Thus, my findings indicate that the causal effect of income on older adults' perceived quality of life has little to do with future possibilities or aspirations.

The Effect of Income on Survival Expectation

Table 11 shows OLS and Lewbel's 2SLS results for the association between income and survival expectation (N=5,854). As mentioned earlier in previous chapter, I use survival expectation, or optimism regarding survival as measured by reports of individual's expected longevity, as an outcome variable and it is modeled after Puri and Robinson's (2007) paper. The OLS estimate implies a positive and significant effect of income on subjective probability of 10-year survival, in that an additional $1,000 in annual Social Security income increases older adults' survival probability by about 0.22. In other words, additional income makes older adults more optimistic about their survival expectation. However, despite some evidence of positive effect of income in the OLS estimation, the more rigorous 2SLS estimation does not support this conclusion. Although the Social Security income results in positive coefficient in 2SLS model, it was not significant.

In terms of covariates, female in both OLS and 2SLS estimation shows a negative and statistically significant association with survival expectation. This is consistent with Engberg, Jeune, Andersen-Ranberg, Martinussen, Vaupel, and Christensen's (2013) finding that among the oldest-old individuals in Denmark, males are more optimistic than females. Also, it supports Khwaja, Sloan, and Chung's (2007) and Liu, Tsou, and Hammitt's (2007) finding that compared to females, males are more optimistic about surviving. Furthermore, this is consistent with results

in Table 5 of the current study that shows calculated level of optimism. Under this optimism measure, the average optimism for females in the AHEAD survey data was much lower than the optimism for males (3.09 and 18 probability score, respectively). This is similar to the results of Liu et al.'s (2007) study. In their study, compared with life table survival probabilities, male respondents tend to significantly overestimate their survival expectation.

In terms of other covariates, education has a statistically significant positive association with survival expectation or optimism. Compared to respondents with lower than high school education, those with some college and college degrees are more likely to report higher survival expectation. Literature shows that there is a positive relationship between education level and longevity (Khwaja, Sloan, & Chung, 2007; Rogot, Sorlie, & Johnson, 1992). In terms of race/ethnicity, Black respondents reported higher perceived probability of 10-year survival compared to White respondents. The finding that Black respondents report higher survival expectation and that they are more optimistic than Whites is consistent with Guralnik, Land, Blazer, Fillenbaum, and Branch's (1993), who found that Black adults aged 75 and older had higher total life expectancy and active life expectancy compared relative to Whites in the same age category. Moreover, using Health and Retirement Study data, Bulanda and Zhang (2009) and Hurd and McGarry (1995) also find that Black respondents expect a greater probability of living to ages of 75 and 85 than White respondents. Although Hispanics show negative but statistically insignificant coefficient in my study, Bulanda and Zhang especially focus on the survival expectancy of Hispanics and find that Mexican Americans expect a lower survival expectancy than White and Black respondents.[25] These results show that Blacks are optimistic about their

[25] Bulanda and Zhang (2009) mention in their study that among different Hispanic groups, "Mexican Americans appear to have the most pronounced mortality advantages in later life" (Bulanda & Zhang, 2009, p. 690). Also, their study could not consider other Hispanic groups due to small sample sizes of the groups in the Health and Retirement Study data.

survival life expectancy while Hispanics are pessimistic about their survival expectancy. Also, these results might imply an underlying role of cultural factors in perceived survival likelihood among older population.

OLS shows that age has a positive and significant association with the survival expectation, meaning as respondents get older, they adjust their expectation of survival probability upward and become more optimistic in terms of their longevity. This is also consistent with Liu, Tsou, and Hammitt's (2007) findings that there is a convex relationship between age and survival expectation, and that respondents' subjective survival expectation of living to age 75 or 85 increased at an increasing rate with age. Yet, age is not significant in my 2SLS model result. Some other factors also show a significant association with survival expectation. With regard to marital status, my finding is inconsistent with previous literature that showed married respondents were more optimistic about longevity compared to single respondents (Liu, Tsou, & Hammitt, 2007). Ross & Mirowsky, (2002) also found that marriage (only for older men) and having adult children increased subjective life expectancy. However, in my study, the coefficient on variable indicating a married couple is negative and insignificant compared to never-married respondents. However, compared to never-married respondents, divorced respondents reported higher survival expectation, or they were more optimistic about survival both in OLS and 2SLS results. Compared to those who were never-married, the divorced might already have recovered both emotionally and financially from their previous unhappy marriage.[26] Perhaps divorce brings about more optimistic longevity expectations as it

[26] According to Social Security Administration, if a person is divorced but his/her marriage lasted 10 years or longer, he/she can receive benefits on ex-spouse's record if he/she meets all these requirements: [a] he/she is unmarried, [b] he/she is age 62 or older, [c] his/her ex-spouse is entitled to Social Security retirement or disability benefits, and [d] the benefit he/she is entitled to receive is less than the benefit he/she would receive based on ex-spouse's work (Social Security Administration, n.d.b). This information is retrieved from the following link: https://www.ssa.gov/planners/retire/divspouse.html.

might be interpreted as opening a "new chapter" in life. Brown and Wright (2017) suggest that "older adults who wanted to get divorced, are financially secure, and in good health may experience few or no downsides to calling it quits" (Brown & Wright, 2017, p. 6). They further suggest that the quality of life of these older adults could improve following the divorce. Also, a study by Brown and Lin (2012) examined rising divorce rate among older adults in United States from 1990 to 2010 and found significant association between economic resources and divorce. Although the findings revealed that divorce rate was the highest among the unemployed and those with high school education which reflects fewer economic resources, through an investigation of interaction effects between economic resources and gender, they found that financial or economic autonomy might encourage older women to divorce. In any case, this apparent inconsistency between the literature and my estimates of correlation between marriage and subjective longevity poses an interesting question and might serve as inspiration for a deeper investigation of association between survival expectation and marital status among the oldest old population in United States.

Table 11 OLS and Lewbel's IV-2SLS Models of Survival Expectation

		2SLS (Lewbel's)	
	OLS	*2nd Stage*	*1st Stage*
Social Security Income in $1,000s	0.218**	0.256	-
	(0.104)	(0.208)	
Objective Survival Expectation	0.602***	0.600***	0.010
	(0.054)	(0.057)	(0.006)
Age of Head	0.259*	0.245	0.082***
	(0.156)	(0.171)	(0.020)
Female	-8.052***	-8.140***	-0.742***
	(1.245)	(1.281)	(0.147)
Marital Status			
Married	-1.893	-2.183	6.040***
	(2.384)	(2.780)	(0.286)
Divorced	7.932**	7.634**	0.196
	(3.140)	(3.377)	(0.383)
Widowed	-2.600	-2.587	0.890***
	(2.340)	(2.519)	(0.297)

Race/Ethnicity			
Black	8.826***	9.021***	-1.158***
	(1.500)	(1.645)	(0.163)
Other Race	-1.081	-0.329	-1.448***
	(4.030)	(4.446)	(0.456)
Hispanic	-3.572	-4.005	-1.490***
	(2.325)	(2.696)	(0.281)
Number of Children (average)	0.092	0.086	-0.035
	(0.216)	(0.219)	(0.024)
Education			
High School	1.443	1.440	1.127***
	(1.002)	(1.046)	(0.115)
Some College	6.795**	6.846**	1.089***
	(3.235)	(3.316)	(0.335)
College	3.221**	3.303**	2.142***
	(1.473)	(1.489)	(0.147)
Urban	2.531**	2.484*	0.707***
	(1.065)	(1.050)	(0.117)
Region of Residence			
Midwest	-2.473*	-2.452*	0.165
	(1.312)	(1.322)	(0.145)
South	1.327	1.335	-0.601***
	(1.246)	(1.293)	(0.141)
West	5.469***	5.428***	-0.353**
	(1.456)	(1.457)	(0.159)
Cohort Group			
Prewindfall	-	-	-0.792***
			(0.181)
Notch	-	-	-0.036
			(0.139)
Postnotch	-	-	-0.354*
			(0.183)
Constant	1.515	2.465	0.428
	(13.438)	(14.563)	(1.739)
R^2	0.092		
F-statistic	33.2***		34.76***

Note: **N=5,854**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors.

Moreover, the results show that those who live in urban areas and West region of the country (compared to respondents from Northeast region) reported higher survival expectations,

while those living in Midwest reported lower survival expectations. Thus, it may signify that subjective longevity differs systematically by the location of residence. Living in urban or rural area not only correlated with economic resources, but also with opportunities for participation in the community through social and institutional structure available (Ferriss, 2006). Ferriss (2006) emphasized the impact of demographic factors, including the population size of the community, which in turn determines the availability of institutions that the community can maintain, affects people's participation and satisfaction, hence overall quality of life. Different studies also found significant differences in services and programs provided by senior centers in urban and rural areas (Conrad, Hultman, Hughees, & Hanrahan, 1993; Krout, 1987). Conrad, Hultman, Hughees, and Hanrahan (1993) found significantly lower enrollment and fewer staff, services, and activities in rural adult day care centers, which implies that the overall quality of service offered by these centers is inferior to urban centers. Krout's (1987) study also supports this conclusion by reporting that small budget and fewer staff members in rural areas put rural centers at a disadvantage to larger centers located in urban and metro areas that provides more and better community services to higher socio-economic status residents.

Robustness Checks and Heterogeneity of Income Effects

The Social Security notch identification strategy is based on cohort differences in income and there may be unobserved variables that correlate with the notch and quality of life as well as survival expectation among older adults. To examine potential biases in estimates presented in this study, I perform several robustness checks. Moreover, I generate several additional insights into the heterogeneous nature of income effects by stratifying estimation sample by various socio-demographic variables.

1. *Removing widowed and divorced women*

First, following previous studies that examined the effect of Social Security notch on health-related outcomes (Goda, Golberstein, & Grabowski, 2011; Golberstein, 2015; Moran & Simon, 2006; Tsai, 2015), I run the analysis without widows and divorced women. Since widowed and divorced female's birth year is calculated by using the imputed birth year of the deceased or former husband, it may introduce measurement error to the analysis. Table 12 shows the estimation results for this sample restriction. The results are similar to the baseline estimates for the "Fulfillment & Control" in Table 9 in that the Social Security income is still positive and significant, and the magnitude of the effect is relatively unchanged. However, for "Hopefulness", the effect of Social Security income now becomes negative but statistically significant at the 10% significance level. However, the magnitude of the estimate appears to be quantitatively negligible. Moreover, estimates of the effect of income on survival expectation or optimism show some inconsistency relative to the baseline estimates. While the effect of Social Security income is still positive, it now has much smaller coefficient size.

Table 12 Robustness Check without Widow and Divorced women

	2SLS (Lewbel's)					
	"Fulfillment & Control"		"Hopefulness"		Survival Expectation	
	1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*	*1st Stage*	*2nd Stage*
Social Security Income (in 1,000s)	-	0.023*	-	-0.002*	-	0.002
		(0.013)		(0.014)		(0.305)
Female	0.547	0.091	0.547	0.067	-0.139	-10.807***
	(0.337)	(0.081)	(0.337)	(0.086)	(0.206)	(1.561)
Marital Status (ref: Never-Married)						
Married	6.165***	-0.001	6.165***	-0.130	6.084***	-1.395
	(0.809)	(0.162)	(0.809)	(0.191)	(0.397)	(3.114)
Divorced	2.713*	-0.122	2.713*	-0.311	1.433**	11.068**
	(1.551)	(0.389)	(1.551)	(0.322)	(0.636)	(5.006)
Widowed	1.978*	0.069	1.078*	0.210	1.741***	-5.694*
	(1.154)	(0.183)	(1.154)	(0.189)	(0.487)	(3.054)
Race/Ethnicity (ref: White)						
Black	-1.814***	0.267**	-1.814***	-0.108	-1.448***	8.520***
	(0.539)	(0.129)	(0.539)	(0.146)	(0.241)	(2.060)
Other Race	-4.160	-0.526*	-4.160	-0.135	-1.276**	4.246
	(3.476)	(0.316)	(3.476)	(0.348)	(0.669)	(5.297)
Hispanic	-0.992	0.070	-0.992	-0.665**	-1.949***	-5.785*
	(1.203)	(0.239)	(1.203)	(0.286)	(0.421)	(3.246)
Number of Children (average)	-0.043	0.005	-0.043	0.030	-0.010	-0.013
	(0.086)	(0.019)	(0.086)	(0.021)	(0.032)	(0.255)
Education (ref: Less than High School)						
High School	1.444***	0.330***	1.444***	0.246**	1.227***	0.987
	(0.400)	(0.094)	(0.400)	(0.096)	(0.165)	(1.287)
Some College	4.603**	0.781***	4.603**	0.744***	0.870*	4.680
	(2.238)	(0.244)	(2.238)	(0.164)	(0.489)	(3.866)
College	2.344***	0.322**	2.344***	0.185	2.392***	3.350*
	(0.525)	(0.129)	(0.525)	(0.125)	(0.201)	(1.792)

Urban	1.234***	-0.082	1.234***	-0.003	0.872***	1.447
	(0.418)	(0.088)	(0.418)	(0.103)	(0.164)	(1.260)
Region of Residence (ref: Northeast)						
Midwest	0.579	0.109	0.579	-0.031	0.188	-0.438
	(0.526)	(0.110)	(0.526)	(0.107)	(0.204)	(1.564)
South	-1.062**	0.024	-1.062**	-0.070	-0.681***	2.862*
	(0.516)	(0.110)	(0.516)	(0.102)	(0.198)	(1.538)
West	-0.612	-0.029	-0.612	0.029	-0.544**	7.361***
	(0.632)	(0.130)	(0.632)	(0.124)	(0.221)	(1.721)
Age of Head	0.063	-0.017***	0.063	-0.016**	0.124***	0.331*
	(0.044)	(0.006)	(0.044)	(0.007)	(0.027)	(0.194)
Objective Survival Expectation	-	-	-	-	0.015*	0.695***
					(0.009)	(0.068)
Cohort Group (ref: Windfall)						
Prewindfall	-0.925	-	-0.925	-	-1.028***	-
	(0.799)		(0.799)		(0.272)	
Notch	-0.051	-	-0.051	-	-0.152	-
	(0.450)		(0.450)		(0.201)	
Postnotch	-0.784	-	-0.784	-	-0.616**	-
	(0.566)		(0.566)		(0.254)	
Constant	1.034	0.745	1.024	1.127*	-3.247	-3.654
	(3.766)	(0.519)	(3.766)	(0.595)	(2.309)	(16.274)
F-statistic	5.05***		5.05***		11.74***	

Note: **N=512** for "Fulfillment & Control" and "Hopefulness". **N=4068** for Survival Expectation. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors.

2. Removing respondents born in 1918 or 1919

Following previous literature (Ayyagari & Frisvold, 2015; Goda, Golberstein, & Grabowski, 2011; Golberstein, 2015; Moran & Simon, 2006; Tsai, 2015), I re-run the instrumental variable analysis without respondents who were born in 1918 or 1919 and thus exposed to the 1918 flu pandemic.[27] Using the 1960-1980 decennial U.S. Census data, Almond (2006) examined the long-term effect of the influenza and found that the cohorts in utero during the pandemic showed reduced educational attainment, lower income and socioeconomic status, and increased rates of physical disability than other birth cohorts. Lin and Liu's (2014) study also supports Almond's findings in that those who were in utero during the pandemic in Taiwan were shorter as children or adolescents, less educated, and more likely to experience health problems. Likewise, prenatal exposure to the 1918 pandemic was lined to cardiovascular disease after the age of 60 (Mazumder, Almond, Park, Crimmins, & Finch, 2010). Thus, excluding those born in 1918 or 1919 from the analysis allows me to examine whether the effect of income on quality of life and survival expectation of this study cohorts is purely due to the Social Security notch and not the outside adverse factors like the 1918 influenza pandemic. The results (Table 13) are robust for all the outcome variables with similar signs and magnitudes of the coefficients as in the baseline estimations. The effect of Social Security income is still positive and significant for the "Fulfillment & Control" dimension of quality of life, but non-significant for the "Hopefulness" and survival expectation. It should be noted, however, that the sufficient strength of the first-stage F statistic (>10) was achieved only in the survival expectation estimation.

[27] Such pandemic resulted in at least 50 million deaths worldwide and about 670,000 in the United States (Center for Disease Control and Prevention, 2019).

Table 13 Robustness Check without Respondents Born in 1918 or 1919 due to Flu Pandemic

	2SLS (Lewbel's)					
	"Fulfillment & Control"		"Hopefulness"		Survival Expectation	
	1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*	*1st Stage*	*2nd Stage*
Social Security Income (in 1,000s)	-	0.030**	-	0.012	-	0.263
		(0.012)		(0.013)		(0.218)
Female	-0.123	0.144*	-0.123	-0.016	-0.796***	-7.510***
	(0.301)	(0.074)	(0.301)	(0.078)	(0.160)	(1.374)
Marital Status (ref: Never-Married)						
Married	6.176***	-0.116	6.176***	-0.147	5.917***	-2.958
	(0.646)	(0.165)	(0.646)	(0.194)	(0.303)	(3.019)
Divorced	1.514	-0.080	1.514	0.125	0.226	6.965*
	(0.961)	(0.219)	(0.961)	(0.236)	(0.407)	(3.766)
Widowed	1.046	-0.111	1.046	0.055	0.797**	-3.154
	(0.700)	(0.152)	(0.700)	(0.174)	(0.315)	(2.754)
Race/Ethnicity (ref: White)						
Black	-1.289***	0.298***	-1.289***	-0.155	-1.132***	9.161***
	(0.421)	(0.111)	(0.421)	(0.122)	(0.182)	(1.763)
Other Race	-3.349	-0.471	-3.349	-0.443	-1.274**	1.179
	(2.544)	(0.323)	(2.544)	(0.461)	(0.491)	(4.849)
Hispanic	-1.834*	0.052	-1.834*	-0.629**	-1.406***	-2.970
	(0.972)	(0.216)	(0.972)	(0.291)	(0.305)	(2.966)
Number of Children (average)	0.006	0.022	0.006	0.032*	-0.037	0.147
	(0.067)	(0.016)	(0.067)	(0.018)	(0.026)	(0.238)
Education (ref: Less than High School)						
High School	1.487***	0.311***	1.487***	0.294***	1.204***	1.482
	(0.340)	(0.086)	(0.340)	(0.089)	(0.124)	(1.124)
Some College	4.646***	0.588**	4.646***	0.826***	1.098***	6.182*
	(1.341)	(0.227)	(1.341)	(0.139)	(0.363)	(3.465)
College	2.560***	0.494***	2.560***	0.295**	2.295***	2.752
	(0.421)	(0.116)	(0.421)	(0.118)	(0.158)	(1.629)

Urban	1.092***	-0.020	1.092***	-0.028	0.727***	2.652**
	(0.357)	(0.083)	(0.357)	(0.092)	(0.125)	(1.127)
Region of Residence (ref: Northeast)						
Midwest	-0.030	0.192*	-0.030	-0.021	0.127	-1.497
	(0.414)	(0.101)	(0.414)	(0.094)	(0.160)	(1.423)
South	-0.770*	0.060	-0.770*	-0.138	-0.591***	2.317*
	(0.419)	(0.101)	(0.419)	(0.092)	(0.156)	(1.399)
West	-0.291	0.053	-0.291	-0.011	-0.345**	7.141***
	(0.502)	(0.117)	(0.502)	(0.121)	(0.175)	(1.572)
Age of Head	0.074**	-0.012**	0.074**	-0.015**	0.084***	0.114
	(0.033)	(0.006)	(0.033)	(0.007)	(0.021)	(0.185)
Objective Survival Expectation	-	-	-	-	0.011	0.554***
					(0.007)	(0.063)
Cohort Group (ref: Windfall)						
Prewindfall	-0.791	-	-0.791	-	-0.806***	-
	(0.500)		(0.500)		(0.185)	
Notch	-0.219	-	-0.219	-	-0.110	-
	(0.392)		(0.392)		(0.156)	
Postnotch	-0.657	-	-0.657	-	-0.377**	-
	(0.433)		(0.433)		(0.187)	
Constant	0.366	0.264	0.366	0.990*	0.353	13.097
	(2.883)	(0.493)	(2.883)	(0.567)	(1.853)	(15.734)
F-statistic	11.44***		11.44***		32.58***	

Note: **N=620** for "Fulfillment & Control" and "Hopefulness". **N=5031** for Survival Expectation. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors.

3. Measuring quality of life with factor-based scores

In order to avoid any potential measurement bias with the creation of two quality of life measures based on principal component scores ("Fulfillment & Control" and "Hopefulness"), I assess the sensitivity of results to alternative measures. Instead of using principal component scores for the two quality of life factors, I created two index variables that summarize quality of item responses for these items with component loadings above 0.4. This approach follows an example of O'Rourke and Hatcher's (2013) who call these measures factor-based scores. Since items QOL3 – QOL12 loaded on the first component ("Fulfillment & Control") while items QOL1, QOL2, QOL13, and QOL14 loaded on the second component ("Hopefulness"), the new variables are created using the following formula:

$$[1]\ Factor\ 1 = \begin{pmatrix} QOL3 + QOL4 + QOL5 + QOL6 + QOL7 + \\ QOL8 + QOL9 + QOL10 + QOL11 + QOL12 \end{pmatrix}$$

$$[2]\ Factor\ 2 = (QOL1 + QOL2 + QOL3 + QOL13 + QOL14)$$

As shown in the Table 14, the estimation results using these new dependent variables are similar to the baseline estimates. Income still shows a positive and significant effect on Factor 1 ("Fulfillment & Control" dimension of the quality of life) and a not-significant effect on Factor 2 ("Hopefulness").

Table 14 Robustness Check Using Sum of Responses of Quality of Life Questionnaires

	Lewbel's 2SLS			
	Factor 1 ("Fulfillment & Control")		Factor 2 ("Hopefulness")	
	1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*
Social Security Income (in 1,000s)	-	0.133**	-	0.032
		(0.058)		(0.026)
Female	-0.204	0.487	-0.315	-0.116
	(0.264)	(0.336)	(0.032)	(0.143)
Marital Status (ref: Never-Married)				
Married	5.834***	0.209	6.123***	-0.388
	(0.608)	(0.755)	(0.618)	(0.360)
Divorced	0.790	0.400	0.978	0.413
	(0.898)	(1.020)	(0.902)	(0.450)
Widowed	0.695	0.360	0.983	0.078
	(0.655)	(0.670)	(0.660)	(0.333)
Race/Ethnicity (ref: White)				
Black	-1.205***	1.104**	-1.146***	-0.125
	(0.384)	(0.524)	(0.375)	(0.218)
Other Race	-4.387**	-1.391	-4.274**	0.318
	(2.018)	(1.765)	(2.056)	(0.673)
Hispanic	-1.582*	0.041	-1.443*	-1.273**
	(0.864)	(0.990)	(0.866)	(0.523)
Number of Children (average)	-0.031	0.056	-0.051	0.040
	(0.060)	(0.078)	(0.060)	(0.032)
Education (ref: Less than High School)				
High School	1.438***	1.625***	1.434***	0.574***
	(0.292)	(0.390)	(0.286)	(0.162)
Some College	4.550***	2.630***	4.579***	1.141***
	(1.214)	(0.956)	(1.205)	(0.433)
College	2.438***	2.020***	2.413***	0.551**

	(0.375)	(0.550)	(0.367)	(0.226)
Urban	1.020***	0.004	1.008***	-0.049
	(0.319)	(0.381)	(0.315)	(0.163)
Region of Residence (ref: Northeast)				
Midwest	0.172	0.466	0.419	-0.079
	(0.372)	(0.463)	(0.371)	(0.187)
South	-0.639*	-0.107	-0.599	-0.317*
	(0.373)	(0.455)	(0.368)	(0.179)
West	-0.295	-0.002	-0.214	-0.345
	(0.436)	(0.532)	(0.431)	(0.220)
Age of Head	0.047	-0.074***	0.054*	-0.030**
	(0.033)	(0.026)	(0.032)	(0.012)
Cohort Group (ref: Windfall)				
Prewindfall	-0.587	-	-0.646	-
	(0.494)		(0.449)	
Notch	-0.215	-	-0.097	-
	(0.334)		(0.326)	
Postnotch	-0.745*	-	-0.752*	-
	(0.445)		(0.441)	
Constant	2.893	26.317***	2.137	14.602***
	(2.818)	(2.242)	(2.740)	(0.999)
F-statistic	11.89***		11.81***	

Note: **N=732**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors. Two new variables (Factor 1 and Factor 2) are created. For each respondent, the responses to quality of life items 1, 2, 3, 13, and 14 are added together for Factor 1. For each respondent, the responses to quality of life items 3-12 are added together for Factor 2.

4. Controlling for assets and health

Given that health and financial status might be endogenous to the quality of life and perceived longevity, controls for these covariates were not included in the baseline analyses. However, for robustness check, I re-run my estimations with added controls for self-rated health status, non-Social Security income, and net worth (Tables 15, 16, and 17). Adjusting for these covariates should help disentangle the effect of Social Security income from the broader effect of one's economic circumstances. The results for both "Fulfillment & Control" and "Hopefulness" are nearly identical to the base model estimates. The similar signs and magnitude of coefficients suggest that the baseline analyses are robust, and the estimates of effect of Social Security income on quality of life presented before do not simply proxy for the correlation of quality of life with financial status. For survival expectation, the results of base estimations also appear to be robust to added controls for non-Social Security income and net wealth. However, adjusting the effect of Social Security income by health status reduces the magnitude of impact. This result is not entirely unexpected, given that Golberstein (2015) found notch-instrumented Social Security income to be a significant predictor of mental health. Assuming that mental health is an important covariate of optimism for survival, adding controls for subjective health status should imply lower estimate of the causal effect of income.

The coefficient estimates on added control variables generally reveal expected signs of the effects. Net wealth is positively related to both dimensions of the quality of life, and non-Social Security income is positively related to the survival expectation. Similarly, better health generally implies higher quality of life and higher survival expectation or optimism regarding longevity.

Table 15 Robustness Check on "Fulfillment & Control" with Asset and Health Status

	2SLS (Lewbel's)					
	Base model		Model with asset		Model with health	
	1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*	*1st Stage*	*2nd Stage*
Social Security Income (in 1,000s)	-	0.026**	-	0.028**	-	0.025**
		(0.012)		(0.011)		(0.012)
Female	-0.234	0.101	-0.195	0.093	-0.272	0.087
	(0.266)	(0.067)	(0.258)	(0.067)	(0.275)	(0.065)
Marital Status (ref: Never-Married)						
Married	6.064***	-0.012	5.817***	-0.023	6.113***	0.001
	(0.620)	(0.161)	(0.591)	(0.160)	(0.617)	(0.148)
Divorced	0.959	0.004	0.847	0.000	0.946	0.021
	(0.903)	(0.207)	(0.845)	(0.207)	(0.914)	(0.189)
Widowed	0.861	0.039	0.681	0.039	0.818	0.051
	(0.667)	(0.149)	(0.635)	(0.149)	(0.664)	(0.137)
Race/Ethnicity (ref: White)						
Black	-1.188***	0.252**	-1.299***	0.256**	-1.274***	0.267***
	(0.384)	(0.104)	(0.385)	(0.104)	(0.393)	(0.102)
Other Race	-4.391**	-0.268	-4.365**	-0.263	-4.169**	-0.061
	(2.031)	(0.353)	(1.931)	(0.352)	(1.824)	(0.349)
Hispanic	-1.450*	-0.003	-1.753**	0.005	-1.585*	0.017
	(0.864)	(0.196)	(0.853)	(0.197)	(0.867)	(0.199)
Number of Children (average)	-0.021	0.012	-0.009	0.014	-0.023	0.010
	(0.061)	(0.015)	(0.060)	(0.016)	(0.059)	(0.014)
Education (ref: Less than High School)						
High School	1.460***	0.332***	1.461***	0.333***	1.462***	0.263***
	(0.295)	(0.079)	(0.291)	(0.078)	(0.304)	(0.077)
Some College	4.545***	0.523***	4.579***	0.515***	4.108***	0.358*
	(1.219)	(0.196)	(1.164)	(0.195)	(1.153)	(0.212)
College	2.469***	0.404***	2.263***	0.396***	2.312***	0.253**
	(0.376)	(0.110)	(0.386)	(0.110)	(0.389)	(0.110)

Urban	1.021***	0.000	1.004***	0.003	0.957***	-0.036
	(0.322)	(0.076)	(0.310)	(0.076)	(0.321)	(0.074)
Region of Residence (ref: Northeast)						
Midwest	0.209	0.102	0.188	0.103	0.290	0.075
	(0.375)	(0.093)	(0.377)	(0.093)	(0.383)	(0.089)
South	-0.658*	0.013	-0.609*	0.022	-0.638*	0.030
	(0.375)	(0.090)	(0.366)	(0.090)	(0.375)	(0.087)
West	-0.332	0.004	-0.332	0.003	-0.194	0.019
	(0.436)	(0.106)	(0.418)	(0.106)	(0.427)	(0.102)
Age of Head	0.054	-0.015***	0.045	-0.015***	0.058*	-0.012**
	(0.033)	(0.005)	(0.031)	(0.005)	(0.034)	(0.005)
Net Worth (in 100,000s)	-	-	-0.021	0.002***	-	-
			(0.024)	(0.000)		
Non-SS Income (in 100,000s)	-	-	1.110***	-0.015	-	-
			(0.246)	(0.014)		
Self-rated Health (ref: Health Very Good)						
Health Excellent	-	-	-	-	0.680	0.089
					(0.431)	(0.091)
Health Good	-	-	-	-	-0.117	-0.091
					(0.323)	(0.080)
Health Fair	-	-	-	-	0.010	-0.511***
					(0.336)	(0.094)
Health Poor	-	-	-	-	-0.787	-0.590***
					(0.495)	(0.128)
Cohort Group (ref: Windfall)						
Prewindfall	-0.611	-	-0.579	-	-0.681	-
	(0.494)		(0.489)		(0.505)	
Notch	-0.177	-	-0.177	-	-0.269	-

	(0.336)		(0.331)		(0.329)	
Postnotch	-0.805*	-	-0.879**	-	-0.875*	-
	(0.449)		(0.437)		(0.452)	
Constant	2.194	0.479	2.575	0.480	2.012	0.534
	(2.809)	(0.470)	(2.757)	(0.470)	(2.877)	(0.447)
F-statistic	12.16***		16.94***		11.26***	

Note: **N=732**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income, net worth, and non-SS income are measured in 100,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors. Non-ss income refers to household's total income excluding Social Security income.

Table 16 Robustness Check on "Hopefulness" with Asset and Health Status

	2SLS (Lewbel's)					
	Base model		Model with asset		Model with health	
	1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*	*1st Stage*	*2nd Stage*
Social Security Income (in 1,000s)	-	0.011 (0.012)	-	0.013 (0.011)	-	0.004 (0.011)
Female	-0.234 (0.266)	0.015 (0.069)	-0.195 (0.258)	0.012 (0.069)	-0.272 (0.275)	-0.017 (0.067)
Marital Status (ref: Never-Married)						
Married	6.064*** (0.620)	-0.192 (0.178)	5.817*** (0.591)	-0.025 (0.174)	6.113*** (0.617)	-0.130 (0.180)
Divorced	0.959 (0.903)	0.115 (0.213)	0.847 (0.845)	0.111 (0.221)	0.946 (0.914)	0.154 (0.201)
Widowed	0.861 (0.667)	0.021 (0.160)	0.681 (0.635)	0.018 (0.160)	0.818 (0.664)	0.046 (0.165)
Race/Ethnicity (ref: White)						
Black	-1.188*** (0.384)	-0.145 (0.113)	-1.299*** (0.385)	-0.142 (0.113)	-1.274*** (0.393)	-0.138 (0.111)
Other Race	-4.391** (2.031)	-0.165 (0.344)	-4.365** (1.931)	-0.159 (0.345)	-4.169** (1.824)	0.009 (0.385)
Hispanic	-1.450* (0.864)	-0.735*** (0.267)	-1.753** (0.853)	-0.701*** (0.266)	-1.585* (0.867)	-0.704** (0.275)
Number of Children (average)	-0.021 (0.061)	0.029* (0.016)	-0.009 (0.060)	0.030* (0.016)	-0.023 (0.059)	0.025 (0.015)
Education (ref: Less than High School)						
High School	1.460*** (0.295)	0.261*** (0.080)	1.461*** (0.291)	0.261*** (0.079)	1.462*** (0.304)	0.186** (0.076)
Some College	4.545*** (1.219)	0.788*** (0.124)	4.579*** (1.164)	0.779*** (0.122)	4.108*** (1.153)	0.649*** (0.133)
College	2.469*** (0.376)	0.251** (0.105)	2.263*** (0.386)	0.247** (0.104)	2.312*** (0.389)	0.107 (0.103)

Urban	1.021***	-0.007	1.004***	-0.007	0.957***	-0.057
	(0.322)	(0.083)	(0.310)	(0.083)	(0.321)	(0.080)
Region of Residence (ref: Northeast)						
Midwest	0.209	-0.080	0.188	-0.080	0.290	-0.132
	(0.375)	(0.085)	(0.377)	(0.084)	(0.383)	(0.083)
South	-0.658*	-0.136	-0.609*	-0.130	-0.638*	-0.139
	(0.375)	(0.083)	(0.366)	(0.083)	(0.375)	(0.079)*
West	-0.332	-0.065	-0.332	-0.065	-0.194	-0.080
	(0.436)	(0.107)	(0.418)	(0.107)	(0.427)	(0.105)
Age of Head	0.054	-0.017***	0.045	-0.017***	0.058*	-0.014**
	(0.033)	(0.006)	(0.031)	(0.006)	(0.034)	(0.006)
Net Worth (in 100,000s)	-	-	-0.021	0.001**	-	-
			(0.024)	(0.000)		
Non-SS Income (in 100,000s)	-	-	1.110***	-0.015	-	-
			(0.246)	(0.012)		
Self-rated Health (ref: Health Very Good)						
Health Excellent	-	-	-	-	0.680	-0.162**
					(0.431)	(0.073)
Health Good	-	-	-	-	-0.117	-0.413***
					(0.323)	(0.096)
Health Fair	-	-	-	-	0.010	-0.413***
					(0.336)	(0.096)
Health Poor	-	-	-	-	-0.787	-0.903***
					(0.495)	(0.148)
Cohort Group (ref: Windfall)						
Prewindfall	-0.611	-	-0.579	-	-0.681	-
	(0.494)		(0.489)		(0.505)	
Notch	-0.177	-	-0.177	-	-0.269	-
	(0.336)		(0.331)		(0.329)	

Postnotch	-0.805* (0.449)	-	-0.879** (0.437)	-	-0.875* (0.452)	-
Constant	2.194 (2.809)	1.148** (0.520)	2.575 (2.757)	1.155** (0.519)	2.012 (2.877)	1.309*** (0.492)
F-statistic	12.16***		16.94***		11.26***	

Note: **N=732**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income, net worth, and non-SS income are measured in 100,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors. Non-ss income refers to household's total income excluding Social Security income.

Table 17 Robustness Check on Survival Expectation with Asset and Health Status

	2SLS (Lewbel's)					
	Base model		Model with asset		Model with health	
	1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*	*1st Stage*	*2nd Stage*
Social Security Income (in 1,000s)	-	0.256 (0.208)	-	0.268 (0.199)	-	0.152 (0.199)
Objective Survival Expectation	0.010 (0.006)	0.600*** (0.057)	0.011* (0.006)	0.601*** (0.057)	0.010 (0.006)	0.591*** (0.055)
Female	-0.742*** (0.147)	-8.140*** (1.281)	-0.711*** (0.146)	-8.127*** (1.280)	-0.742*** (0.146)	-8.106*** (1.230)
Marital Status (ref: Never-Married)						
Married	6.040*** (0.286)	-2.183 (2.780)	5.854*** (0.282)	-2.396 (2.756)	5.989*** (0.288)	-2.932 (2.628)
Divorced	0.196 (0.383)	7.634** (3.377)	0.115 (0.378)	7.602** (3.376)	0.149 (0.384)	5.721* (3.193)
Widowed	0.890*** (0.297)	-2.587 (2.519)	0.839*** (0.291)	-2.603 (2.519)	0.854*** (0.299)	-3.937* (2.371)
Race/Ethnicity (ref: White)						
Black	-1.158*** (0.163)	9.021*** (1.645)	-1.078*** (0.160)	9.146*** (1.641)	-1.092*** (0.163)	11.167*** (1.593)
Other Race	-1.448*** (0.456)	-0.329 (4.446)	-1.655*** (0.488)	-0.392 (4.439)	-1.347*** (0.455)	3.624 (4.223)
Hispanic	-1.490*** (0.281)	-4.005 (2.696)	-1.385*** (0.277)	-3.853 (2.693)	-1.401*** (0.280)	-1.201 (2.599)
Number of Children (average)	-0.035 (0.024)	0.086 (0.219)	-0.033 (0.024)	0.077 (0.219)	-0.035 (0.024)	0.012 (0.210)
Education (ref: Less than High School)						
High School	1.127*** (0.115)	1.440 (1.046)	1.039*** (0.114)	1.305 (1.045)	1.026*** (0.114)	-1.962* (1.013)
Some College	1.089***	6.846**	0.980***	6.749**	0.959***	2.847

	(0.335)	(3.316)	(0.331)	(3.319)	(0.333)	(3.254)
College	2.142***	3.303**	1.725***	2.915*	1.977***	-2.873**
	(0.147)	(1.489)	(0.162)	(1.487)	(0.148)	(1.435)
Urban	0.707***	2.484*	0.655***	2.380**	0.655***	1.583
	(0.117)	(1.050)	(0.115)	(1.050)	(0.116)	(1.001)
Region of Residence (ref: Northeast)						
Midwest	0.165	-2.452*	0.175	-2.456*	0.142	-2.879**
	(0.145)	(1.322)	(0.144)	(1.322)	(0.145)	(1.275)
South	-0.601***	1.335	-0.564***	1.323	-0.597***	1.250
	(0.141)	(1.293)	(0.140)	(1.294)	(0.141)	(1.249)
West	-0.353**	5.428***	-0.371**	5.407***	-0.382**	4.481***
	(0.159)	(1.457)	(0.158)	(1.457)	(0.159)	(1.398)
Age of Head	0.082***	0.245	0.091***	0.252	0.085***	0.378**
	(0.020)	(0.171)	(0.020)	(0.171)	(0.020)	(0.162)
Net Worth (in 100,000s)	-	-	0.003***	0.009	-	-
			(0.001)	(0.010)		
Non-SS Income (in 100,000s)	-	-	1.479***	1.263***	-	-
			(0.224)	(0.404)		
Self-rated Health (ref: Health Very Good)						
Health Excellent	-	-	-	-	0.098	6.669***
					(0.157)	(1.427)
Health Good	-	-	-	-	-0.361***	-9.751***
					(0.125)	(1.107)
Health Fair	-	-	-	-	-0.516***	-20.632***
					(0.142)	(1.229)
Health Poor	-	-	-	-	-0.907***	-25.832***
					(0.189)	(1.672)
Cohort Group (ref: Windfall)						

Prewindfall	-0.792***	-	-0.856***	-	-0.800***	-
	(0.181)		(0.178)		(0.181)	
Notch	-0.036	-	-0.011	-	-0.050	-
	(0.139)		(0.137)		(0.140)	
Postnotch	-0.354*	-	-0.327*	-	-0.375**	-
	(0.183)		(0.182)		(0.183)	
Constant	0.428	2.465	-0.318	1.818	0.680	7.385***
	(1.739)	(14.563)	(1.731)	(14.543)	(1.758)	(13.861)
F-statistic	34.76***		34.47***		29.37***	

Note: **N=5851**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income, net worth, and non-SS income are measured in 100,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors. Non-ss income refers to household's total income excluding Social Security income.

5. *Effect heterogeneity by demographic characteristics*

a. Gender

To see if there are any differences in the effect of Social Security income on quality of life and survival expectation for females versus males, I re-ran the analysis with sample stratified by gender (Table 18). The effect of income on "Fulfillment & Control" dimension of the quality of life is remarkably symmetric for both genders. However, while Social Security income exerts a very statistically and quantitatively significant effect on "Hopefulness" dimension of the quality of life among male respondents, it has zero effect among females. Finally, for both genders the effect of income on survival expectation is not estimated with precision sufficient to conclude that the effect is different from zero.

In terms of the differences in role of covariates by gender, being Black and residing in Western region, regardless of gender, resulted in higher survival expectation. For females, being Hispanic was negatively associated and living in urban was positively associated with survival expectation. The same covariates did not have any significant effects for males. Moreover, all levels of education had positive and significant effect on survival expectation for females, with none of them found to be significantly affecting male's survival expectation. However, for males, age and divorce were negatively and significantly related to survival expectation while both variables did not have significant effect on female's survival expectation.

For females, the average number of children had positive and statistically significant effect on overall quality of life. The higher number of children resulted in higher quality of life score for female respondents . This is consistent with results of Margolis and Myrskylä's (2011) who found that, at older ages, the relationship between number of children and happiness is positive and stronger for female (although it was not statistically significant in all their tests).

Also, for females, education level was important and significant for quality of life and survival expectation, whereas for males, education did not have significant effect on "Hopefulness" and survival expectation. It was only for "Fulfillment & Control" that education had some significant effect. The finding that additional Social Security income has statistically significant effect on "Hopefulness" for male but not for female suggests a need for a more in-depth investigation of gender differences of quality of life in older age.

b. Education, marital status, and health status

Tables 19, 20, and 21 show the results of estimations stratified by education level, marital status, and health status. In order to run the instrumental variable analysis, the number of observations must be greater than number of instruments including constant. Yet, due to insufficient number of observations for some variables I could not conduct analyses by listed demographic characteristics on quality of life factors. For example, only 12 respondents answered quality of life questionnaires and had some college education level.

Results in Table 19 show that as previous studies suggested, less than high school has the strongest first stage F-statistic value ($F = 11.50$, $p<.001$) which is slightly more than the minimum requirement of F-statistic to have a stable strength of the analysis ($F>10$). Robustness check on survival expectation or optimism by education level shows that additional Social Security income did not have statistically significant effect on survival expectation among older adults, except for those who have some college. Each separate analysis by education shows positive coefficient of Social Security income on survival expectation similar to baseline model.[28] Across all education levels, except college, being Black implies higher survival

[28] Estimates and standard errors for some college sub-sample may need to be interpreted with caution as estimated covariance matrix was not of full rank. To address such problem, I added *partial* option suggested by Stata which makes the exogenous regressors to be partialled out from all other variables.

expectation compared to being White. For respondents in less than high school and high school sub-samples, being in other race category implies lower survival expectation compared to Whites, while being Hispanic implies lower survival expectation in sub-samples of less than high school and college attainment groups. Yet, some college sub-sample shows extremely larger coefficients for all the race/ethnicity variables with statistically significance. Further investigation for such result showed that less than 10 respondents of Black, Hispanic, and other race had some college education level.

Yet, both with and without the *partial* option I get the same results where Social Security income is still positive and statistically significant on survival expectation.

Table 18 Robustness Check by Gender

	2SLS (Lewbel's)					
	"Fulfillment & Control"		"Hopefulness"		Survival Expectation	
	Female (N=466)	*Male* (N=267)	*Female* (N=466)	*Male* (N=267)	*Female* (N=3671)	*Male* (N=2183)
Social Security Income (in 1,000s)	0.025** (0.013)	0.024* (0.014)	0.004 (0.015)	0.036*** (0.011)	0.231 (0.274)	0.254 (0.349)
Marital Status (ref: Never-Married)						
Married	0.001 (0.215)	0.018 (0.239)	-0.181 (0.253)	-0.263 (0.225)	-4.857 (3.682)	2.330 (4.277)
Divorced	0.138 (0.243)	-0.094 (0.417)	0.325 (0.267)	-0.367 (0.366)	3.946 (4.234)	14.769** (5.715)
Widowed	0.056 (0.201)	0.089 (0.241)	-0.060 (0.224)	0.310 (0.231)	-4.033 (3.236)	-1.520 (4.069)
Race/Ethnicity (ref: White)						
Black	0.163 (0.127)	0.361** (0.181)	-0.234 (0.150)	0.067 (0.169)	7.113*** (2.051)	12.457*** (2.751)
Other Race	-0.102 (0.407)	-0.534** (0.206)	0.098 (0.353)	-1.361*** (0.176)	-3.760 (5.474)	5.041 (7.240)
Hispanic	-0.371 (0.227)	0.615* (0.339)	-1.004*** (0.313)	-0.358 (0.418)	-7.304** (3.346)	1.153 (4.519)
Number of Children (average)	0.033* (0.018)	-0.017 (0.027)	0.036** (0.018)	0.024 (0.031)	0.261 (0.279)	-0.335 (0.355)
Education (ref: Less than High School)						
High School	0.384*** (0.097)	0.239** (0.131)	0.329** (0.097)	0.043 (0.125)	2.732** (1.343)	-0.437 (1.679)
Some College	0.532*** (0.204)	-	0.797*** (0.140)	-	9.209** (3.763)	0.617 (7.027)
College	0.477*** (0.141)	0.332* (0.173)	0.292** (0.139)	0.087 (0.154)	6.837*** (2.046)	-0.598 (2.191)
Urban	0.085	-0.146	0.109	-0.228	3.232**	1.492

	(0.094)	(0.129)	(0.099)	(0.143)	(1.312)	(1.751)
Region of Residence (ref: Northeast)						
Midwest	0.074	0.121	-0.157	0.007	-3.833**	-0.562
	(0.108)	(0.182)	(0.107)	(0.142)	(1.667)	(2.146)
South	0.041	-0.057	-0.144	-0.154	0.264	2.967
	(0.102)	(0.182)	(0.099)	(0.149)	(1.647)	(2.067)
West	0.034	-0.040	-0.170	-0.077	4.289**	7.321***
	(0.121)	(0.208)	(0.143)	(0.166)	(1.866)	(2.303)
Age of Head	-0.015**	-0.020*	-0.012*	-0.037***	0.033	0.883***
	(0.006)	(0.011)	(0.007)	(0.011)	(0.205)	(0.311)
Objective Survival Expectation	-	-	-	-	0.514***	0.930***
					(0.066)	(0.117)
Constant	0.460	1.121	0.834	2.697***	15.325	-56.792**
	(0.532)	(0.924)	(0.627)	(0.906)	(18.197)	(26.715)
R^2	0.135	0.070	0.129	0.139	0.101	0.094

Note: *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors. Only the second stage results are provided. For running analysis of both Factor 1 and Factor 2 where Male==1, both with and without partialling out option are tested due to causes of singleton dummy variable and estimated covariance matrix being lower than the full rank. However, both with and without the partilling out option, SomeCollege variable is automatically dropped from the analysis due to having no observation that meets this criterion (being Male and having some college education level).

Overall, there is not much statistically significant effect of Social Security income on survival expectation by different education levels. This is reflected in second stage of 2SLS baseline model results in Table 19 where education (specifically some college and college) had only marginal significance on survival expectation among older adults.

Table 19 Robustness Check for Survival Expectation by Education

	Lewbel's 2SLS			
	Less than HS	High School	Some College	College
	(N=2116)	(N=2875)	(N=113)	(N=750)
Social Security Income (in 1,000s)	0.404	0.154	1.284*	0.163
	(0.411)	(0.343)	(0.770)	(0.447)
Female	-7.786***	-9.293***	-0.170	-6.886**
	(2.284)	(1.783)	(9.787)	(3.270)
Marital Status (ref: Never-Married)				
Married	-3.034	1.533	-42.837**	-9.795
	(4.752)	(4.077)	(21.462)	(6.830)
Divorced	8.732	8.502*	-20.279	2.147
	(5.842)	(4.713)	(24.844)	(8.592)
Widowed	-3.088	0.835	-36.230*	-10.213
	(4.188)	(3.505)	(20.201)	(6.730)
Race/Ethnicity (ref: White)				
Black	10.179***	7.882***	25.079*	4.539
	(2.260)	(2.711)	(13.548)	(5.599)
Other Race	-0.839	-8.342	31.236**	9.866
	(6.670)	(7.642)	(12.528)	(8.124)
Hispanic	-2.886	0.363	-42.721***	-6.312
	(3.491)	(4.954)	(12.133)	(10.517)
Number of Children (average)	-0.327	0.299	6.117**	0.695
	(0.342)	(0.315)	(2.572)	(0.682)
Urban	3.566**	2.286	-6.225	0.652
	(1.801)	(1.465)	(7.942)	(3.087)
Region of Residence (ref: Northeast)				
Midwest	-3.056	-2.549	5.740	-1.273
	(2.252)	(1.821)	(10.600)	(3.794)
South	0.995	1.829	4.698	1.056
	(2.231)	(1.820)	(10.150)	(3.339)
West	1.815	6.456***	6.782	7.172**
	(2.912)	(1.970)	(9.915)	(3.571)
Age of Head	-0.213	0.469*	-0.090	0.465
	(0.308)	(0.246)	(1.334)	(0.396)
Objective Survival Expectation	0.359***	0.709***	0.304	0.831***
	(0.105)	(0.079)	(0.459)	(0.139)
Constant	45.151**	19.222	52.172	-11.398
	(26.574)	(20.525)	(113.728)	(33.685)
R^2	0.066	0.106	0.199	0.156

Note: **N=732**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors. Only the second stage results are provided. As previous studies suggested, I also found the strongest first stage F-statistic value (standard 2SLS) for Less than HS analysis ($F = 9.68$***) which is also very close to the minimum requirement of F-statistic ($F>10$) to have a stable strength of the analysis.

Results in Table 20 show survival expectation by marital status, where Social Security income has negative coefficient for never-married and married while it has positive coefficient for divorced and widowed. Yet, the effect of income on perceived survival is not significant across all marital status analyses. Also, only the results for never-married respondents show that number of children has a negative and statistically significant effect on survival expectation. However, similar to analyses by education levels, being Black implies higher survival expectation compared to Whites across all marital status groups. For married and widowed respondents, living in urban area has positive and statistically significant effect on survival expectation, while the results of region of residence is different by marital status. Compared to those who live in Northeast, living in West results in higher survival expectation for married, whereas living in Midwest and South results in negative and significant effect on survival expectation for divorced. For widowed, however, living in Midwest and West result in lower and higher survival expectation, respectively. Overall, first stage F-statistic was strongest for divorced ($F = 12.15$, $p<.001$). Yet, when running estimation for divorced, other race was dropped due to insufficient number of observations.

The final robustness check results in Table 21 shows the analysis of survival expectation by self-rated health status. First stage F-statistic was the strongest for 'health very good' group ($F = 21.64$, $p<.001$). Overall, the estimations show that being female is negatively and statistically significantly related to survival expectation across all health status sub-groups, except for those in the worst health. Even among those who rated their health as excellent, females have lower perceived longevity than males. Another important finding is that, across all

health status groups, being Black is consistently positively related with survival expectation. This result is similar to results of analyses stratified by marital status and education levels. Such results are consistent with Guralnik, Land, Blazer, Fillenbaum, and Branch's (1993) finding where they found that Black older adults aged 75 and older had higher total life and active life expectancy compared to Whites.

In terms of education level, however, results are inconsistent across health groups. Among those who report fair health, high school and college shows statistical significance with negative coefficient. This finding means that among those in fair health category, compared to less than high school, those with high school and college report lower survival expectation. It is possible that some respondents, especially those with low education, are too optimistic of their health and thus perceived longevity. Hong, Zarit, and Malmberg (2004) examined health congruence and depression among oldest old adults and found a discrepancy between objective and subjective health. Their results suggested that individuals may be realists and correctly evaluate their health was good/poor, but they also can be too optimistic/pessimistic and evaluate about their health as better or worse than objective measurements. van Doorn's (1999) study also examined how older people's ratings of their own health depend on whether they are optimist, realist, or pessimist and found similar variation. Interesting finding from van Doorn's study is that family longevity and family health history were important factors that respondents used to explain their own health perceptions. This might suggest that even among respondents with lower than high school education, if they do not have any family member with poor health, the individuals may have higher survival expectation than an individual who might have better education but family history of poor health.

Table 20 Robustness Check for Survival Expectation by Marital Status

	Lewbel's 2SLS			
	Never-Married (N=155)	Married (N=3407)	Divorced (N=221)	Widowed (N=1993)
Social Security Income (in 1,000s)	-2.242 (1.414)	-0.144 (0.442)	0.145 (1.382)	0.051 (0.865)
Female	-4.046 (7.961)	-11.531*** (1.633)	-18.040** (7.329)	-3.642 (2.615)
Race/Ethnicity (ref: White)				
Black	17.709 (11.915)	5.891** (2.478)	9.518 (6.145)	9.446*** (2.710)
Other Race	37.024*** (10.727)	2.213 (5.777)	-	-9.131 (6.863)
Hispanic	17.662 (14.977)	-8.808** (3.572)	9.221 (10.267)	-1.552 (5.027)
Education (ref: Less than High School)				
High School	4.740 (6.996)	1.872 (1.473)	-0.423 (6.167)	2.503 (1.889)
Some College	11.724 (16.570)	5.545 (4.108)	4.649 (15.787)	8.205 (6.112)
College	14.142 (9.826)	3.265 (2.070)	8.612 (8.504)	4.349 (3.148)
Number of Children (average) †	-5.230* (3.049)	0.092 (0.273)	0.137 (1.312)	0.338 (0.410)
Urban	-11.971 (7.430)	2.714* (1.399)	5.180 (6.306)	3.882** (1.871)
Region of Residence (ref: Northeast)				
Midwest	-3.788 (7.353)	-0.298 (1.721)	-18.592** (8.570)	-4.873** (2.265)
South	12.689 (8.324)	2.696 (1.721)	-15.476** (7.426)	-0.354 (2.203)
West	-11.640 (11.561)	7.644*** (1.908)	-11.866 (8.315)	4.357* (2.545)
Age of Head	-0.053 (1.221)	0.319 (0.212)	1.709 (1.127)	0.298 (0.363)
Objective Survival Expectation	0.502 (0.418)	0.701*** (0.072)	0.834** (0.363)	0.511*** (0.111)
Constant	54.173 (107.491)	-3.508 (16.967)	-89.899 (95.820)	-4.506 (32.192)
First Stage F-statistic	4.18***	6.88***	12.15***	3.63***

Note: **N=732**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors. Only the second stage results are provided. †Among those never-married respondents, although classified as never-married, some (n=21) reported having one or more children.

Table 21 Robustness Check for Survival Expectation by Self-rated Health Status

	Lewbel's 2SLS				
	Health Excellent (N=712)	Health Very Good (N=1481)	Health Good (N=1842)	Health Fair (N=1255)	Health Poor (N=561)
Social Security Income	0.498	-0.341	0.326	0.017	-1.461**
(in 1,000s)	(0.561)	(0.324)	(0.380)	(0.400)	(0.641)
Female	-9.854***	-10.094***	-7.604***	-8.956***	-3.923
	(3.197)	(2.424)	(2.285)	(2.581)	(4.181)
Marital Status (ref: Never-Married)					
Married	-4.179	-9.601*	-2.466	-1.975	11.597
	(7.461)	(5.754)	(4.758)	(5.399)	(7.840)
Divorced	4.832	-1.315	5.610	8.164	7.793
	(8.450)	(6.654)	(6.016)	(6.702)	(10.262)
Widowed	-3.316	-12.950**	-2.515	-1.853	-0.979
	(6.661)	(5.522)	(4.172)	(4.896)	(6.810)
Race/Ethnicity (ref: White)					
Black	9.223*	7.156**	13.561***	10.863***	11.312**
	(5.386)	(3.540)	(2.906)	(2.857)	(4.883)
Other Race	15.001	-9.314	11.742	2.036	-5.501
	(11.543)	(13.862)	(9.488)	(6.962)	(8.201)
Hispanic	-7.938	4.626	-3.941	1.599	-1.502
	(8.611)	(5.636)	(4.582)	(4.809)	(7.215)
Education (ref: Less than High School)					
High School	-4.104	0.695	-1.893	-3.869*	1.839
	(3.288)	(2.148)	(1.780)	(1.994)	(3.237)
Some College	-3.614	5.874	-1.242	3.876	19.795
	(8.257)	(6.110)	(5.411)	(7.190)	(16.325)
College	-5.148	0.344	-3.165	-7.286*	1.345
	(3.772)	(2.692)	(2.586)	(3.713)	(5.632)
Number of Children (average)	-0.403	1.079**	-0.250	-0.047	-0.753
	(0.620)	(0.423)	(0.372)	(0.428)	(0.724)

Urban	3.272	4.949**	-2.001	2.001	2.675
	(2.940)	(1.997)	(1.827)	(2.050)	(3.239)
Region of Residence (ref: Northeast)					
Midwest	1.263	-0.843	-6.931***	-0.012	-7.095
	(3.903)	(2.497)	(2.223)	(2.624)	(4.594)
South	6.764*	-0.107	0.825	1.748	-3.954
	(3.631)	(2.546)	(2.199)	(2.578)	(4.240)
West	9.772**	5.337**	3.102	4.896	-6.153
	(3.994)	(2.716)	(2.488)	(3.022)	(5.304)
Age of Head	0.118	0.481	0.575*	0.431	-0.336
	(0.388)	(0.298)	(0.323)	(0.339)	(0.591)
Objective Survival Expectation	0.628***	0.665***	0.635***	0.575***	0.202
	(0.135)	(0.101)	(0.106)	(0.115)	(0.208)
Constant	27.191	3.492	-16.936	-16.326	57.056
	(32.944)	(25.194)	(27.472)	(29.375)	(50.743)
First Stage F-statistic	8.02***	21.64***	9.93***	8.19***	8.45***

Note: **N=732**. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars.
Numbers in parenthesis represent robust standard errors. Only the second stage results are provided.

CHAPTER 5

CONCLUSION AND DISCUSSION

Conclusion

Using the Social Security "notch", which allowed retired individuals born in different years to receive different benefits, this study examined the question of whether a change in income influences the quality of life and perceived longevity of older adults in America. Findings of this study are based on the 1993 AHEAD data, which was surveyed about 27 years ago from today. A lack of the dataset to do the present work on the causal analysis of income on the outcome variables was the primary reason I had to rely on 1993 dataset, and the findings of this study would be even more impactful now if a recently updated dataset was available for the current study. Yet, the findings of this study still provide some meaningful insights to today's policymakers. Over the years, nominal value of wages/earnings and Social Security benefits have increased. Real value of these income sources, on the other hand, have fell for several demographic groups (Congressional Research Service, 2019b). Although most Americans experienced larger wages and earnings compared to 1960s, today's real wage has approximately similar purchasing power it did in 1960s (DeSilver, 2018).

Especially, those in the top income distribution with higher education level and skills experience gains in their real wages (Jones & Weinberg, 2000). However, those at the bottom of the distribution experience losses in their real wages, which magnifies the inequality in terms of wages and Social Security income benefits. Moreover, such rising trends in wages or income inequality have caused challenges in Social Security's financial health (Vallas, Weller, West, &

Odum, 2015). Referring back to my theoretical conceptualization where I introduced the idea of relative income and concept of comparison that people derive satisfaction from how they rank to others, and the idea of prospect theory that individuals weigh losses more heavily than equivalent gains, rising trends in income inequality might imply that there is even more problem and challenges that older adults face now and forward compared to back in 1993. Thus, based on this study's finding that income improves some parts of quality of life of older adults along with theoretical framework, unless there is a reduction in inequality and individuals' – especially those at the bottom of income distribution – Social Security income becomes more equal, future changes in the Social Security benefits will have a significant effect on older adults' overall well-being in terms of living a fulfilled life and being in control of their own lives.

The findings from first stage IV estimation reveals that, relative to the windfall cohort, members of all other cohorts experience lower Social Security income, and the difference is statistically significant for the postnotch cohort. The results also show that additional Social Security income has a positive effect on some dimensions of the quality of life of older adults. In particular, income has a meaningful effect on the Fulfillment & Control dimension of quality of life, implying that income gives older adults feelings of living a fulfilled life and being in control of their life. However, the effect of income on the Hopefulness dimension of quality of life appears to be more nuanced. While here is no significant relationship for females, among male respondents, income appears to imply higher hopefulness. Finally, while the reduced form estimations reveal a positive correlation between Social Security income and subjective 10-year survival probability, the rigorous statistical tests fail to capture causal relationship.

The result that income did not have the overall significant effect on the Hopefulness dimension of quality of life among older adults supports Wagnild's (2003) finding that resilience

is not related to income among older adults. Wagnild found a significant and positive association between resilience and successful aging regardless of income. A potential reason for the insignificance of income might be that the items under that specific dimension are directly related to older adults' life values and perspectives and innate optimistic personality. Lamond et al.'s (2008) finding reveals that resilience among older adults is strongly correlated with optimism and emotional well-being. Simply put, the finding in this study might mean that older adults' value of and positivity regarding their lives and future might not depend on a change of income. Sheldon and Kasser's (2001) study suggest that older adults are less focused on materialistic issues and more focused on values related to self-acceptance, emotional intimacy, and community contribution. Moreover, the lack of strong association between income and hopefulness may be due to an adaptation mechanism. Although an initial increase in income could increase the perceived quality of life, if the views and aspirations evolve to reflect the new possibilities, then the perceived quality of life would come back to its original level. Previous studies that have examined the relationship between income and life satisfaction/happiness/subjective well-being/quality of life implemented adaptation mechanism (Ferrer-i-Carbonell & Van Praag, 2008; Paul & Guilbert, 2013; Di Tella & MacCulloch, 2008; Di Tella, New, & MacCulloch, 2010; Vendrik, 2013; Clark, 2016). Yet, in order to examine whether the adaptation mechanism holds true in the relationship between income and quality of life among older adults, I would need longitudinal data that was not available for the measures of quality of life utilized in this project.

On the other hand, items under the Fulfillment & Control dimension might be related to a feeling of freedom in use of money and financial security: an increase in income may give individuals opportunities to enjoy activities, experience different things, and change and control

things that may be related to financial matters. Thus, changes in income matter to older adults' feeling of fulfillment in life through enjoyment, activities, achieving goals, and feeling of control in life. Further investigation of the possible association between Social Security income and individual quality of life items reveals interesting findings. There is a significant effect of Social Security income on the following items: feeling of putting in time for the rest of life, feeling that real enjoyments are in the past, feeling as though all there is to do in life has been done, feeling in control, and feeling of mindpower. Consistent with the literature (Ailshire & Crimmins, 2011), the older population in this study have a positive quality of life overall. Using the Health and Retirement Study data, Ailshire and Crimmins (2011) found that the oldest-old adults have a negative perception towards the aging experience and are more likely to feel lonely and isolated, yet they have a higher satisfaction with life compared to the younger elderly adults.

In terms of control variables, age, education and race have a significant effect on the perceived quality of life as measured by both the Fulfillment & Control and Hopefulness dimensions of quality of life, and on the expectation towards longevity. Older age implies lower perceived quality of life, and higher education implies higher quality of life and longevity expectation which supports the literature that education level is positively associated with levels of self-esteem and psychological well-being among older adults (Butkovic, Brkovic, & Bratko, 2012). Race, on the other hand, has different effects on quality of life and perceived longevity, which might suggest that there is a cultural effect or difference when it comes to measuring different dimensions of quality of life and perceived longevity among older adults. Overall, being Black implies higher Fulfillment & Control dimension of quality of life and more optimistic response to survival expectation, compared to being White. Marital status also has a significant effect on perceived longevity. In particular, divorced respondents reported higher

survival expectation compared to never-married respondents. These results are consistent with the literature that shows evidence of association between sociodemographic factors and quality of life of older adults (Gobbens & Rammen, 2018) and longevity (Rogers, 1995). Furthermore, being female has a negative and statistically significant effect on survival expectation. This also means that females have lower survival expectation and are less optimistic regarding their survival than males.

The strength of this paper is the use of the exogenous variation in older adults' Social Security income. I use the Social Security "notch" as an instrument to examine the causal effect of income on the quality of life and survival expectation of older adults. As mentioned earlier, Social Security income is a very important source of income for older adults, and the benefit differences caused by the government's mistake was meaningful to older adults in that the policy was grandfathered for permanent and continued on to their post-retirement life. Also, since the federal government is likely to propose changes to the program in response to the Social Security system's projected insolvency by 2035, this study is very timely and relevant to public policy. The findings here suggest that reductions to future benefits in Social Security income may have important impacts on some aspects of the quality of life and perceived longevity among older adults.

Limitations

While there are some strengths, there are also some limitations with this study. First, due to an unavailability of the quality of life modules in later waves of the Asset and Health Dynamics among the Oldest Old (AHEAD), I was able to use only the 1993 wave of the AHEAD and could not capture the effect of income on the quality of life in a long run. Thus, while the literature applied the adaptation theory in examining income and well-being, my

findings cannot speak to the adaptation theory which helps in examining and explaining if older adults adapt to the changes in their income and their well-being level returns to the original point after a certain time period. Yet, for future study, it would be interesting to see whether the adaptation theory still holds true in the relationship between income and quality of life and perceived longevity among older adults in America.

Second, this study did not control for the Great Depression. The Great Depression occurred during the period 1929-1939, and it might have affected the overall well-being of older populations who went through the depression era as children. As Martin, da Rosa, and Poon (2011) suggested, when considering the well-being of older adults, one should not only examine the current level of life satisfaction or well-being but also look at the long series of events "starting with lasting influences that date back to childhood experiences and finishing with recent events that affect old and very old adults" (Martin, da Rosa, & Poon, 2011, p. 107). The Great Depression may have been a traumatic event for some respondents and may have had a lasting effect on their socioeconomic status or health. A study by Kraaij and de Wilde (2010) examined the association between negative life events and depressiveness among the elderly, suggesting that negative events in life may have a significant impact on people's well-being. Their study found that having a depressed mood was related to the elderly respondents' reporting of negative socio-economic environment and emotional abuse and neglect during childhood. Thus, those elderly who experienced hardships during the Great Depression during childhood may have had lower overall well-being in later life.

From an economics perspective, the Depression era may have had direct and indirect impacts on lifetime well-being in terms of an individual's education level, lifetime earnings, cognitive ability, or overall physical health as an asset. On the other hand, among those who may

have perceived the Depression era as a lifelong trauma, it may have helped them to be able to better cope with stressful events or hardships they may have experienced in their lives. In a study that examined post-traumatic growth from life's most traumatic event and its influence on elders' current coping and adjustment, the authors found a positive influence of post-traumatic growth from events that occurred in elders' lives on subsequent coping, death attitudes, and adjustment to recent stressors (Park, Mills-Baxter, & Fenster, 2005). Since including controls for the Great Depression would be colinear with cohort dummies used in my study, future studies that utilize different identification strategies could address this issue.

Third, not everyone in the data was chosen, nor did everyone agree to answer the quality of life module, which led to a significantly small sample than the original AHEAD dataset. In addition, the findings are only generalized to older adults in America. Thus, effect of income on quality of life and perceived longevity among younger generations may have different meanings and results. Also, lower levels of well-being or quality of life may be leading to higher mortality rates, yet, I could not observe the relationship between the quality of life and mortality due to the design of the AHEAD data and the quality of life module. Examining such a relationship would require a longitudinal study that follows the same older adult over long periods of time. This would allow a researcher to capture any changes of quality of life over the years, and examine a complicated relationship between income, quality of life, and mortality among older adults.

Recommendations

One of the important recommendations for future research is to examine the effect of income on quality of life and survival expectation among older adults living in different facilities (e.g., nursing home or long-term care facility) or attending senior day care center as they may

have different living and health conditions.[29] Previous studies have examined quality of life or well-being of older adults living in different facilities or having chronic disease conditions. One of the studies examined depression, stress, and quality of life of individuals with chronic kidney disease and found that those with the disease had significantly worse overall health and modestly lower quality of life, but had similar mental health compared to those without the disease (Odden, Whooley, & Shlipak, 2006). Other studies identified and examined different domains of quality of life that are directly related to residents in nursing homes (Kane et al., 2003) and in assisted living homes (Mitchell & Kemp, 2000). Kane et al. (2003) recognized the importance of nursing home residents' subjective and self-reported quality of life, and that the quality of life is a different phenomenon among different types of nursing home residents (e.g., short-stay vs. long-stay residents). In terms of well-being in old age, people may perceive well-being as having a good health status that could allow them to be physically independent and do daily activities without much of limitation. Thus, those elderly living in facilities where they receive care and help doing daily activities may have less quality of life due to having health-related limitations.

However, since social engagement is an important factor for the well-being among older adults, even with a possible reduction in Social Security income, individuals living in facilities may have a greater chance for more interaction and activities as a group and may report higher social well-being compared to those that tend to be healthy but live in isolation. In Bowling et al.'s (2003) study, about 60 percent of older adults aged 65 and up reported participating in social, leisure, educational, local community and voluntary services as important factors to their life quality. Other study also shows an evidence of a positive association between activity

[29] There are also different types of group housing or facilities for older adults. Some of them are: board and care homes, adult foster care homes, adult care facilities, residential care facilities, assisted living facilities, and Continuing Care Retirement Communities (Robinson, n.d.).

participation and quality of life or life satisfaction among older adults with disease and disability (Jang, Mortimer, Haley, & Graves, 2004). Moreover, in a study of following elderly Americans for 13 years, increased social and productive activities predicted longer length of life (Glass, de Leon, Marottoli, & Berkman, 1999), and from a 20 year longitudinal study older adults' reported activity levels and self-rated level of activity predicted longevity (Mullee, Coleman, Briggs, Stevenson, & Turnbull, 2008). Thus, those living in a care facility or attending senior care centers may have a greater quality of life or well-being compared to those not living in the care facility or not attending care center, if they gain greater satisfaction from social interaction and activity participation within the facility or the care center. Yet, the way income affect quality of life among those older adults in different care facilities might not be different compared to those not living in the facilities. To examine the income effect on quality of life and perceived longevity of older adults in different facilities thus would need a special quality of life measure that could capture all domains of quality of life that are pertinent not only to older adults living in independent living communities but also to those living in different senior care facilities.

In future research, I would investigate deeper into the effect of income on quality of life among older adults in America by using three different approaches of the psychological well-being listed in Steptoe, Deaton, and Stone's (2015) study. They distinguished the three aspects of psychological well-being as follows: evaluative well-being, hedonic well-being, and eudemonic well-being. Evaluative well-being refers to individuals' overall life satisfaction or perceived quality of life, hedonic well-being refers to everyday emotions or moods such as sadness, happiness, and anger, and eudemonic well-being refers to individuals' purpose and meaning in life. Although the quality of life module in the AHEAD data includes items regarding purpose in life and personal control, it does not include emotional or mood-related well-being questions.

Thus, as Steptoe et al. (2015) suggest that these well-being are relevant to health and quality of life of ageing population, it would be informative from policy perspective to know which aspect of these well-being among older adults are strongly affected by the changes in Social Security income.

Diener, Lucas, Schimmack, and Helliwell (2009) and Dolan and White (2007) suggest that subjective well-being measures should be used to inform public policy. They acknowledge the importance of economic indicators to inform and implement policy, but their arguments strongly support how the well-being measure is imperative and adds a value to inform policy. Further, Diener et al. (2009) quote in their book, "we think that high well-being is already the goal toward which policy makers strive… Information about current well-being will allow policy makers to achieve their current goals more effectively and efficiently" (p. 7). In terms of policy, the results of my study will add a value and contribute a knowledge on how changes in public policy proposals, specifically Social Security benefits, may have an important effect on the well-being of older adults. Understanding the causal effect of income on different aspects of well-being among older adults might help policymakers to predict outcomes and prevent any possible negative consequences of future policies, and evaluate any existing policies that have a goal of increasing the overall quality of life and longevity of older adults.

In addition to examining the impact of income on continuous measures of the quality of life, it would be important to look at those individuals who may have either very low or very high quality of life scores and perceived longevity probabilities. It is possible that the income effect is concentrated at a lower or upper end of the quality of life spectrum and perceived longevity, i.e., it may prevent people from being too pessimistic in the assessment of their life quality and longevity, or it might induce excessive optimism. Toward this goal, future research

should examine the effects of income on dichotomized outcomes indicating an arbitrary range of the quality of life measurement and perceived longevity (e.g., the bottom or top 30% of the distribution). To examine the heterogeneity of the impact of income, instrumental variable quantile regression (Kwak, 2010) following Ayyagari and Frisvold's (2015) study could be used.

In terms of perceived longevity measure, the current measure in 1993 AHEAD data asks: "What do you think are the chances that you will live to be at least (born 1904-1908:100; born 1909-1913: 95; born 1914-1918: 90; born 1919-1923: 85; born 1924 or after: 80)?". This asks the self-reported probability of living about another 10 years; yet, forward looking to 10 years from the time respondents were asked to respond about their longevity may have affected the way they responded. The 10 year time-horizon might make respondents to be either too optimistic or pessimistic and be far away from being realistic about their future longevity. Thus, instead of asking the probability of living about another 10 years, asking the expectation on longevity probability for a shorter time-horizon, for example 5 years, might help respondents to be close to realistic in responding to their longevity expectations.

Further, it would be informative for policymakers to know [1] how Social Security income itself, and [2] how a possible reform in the benefit amounts of Social Security income affect the quality of life or well-being of older adults and their perceived longevity, by collecting qualitative responses from the older adults. Several studies used a survey that asked older adults what they think of quality of life is and collected their responses to fully capture and understand the definition of the quality of life from their own perspective (Bowling et al., 2003; Bowling, Banister, Sutton, Evans, & Windsor, 2002; Gabriel & Bowling, 2004). These studies used a national survey of the quality of life among older adults in Britain that includes open-ended questions of respondents' quality of life. Some of the examples of the open-ended questions used

for the survey are: “Thinking about your life as a whole, what is it that makes your life good – that is, the things that give your life quality?”, “What is it that makes your life bad – that is the things that reduce the quality in your life?”, “What single thing would improve the quality of your life?” (Bowling et al., 2003, p. 276). Yet, there is no study that fully captures how the income itself and changes in income, specifically Social Security, truly affect older adults’ well-being, quality of life, and perceived longevity. Thus, for the future study, it would be valuable to design a study that includes both quantitative and qualitative data (or mixed-method study) that collects information on older adults’ quality of life using a scale and their responses on the following questions: [1] how does Social Security income affect your quality of life and perceived longevity?, [2] how a reduction in the Social Security income would affect your quality of life and perceived longevity?, [3] how an increase in the Social Security income would affect your quality of life and perceived longevity?. The responses from these questions could give more accurate and informative views on the relationship between income and well-being of older adults, and thus could help policymakers in regard to designing the future Social Security reform proposals.

In addition, as many older Americans rely on Social Security incomes and benefits to cover and consume basic necessities, they might also rely on such income source to enjoy their lives by participating in different community, social, or leisure activities. The findings from this study that income has a meaningful and positive effect on the Fulfillment & Control dimension of quality of life as well as perceived longevity raise an important policy agenda focusing on the low-income older adults in terms of their well-being. Compared to those with higher income, lower income individuals may not have an equal access to live a fulfilled life, be in control of their life, and look forward to longer healthy lives. Previous research found a significant

difference in services and programs offered by senior centers in urban and rural areas (Conrad, Hultman, Hughees, & Hanrahan, 1993; Krout, 1987), and my result also shows that those live in urban areas and West region of the country reported higher survival expectation probability compared to those in rural and Northeast region, respectively. Thus, from a public health and policy perspectives, it would be critical to further investigate [1] if there is a difference of causal effect of income on the overall well-being of older adults, and [2] whether such an association is mediated by differences in services and programs provided by community, government, and/or senior centers in different areas/regions of United States.

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APPENDIX A

Appendix A. List of Variable Description Used in this Study

Variable	Description in AHEAD/RAND data	Recoded in my study
Dependent Variable		
Quality of Life	**Quality of Life questionnaires "How often do you feel…?"** 1. Hopeful 2. You have much to look forward to 3. You have very few goals 4. You are just putting in time for the rest of your life 5. Real enjoyments for your life are in the past 6. You would not be bothered if your life ended soon 7. Your daily activities seem unimportant to you 8. As if you have done all there is to do in life 9. You have little control over the things that happen to you 10. There is really no way that you can solve some of the problems you have 11. There is little you can do to change many of the important things in your life 12. You are being pushed around in your life 13. What happens to you in the future mostly depends on you 14. You can just do anything you really set your minds to do	Through the principal component analysis, I retained two components using these QOL items. QOL items 3-12 are included in the first component: "Fulfillment & Control". QOL items 1, 2, 3, 13, and 14 are included in the second component: "Hopefulness".
Subjective Survival Expectation	Original variable name: R2LIV10 for the 1993 AHEAD wave. Self-reported probability of living about another 10 years. Respondents who are under 70 years old at the time of survey, R2LIV10 is the self-reported probability of living to age 80; for those 70-74, it is the probability of living to age 85; and so on.	This variable is used as it is recoded in the RAND codebook.

Key Independent Variables		
Social Security Income	**Social Security benefit amount received** [R2ISRET: the amount individual received from Social Security retirement benefits] [S2ISRET: the amount spouse received from Social Security retirement benefits]	It is a continuous and measured in 1993 dollars. I combined the max of respondent's Social Security income and the max of the respondent's spouse's Social Security amount together. I took this combined variable and divided it by 1,000 to represent that the income is measured in $1,000.
Cohort Dummies	**Cohort dummies born between 1901-1930** [RABYEAR] refers to respondents' birth year.	Based on the primary beneficiary's birth year, four different cohort dummies were created. Those born between [1901-1909] were classified as 'prewindfall cohort'. Those born between [1910-1016] classified as 'windfall cohort'. Those born between [1917-1921] classified as 'notch cohort. Lastly, those born between [1922-1930] classified as postnotch cohort.
Objective Survival Expectation	Original variable name: R2LIV10P for the AHEAD 1993 wave. It is the implied 10-year probability of survival calculated from the Vital Statistics life tables. This probability is calculated using the respondent's age and gender.	This variable is used as it is recoded in the RAND codebook.
Independent Variables		
Age	**Age of respondent** [R2AGEY_B] is the age in years, which is represented as the integer portion of the number of months divided by 12.	It was treated as continuous variable.

Female	**Gender** [RAGENDER] variable has two options. 1. Male 2. Female	It was recoded into 1/0 dummy variable (1 indicates Female and 0 indicates Male).
Marital Status	**Respondents' current marital status** Question asks: "Please remind me, are you currently married, living with a partner, divorced, widowed, or have you never been married?" 1. Married 2. Married, spouse absent 4. Separated 5. Divorced 7. Widowed 8. Never-Married	This variable was recoded into four different marital status categories. [1] and [2] were categorized into 'Married'. [4] and [5] were categorized into 'Divorced'. [7] was categorized into 'Widowed', and [8] categorized into 'Never-Married'.
Race/Ethnicity	**Race of respondent** "Do you consider yourself primarily white or Caucasian, Black or African American, American Indian, or Asian, or something else?" 1. White/Causasian 2. Black/African American 3. Other **Race of respondent: Whether Hispanic** "Do you consider yourself Hispanic or Latino?" 0. Not Hispanic 1. Hispanic	Race and Hispanic dummies were created separately since the race and Hispanic origin questions appear separately. Four different race/ethnicity categories created: White, Black, Other Race, and Hispanic.
Number of Children	**Number of children** [H2CHILD] variable provides the number of living children of the respondent and spouse or partner.	This variable was treated as continuous variable.
Educational	**Highest degree received or grade completed** "What is the highest grade of school or year of college you completed?" 0. No degree 1. GED 2. HS 3. HS/GED 4. AA/ Lt BA	This variable was recoded into five different education categories. [0] was categorized as 'Less than high school'. [1], [2], and [3] were categorized as 'High School'.

	5. BA 6. MA/MBA 7. Law/MD/PhD 8. Other	[4] was categorized as 'Some college'. [5] and above were categorized as 'College'.
Urban	**Residence in an urban or rural area** 1. Not in MSA (Rural) 2. MSA (Urban)	This variable was recoded into 0/1 dummy variable. [1] indicates respondents residing in urban area, and [0] respondents residing in rural area.
Region of Residence	**Census Region** 1. Northeast 2. Midwest 3. South 4. West 5. Other	This variable was recoded into 4 different categories. Respondents reside in [1] was coded as 'Northeast', [2] was coded as 'Midwest', [3] as South, and [4] as West.
Other Independent Variables included for Robustness Checks		
Net Worth	**Net value of total wealth** [H2ATOTA: the net value of total household wealth (excluding second home)] It is calculated as the sum of all wealth components subtract all debt.	It is a continuous and measured in 1993 dollars. I took this variable and divided it by 10,000 to represent that the net worth is measured in $10,000.
Non-Social Security Income	**Household non-social security income** [R2ISRET: the amount individual received from Social Security retirement benefits] [S2ISRET: the amount spouse received from Social Security retirement benefits] [H2ITOT: total household income – includes respondents and spouse earnings, pensions and annuities, SSI and Social Security Disability, Social Security retirement, unemployment and workers compensation, other government transfers, household capital income, and other income]	It is a continuous and measured in 1993 dollars. This variable represents total household income excluding social security income. I created this variable by subtracting respondent's Social Security income and spouse's Social Security income from total household income, and divided by 10,000 to represent that the non-

		social security income is measured in $10,000.
Self-rated Health Status	**Self-report of health** [R2SHLT] is the respondent's self-reported general health status. "Would you say your health is excellent, very good, good, fair, or poor?" 1. Excellent 2. Very good 3. Good 4. Fair 5. Poor	This variable was coded as it is. Those answered to [1] classified as having 'excellent' health. Those answered to [2] classified as having 'very good' health. Those answered to [3], [4], and [5], classified as having 'good', 'fair', and 'poor' health, respectively.

Note. The full description of questionnaire and variable lists can be found in RAND HRS Longitudinal File 2016 (V1) Documentation (2019). Also, it can be found here: http://hrsonline.isr.umich.edu/modules/meta/1993/core/codebook/codb-btxt.htm#top.

APPENDIX B

Appendix B Quality of Life (QOL) Items Response Distribution

QOL Items	Question	Response Distribution (%)		
		Most of the time	**Some of the time**	**Hardly ever**
	Feel Hopeful			
	Prewindfall	82 (63.57)	34 (26.36)	13 (10.08)
QOL1	Windfall	204 (73.91)	58 (21.01)	14 (5.07)
	Notch	220 (79.71)	38 (13.77)	18 (6.52)
	Postnotch	96 (82.76)	15 (12.93)	5 (4.31)
	Look Forward			
	Prewindfall	73 (57.03)	42 (32.81)	13 (10.16)
QOL2	Windfall	175 (62.72)	78 (27.96)	26 (9.32)
	Notch	190 (68.84)	72 (26.09)	14 (5.07)
	Postnotch	81 (70.43)	24 (20.87)	10 (8.70)
	Feel Very Few Goals			
	Prewindfall	30 (24.00)	37 (29.60)	58 (46.40)
QOL3	Windfall	53 (19.00)	104 (37.28)	122 (43.73)
	Notch	59 (21.45)	82 (29.82)	134 (48.73)
	Postnotch	31 (27.19)	40 (35.09)	43 (37.72)
	Feel Putting In Time			
	Prewindfall	34 (26.56)	29 (22.66)	65 (50.78)
QOL4	Windfall	54 (19.71)	51 (18.61)	169 (61.68)
	Notch	41 (14.91)	58 (21.09)	176 (64.00)
	Postnotch	12 (10.53)	19 (16.67)	83 (72.81)
	Feel Enjoyment In Past			
	Prewindfall	44 (33.85)	34 (26.15)	52 (40.00)
QOL5	Windfall	67 (24.64)	83 (29.64)	128 (45.71)
	Notch	61 (22.26)	58 (21.17)	155 (56.57)
	Postnotch	24 (20.69)	32 (27.59)	60 (51.72)
	Feel Ok If Life Ended Soon			
	Prewindfall	28 (22.95)	22 (18.03)	72 (59.02)
QOL6	Windfall	48 (17.71)	49 (18.08)	174 (64.21)
	Notch	36 (13.19)	42 (15.38)	195 (71.43)
	Postnotch	11 (9.57)	21 (18.26)	83 (72.17)
	Feel Activities Seem Unimportant			
	Prewindfall	20 (15.38)	43 (33.08)	67 (51.54)
QOL7	Windfall	48 (17.14)	66 (23.57)	166 (59.29)
	Notch	30 (10.99)	52 (19.05)	191 (69.96)
	Postnotch	11 (9.82)	27 (24.11)	74 (66.07)
QOL8	**Feel Done All There Is**			

	Prewindfall	23 (18.11)	28 (22.05)	76 (59.84)
	Windfall	54 (15.83)	54 (19.42)	180 (64.75)
	Notch	39 (14.18)	41 (14.91)	195 (70.91)
	Postnotch	10 (8.77)	20 (17.54)	84 (73.68)
	Feel Little Control			
	Prewindfall	46 (35.66)	31 (24.03)	52 (40.31)
QOL9	Windfall	74 (26.81)	92 (33.33)	110 (39.86)
	Notch	62 (22.71)	68 (24.91)	143 (52.38)
	Postnotch	24 (21.05)	40 (35.09)	50 (43.86)
	Feel No Way To Solve Problems			
	Prewindfall	28 (21.88)	37 (28.91)	63 (49.22)
QOL10	Windfall	47 (16.79)	85 (30.36)	148 (52.86)
	Notch	37 (13.50)	75 (27.37)	162 (59.12)
	Postnotch	16 (14.16)	34 (30.09)	63 (55.75)
	Feel Little Can Change			
	Prewindfall	28 (22.58)	38 (30.65)	58 (46.77)
QOL11	Windfall	64 (23.27)	83 (30.18)	128 (46.55)
	Notch	45 (16.61)	94 (34.69)	132 (48.71)
	Postnotch	24 (21.24)	38 (33.63)	51 (45.13)
	Feel Pushed Around			
	Prewindfall	1 (0.78)	19 (14.73)	109 (84.50)
QOL12	Windfall	10 (3.56)	37 (13.17)	234 (83.27)
	Notch	9 (3.27)	37 (13.45)	229 (83.27)
	Postnotch	1 (0.88)	16 (14.04)	97 (85.09)
	Feel Future Depends On Self			
	Prewindfall	93 (73.23)	19 (14.96)	15 (11.81)
QOL13	Windfall	184 (66.67)	52 (18.84)	40 (14.49)
	Notch	188 (68.36)	49 (17.82)	38 (13.82)
	Postnotch	78 (70.27)	22 (19.82)	11 (9.91)
	Feel Mind Power			
	Prewindfall	76 (59.38)	31 (24.22)	21 (16.41)
QOL14	Windfall	168 (60.22)	84 (30.11)	27 (9.68)
	Notch	169 (61.68)	78 (28.47)	27 (9.85)
	Postnotch	81 (71.05)	26 (22.81)	7 (6.14)

Note: **N=805.** This includes everyone in the study cohort groups [Prewindfall, Windfall, Notch, and Postnotch] and answered QOL module. These items constitute the Quality of Life module of the HRS - AHEAD 1993 (Wave 1). The codebook documentation can be found here: http://hrsonline.isr.umich.edu/modules/meta/1993/ core/codebook/ codb-modtxt.htm#V2122. For the purpose of analysis presented in this dissertation, the responses were coded 1 'mostly (all) of the time', 2 'some of the time', and 3 'hardly ever', but QOL1, QOL2, QOL13, and QOL14 scores are reverse coded – as 1 being 'hardly ever' and 3 being 'mostly (all) of the time'. Thus, higher values are associated with higher quality of life. More detailed response distribution across different birth cohort groups are provided in the Appendix section.

APPENDIX C

Appendix C Effect of Social Security Income on Individual QOL Items

QOL Items	**Effect of HH SS Income**
QOL1	0.011 (0.008)
QOL2	0.009 (0.009)
QOL3	0.004 (0.011)
QOL4	0.016* (0.009)
QOL5	0.033*** (0.010)
QOL6	0.001 (0.011)
QOL7	0.008 (0.010)
QOL8	0.016* (0.009)
QOL9	0.036*** (0.011)
QOL10	0.014 (0.009)
QOL11	0.016 (0.012)
QOL12	0.004 (0.007)
QOL13	-0.008 (0.011)
QOL14	0.018* (0.010)
Note: **N=5630.** Other control variables include age, sex, marital status, race/ethnicity, number of kids, education, MSA, and region of residence. Coefficient indicates the effect of income on each quality of life items, and standard errors are in parentheses. The coefficients are results from Lewbel's 2 stage least square estimation.	

APPENDIX D

Appendix D Standard 2SLS Model of "Fulfillment & Control" (Factor 1)

	Standard 2SLS	
	1st Stage	*2nd Stage*
Social Security Income in $1,000s		0.051
		(0.090)
Age	0.081	-0.017*
	(0.055)	(0.009)
Female	0.206	0.095
	(0.378)	(0.073)
Marital Status (ref: Never-Married)		
Married	6.220***	-0.165
	(0.746)	(0.568)
Divorced	1.015	-0.024
	(1.032)	(0.226)
Widowed	0.662	0.022
	(0.698)	(0.160)
Race/Ethnicity (ref: White)		
Black	-1.738***	0.294
	(0.536)	(0.182)
Other Race	-4.132***	-0.165
	(0.807)	(0.519)
Hispanic	-2.105***	0.049
	(0.574)	(0.274)
Number of Children (average)	0.013	0.012
	(0.072)	(0.016)
Education (ref: Less than High School)		
High School	1.492***	0.294*
	(0.345)	(0.159)
Some College	4.366***	0.416
	(0.888)	(0.432)
College	2.327***	0.348
	(0.597)	(0.226)
Urban	1.159***	-0.028
	(0.345)	(0.128)

Region of Residence (ref: Northeast)		
Midwest	0.406	0.092
	(0.487)	(0.096)
South	-1.056***	0.040
	(0.385)	(0.139)
West	-0.605	0.019
	(0.506)	(0.128)
Cohort Group (ref: Windfall)		
Prewindfall	-0.758	-
	(0.668)	
Notch	-0.169	-
	(0.468)	
Postnotch	-0.976	-
	(0.717)	
Constant	-0.105	0.484
	(4.571)	(0.471)
N	733	733
F-statistic	1.57	3.86***

*$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors.

APPENDIX E

Appendix E Standard 2SLS Model of "Hopefulness" (Factor2)

	Standard 2SLS	
	1st Stage	*2nd Stage*
Social Security Income in $1,000s	-	-0.132
		(0.114)
Age	0.081	-0.005
	(0.055)	(0.012)
Female	0.206	0.050
	(0.378)	(0.093)
Marital Status (ref: Never-Married)		
Married	6.220***	0.685
	(0.746)	(0.725)
Divorced	1.015	0.276
	(1.032)	(0.298)
Widowed	0.662	0.115
	(0.698)	(0.214)
Race/Ethnicity (ref: White)		
Black	-1.738***	-0.387*
	(0.536)	(0.215)
Other Race	-4.132***	-0.759
	(0.807)	(0.589)
Hispanic	-2.105***	-1.034***
	(0.574)	(0.037)
Number of Children (average)	0.013	0.030
	(0.072)	(0.021)
Education (ref: Less than High School)		
High School	1.492***	0.478**
	(0.345)	(0.197)
Some College	4.366***	1.405***
	(0.888)	(0.531)
College	2.327***	0.571*
	(0.597)	(0.292)
Urban	1.159***	0.155
	(0.345)	(0.161)

Region of Residence (ref: Northeast)		
Midwest	0.406	-0.023
	(0.487)	(0.115)
South	-1.056***	-0.288*
	(0.385)	(0.155)
West	-0.605	-0.151
	(0.506)	(0.140)
Cohort Group (ref: Windfall)		
Prewindfall	-0.748	-
	(0.668)	
Notch	-0.169	-
	(0.468)	
Postnotch	-0.976	-
	(0.717)	
Constant	-0.105	1.116
	(4.571)	(0.685)
N	733	733
F-statistic	1.57	2.88***

*$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors.

APPENDIX F

Appendix F Standard 2SLS Model of Survival Expectation

	Standard 2SLS	
	1st Stage	*2nd Stage*
Social Security Income in $1,000s	-	-1.692
		(1.519)
Objective Survival Expectation	0.014**	0.638***
	(0.007)	(0.066)
Age	0.113***	0.464*
	(0.023)	(0.245)
Female	-0.498***	-9.349***
	(0.171)	(1.600)
Marital Status (ref: Never-Married)		
Married	6.088***	9.556
	(0.235)	(9.537)
Divorced	0.263	8.228**
	(0.312)	(3.516)
Widowed	0.714***	-1.223
	(0.229)	(2.787)
Race/Ethnicity (ref: White)		
Black	-1.506***	6.084**
	(0.186)	(2.829)
Other Race	-1.320***	-2.866
	(0.486)	(4.902)
Hispanic	-1.753***	-7.482*
	(0.255)	(3.881)
Number of Children (average)	-0.006	0.073
	(0.026)	(0.227)
Education (ref: Less than High School)		
High School	1.217***	3.823*
	(0.117)	(2.112)
Some College	1.379***	9.526**
	(0.438)	(4.086)
College	2.296***	7.731**
	(0.216)	(3.762)
Urban	0.834***	4.113**

	(0.130)	(1.661)
Region of Residence (ref: Northeast)		
Midwest	0.118	-2.249
	(0.167)	(1.368)
South	-0.680***	-0.029
	(0.156)	(1.694)
West	-0.592***	4.204**
	(0.187)	(1.776)
Cohort Group (ref: Windfall)		
Prewindfall	-0.743***	-
	(0.203)	
Notch	-0.028	-
	(0.171)	
Postnotch	-0.587**	-
	(0.243)	
Constant	-2.273	-2.410
	(1.948)	(15.371)
N	5854	5854
F-statistic	9.21***	32.14***

*$p < 0.10$. **$p < 0.05$. ***$p < 0.01$. Social Security income is measured in 1,000s, and is in 1993 dollars. Numbers in parenthesis represent robust standard errors.