Summer 6-23-2016

Intertemporal Poverty among Older Americans

Gulgun Bayaz-Ozturk
CUNY New York City College of Technology

Sean MacDonald
CUNY New York City College of Technology

Intertemporal Poverty among Older Americans

Abstract

This study uses aggregate intertemporal poverty indices proposed by Gradin, Del Rio, and Canto (2012) to measure poverty among older American households of different races from 2001 through 2009 employing data from the Health and Retirement Study. The findings indicate that the incidence of intertemporal poverty is higher among Black and Hispanic households and that it is also more intense and of longer duration. In our investigation of antipoverty effects of the Supplemental Nutrition Assistance Program, we find that the program has a significant impact in reducing intensity and inequality of poverty among poor populations. However, it does not significantly alter the incidence of intertemporal poverty.

KEYWORDS: Intertemporal poverty, Older American households, Racial disparities, SNAP, Bootstrapped confidence intervals

INTRODUCTION

Increasing availability of longitudinal data and the accompanying methods of poverty measurement facilitate research in poverty dynamics and allow researchers to better summarize individual poverty experience in a longitudinal framework (Foster, 2009; Gradin, Del Rio, & Canto, 2012; Roope & Peters, 2013). In this study, we examine poverty experiences of older American households of different races in the first decade of the 21st century by utilizing data from the Health and Retirement Study (HRS) and using the longitudinal method developed by Gradin, Del Rio, and Canto (2012). Additionally, we investigate how the value of food stamps is associated with the poverty experience of older households.

Understanding of elderly poverty is becoming increasingly important as the proportion of elderly in the U.S. population continues to rise, and growing healthcare costs, changes in the type of pension holdings, and concerns about Social Security continue to threaten the financial security of the elderly. In 2000, 16 percent of the U.S. population was 60 years and older, and by year 2030, one in four people in the U.S. will be 60 years and older (Siegel, 1996). There will also be dramatic changes in the racial composition of all persons aged 60 and over by 2030. In particular, the share of Hispanic persons is expected to increase more than twofold between 2000 and 2030 (from 5 percent in 2000 to 13 percent in 2030) whereas the share of non-Hispanic White persons will decline by 13 percentage points (from 82 percent in 2000 to 69 percent in 2030). Moreover, the share of Black persons will rise from 8 percent in 2000 to 10 percent in 2030 (Siegel, 1996). DeNavas-Walt and Proctor (2014) find that the incidence of poverty varies substantially across racial groups where Blacks and Hispanics were more likely to fall into poverty (27.2 percent and 23.5 percent, respectively) as opposed to Whites (9.6 percent) in 2013.

We believe that a dramatic increase in the number of poor elderly is inevitable in the future if the poverty rate for the elderly does not decline significantly.

According to the snapshot measures of poverty reported by the Census Bureau (based on pooled data from 2009 through 2011), about one out of ten individuals aged 65 years and older was in poverty. Although static measures of poverty are important to inform the general public and policymakers about the extent of poverty, they are inadequate since they do not account for the time in poverty measurement. People who have long spells of poverty are worse off than those who experience poverty in isolated periods (Bradbury, Jenkins, & Micklewrite, 2001). Also, long spells of poverty may be an important issue for poor older adults due to reduced chances of escaping from it. For example, factors such as negative duration dependence or high incidence of health-related work limitation among older adults may contribute to a lower employment rate in this population (Jonhson, Mermin, & Ucello, 2005; Kraft, Lange, & Notowidigdo, 2013).[1] Therefore, intertemporal poverty measures that take into account the overall poverty experience of individuals over time will estimate the extent of elderly deprivation better than the conventional poverty measures.

The first goal of this study is to measure intertemporal poverty among older American households of different races during 2001 through 2009. We use a new family of aggregate intertemporal poverty indices recently proposed by Gradin, Del Rio, and Canto (2012; GDC index hereafter). GDC index has valuable features which make it an attractive tool for intertemporal poverty measurement.[2] In particular, it takes into account all aspects of poverty measurement—incidence, intensity and inequality—in a dynamic framework, and it is sensitive

[1] According to negative duration dependence, the probability of re-employment is lower for the long-term unemployed compared to the short-term unemployed.

[2] A detailed explanation on the method and how it differs from the other poverty measures is provided in the Method section.

to the poverty spell duration and the inequality of poverty experiences. GDC index develops an aggregate intertemporal poverty level for a particular society from the individual intertemporal indices that are constructed from the income profile of each individual and the poverty line.[3] The measure is sensitive to the individual poverty trajectories, and to the duration of consecutive periods (i.e., poverty spell) during which the income falls below the poverty line. As opposed to most of the previous measures of intertemporal poverty based on the "spells approach," the GDC index is sensitive to the distribution of individual intertemporal poverty indicators among the poor population.[4] Using the GDC index, we calculate an aggregate poverty index for households of different races and explore its sensitivity to its components (i.e., incidence, intensity, and inequality) by changing the values of parameters embedded within the measure.[5]

The second goal of our study is to explore whether large racial differences reported by the snapshot measures of poverty are temporary or reflect racial disparities in poverty persistence. Examination of racial disparities in poverty persistence is an important endeavor as persistent poverty experienced by historically disadvantaged groups may lead to a vicious cycle of ongoing economic challenges. Social insurance programs such as Social Security and Medicare help ease the incidence and the severity of poverty experienced by seniors of color (Reno & Veghte, 2010; Ziliak, 2011). However, they are more likely to improve the outcomes of middle-class families rather than the poor (Ziliak, 2011). Higher rates of poverty among Blacks and Hispanics emphasize the importance of policies and programs that alleviate economic insecurity among those groups.

[3] Aggregate intertemporal axiom must satisfy continuity, anonymity, symmetry, replication invariance, and preference for intertemporal poverty equality among poor individuals (equivalent to the Pigou-Dalton principle of transfers used in income inequality literature). For further discussion, see Gradin et al. (2012) p. 338.
[4] Spells approach takes into account duration in poverty measurement.
[5] See Method section for a detailed explanation of the method.

One important program that has a vital role in the U.S. social safety net is the Supplemental Nutrition Assistance Program (SNAP, formerly called the Food Stamp Program). The SNAP program is one of the largest safety net programs in the United States serving more than 22 million households at a cost of almost $70 billion in fiscal year 2011 (FNS, 2014). The program intends to supplement the household resources for food purchase and alleviate "hunger and malnutrition." Even though the problem of food insufficiency is not necessarily an attribute of poor households, previous research has shown that poor households are 3.5 times more likely to experience food insufficiency compared to those not poor (Rose, Gundersen, & Oliveira 1998). Pilkauskas, Currie and Garfinkel (2012) find that food hardship would have been twice the amount observed in the absence of food stamps during the Great Recession. Increased use of food stamps during the Great Recession helped households to pay for food who would otherwise have difficulty in obtaining it.[6] The third goal of this study is to understand to what extent the SNAP program helped ease the hardships faced by the poor elderly from 2001 through 2009.

To the best of our knowledge, our contribution to the literature is unique since it is the first study that examines the poverty experiences of elderly American households of different races in a dynamic framework using uniquely suited data for our purpose. The RAND version of the HRS provides detailed information on poverty thresholds, the household type and composition along with income measures that are consistent with the Census definition of income. The following sections of the paper present related work in the literature, an explanation of the data and the sample, a brief overview of the methodology, the results, a discussion, and the conclusion.

[6] Food hardship measure of Pilkauskas et al. (2012) is based on two questions: "In the past 12 months, did you receive free food or meals? In the past 12 months, were you ever hungry, but didn't eat because you couldn't afford enough food?" (p. 423).

LITERATURE REVIEW

Intertemporal Poverty Measures

A number of recent studies have identified the importance of applying a poverty measure that is dynamic and that captures a more comprehensive picture of individuals' poverty experience over their lifetimes. Such intertemporal measures have recently gained increasing attention as they move away from measures that present a static measure at a given point in time toward a dynamic methodology that encompasses lifetime experience. Frameworks for such intertemporal measures have been established in the works of Foster (2009); Bossert, Chakravarty, D'Ambrosio, and Conchita (2010); Hoy and Zheng (2011); Gradin, Del Rio, and Canto (2012); and Dutta, Roope, and Zank (2013), among others.

The GDC index incorporates core dimensions of poverty measurement (i.e., incidence, intensity, and inequality) proposed by Sen (1976) in a dynamic setting. Incidence of intertemporal poverty measures the proportion of individuals who are ever poor during the analysis period. Intensity of intertemporal poverty is based on the level and the distribution of normalized poverty gaps along with the poverty spell duration. The inequality measure is based on the inequality of intertemporal poverty across the poor population.

Previous literature on intertemporal poverty measurement has emphasized different aspects of poverty measurement. Foster (2007) measures *chronic poverty* by identifying chronically poor individuals whose income is below the poverty line for at least a certain number of periods. However, this measure is not sensitive to the poverty spell duration, and it does not provide a preference for intertemporal poverty equality. On the other hand, Bossert et al.'s (2010) measure of intertemporal poverty is sensitive to poverty spells of any length, and it does not restrict the analysis to chronically poor individuals. Their measure assigns a higher weight to

consecutive periods of poverty than to isolated periods. Hoy and Zheng (2011) extend Bossert et al.'s (2010) measure by assigning a higher weight to spells of poverty that are close in time rather than dispersed. However, Gradin et al. (2012) show that aggregate intertemporal measures obtained from the arithmetic mean of individual intertemporal poverty indices ignore the *complete intertemporal profiles* of individuals since they do not take concentration of poverty in one individual into consideration.[7]

Most applications of intertemporal poverty measures examine poverty dynamics in various countries such as England, Canada, and Ethiopia (Finnie & Sweetman, 2003; Porter & Yalonetzky, 2013; and Roope & Peters, 2013). Studies related to the U.S. measure poverty at discrete points in time. Using data from the HRS, Banerjee (2012) examines how poverty rates have changed from 2001 to 2009 tracking four age groups starting at age 50. The analysis considers the impact of loss of social security income due to death of a spouse and declining health as factors that contribute to poverty, as well as differentials by race, gender, and marital status. The analysis, which examines poverty status at discrete points in time, does not account for intensity or duration of poverty across the age cohorts studied. His findings regarding racial differences in poverty rates indicate that Whites had the lowest poverty rate (7.7 percent) in 2009. The difference between the poverty rates of Whites and Blacks is around 17 percentage points, and it is around 21 percent for Whites and Hispanics. Our study adds to the existing literature by using intertemporal measures of poverty to examine the racial disparities in a dynamic framework. We believe that taking into account the complete poverty experiences of households provides a better assessment of racial poverty dynamics in the U.S.

Supplemental Nutrition Assistance Program

[7] Please see Example 1 in Gradin et al. (2012) for an explanation on the sensitivity of index to poverty concentration in one individual.

Previous research has examined the antipoverty effectiveness of the SNAP program using data from the Current Population Survey (Tiehen, Jolliffe, & Gundersen, 2012; Ziliak 2011). Ziliak (2011) found considerable improvements in elderly poverty rates and aggregate poverty gaps when the income source used by the Census Bureau for official poverty estimation includes in-kind benefits and capital gains and excludes tax payments. His estimates indicate that about two million people were lifted out of poverty from 1999 to 2003, and that number more than doubled to 4.5 million in 2009 as a result of expanded SNAP benefits in response to the Great Recession. Moreover, adjusting income for taxes and transfers led to an 83 and 92 percent reduction in poverty rate and aggregate poverty gap among seniors aged 65 and older, respectively. Tiehen et al. (2012) found that supplementing income with SNAP benefits led to a 10.3 percent and 13.2 percent decline in depth (i.e., the poverty gap) and severity (i.e., squared poverty gap) of poverty, respectively.

The SNAP program administered by the USDA Food and Nutrition Service is the nation's largest nutrition assistance program. The goal of the program is to provide a supplemental resource for food purchases for low-income and low-asset individuals regardless of age and family structure. To be eligible for SNAP benefits, households must pass income and asset tests. In particular, the gross income (pre-tax income) must be less than 130 percent of the federal poverty line, and the net income of the household must be at or below the poverty line.[8] Additionally, income-eligible applicants must have assets less than $2,000 or $3,250 if the household has a member who is older than 60 or disabled (Caswell & Yaktine, 2013). The SNAP benefit is based on the Thrifty Food Plan (TFP) which specifies the foods and their amounts to

[8] Net income is the difference between the gross income and a number of deductions such as 20 percent of earnings, child support, dependent care deduction, standard deduction, excess shelter deduction and a portion of out-of-pocket medical expenditures for persons aged 60 and older and the disabled.

provide a nutritious diet. It is determined by the difference between the cost of the TFP and 30 percent of the participant's net income. Program participants receive monthly benefits in the form of Electronic Transfer Benefit cards which can be used in retail food stores. The benefits are adjusted for inflation each year using the Consumer Price Index.

SNAP (formerly called the Food Stamp program) was signed into law by President Lyndon Johnson in 1964 as part of his "War on Poverty." The number of program participants has increased dramatically since the Program's launch in 1964 from 560,000 individuals to over 46 million people in 2014. SNAP serves as an automatic fiscal stabilizer since participation declines during economic expansions and increases during recessions. The only exception was the expansionary period after the 2001 recession where the number of SNAP recipients continued to increase. However, program participation by the elderly (i.e., adults aged 60 and over) increased at a slower pace compared to the rest of the population, and it actually declined as a percentage of the caseload. There were more than 1.7 million recipients in 2000 (10 percent of the caseload) and more than 3.1 million people (7.9 percent of the caseload) in 2009 (Caswell & Yaktine, 2013).

In accordance with the increase in number of participants, SNAP benefits increased especially after the introduction of American Recovery and Reinvestment Act (ARRA). Real average monthly benefits increased slightly from $94.12 in 2000 to $105.12 in 2008. After the ARRA came into effect in April 2009, the benefits increased by 20 percent from 2008 to 2009 (Tiehen et al., 2012).

Due to its role as a vital part of the nation's social safety net, we believe that it is an important endeavor to examine how poverty levels change once SNAP benefits are accounted for

in poverty measurement. In a similar fashion with the previous studies, we calculate poverty levels after adding SNAP benefits to the income measure, and compare those to the baseline estimates based on income in the absence of benefits. Although our analysis is descriptive, it is worthwhile to examine how poverty levels are associated with the SNAP program given the small behavioral response to SNAP benefits (Currie, 2003; Hoynes & Schanzenbach, 2010).

METHOD

Data and the Sample

In this study, we use data from the Health and Retirement Study (HRS). The HRS is a nationally representative longitudinal survey of older American households, and it investigates the experiences of older workers as they transition from work to retirement. The survey began with an initial cohort of adults age 51 to 61 in 1992 (HRS cohort), and followed them every two years thereafter. The addition of two more cohorts, Children of the Depression (born 1924 to 1930) and War Babies (born 1942 to 1947) cohorts in 1998, resulted in a representative sample of the U.S. households aged 51 and over. A new cohort of Early Baby Boomers (born 1948 to 1953) was added in 2004.

In the RAND version of the HRS, the poverty variables are included from Wave Six forward. Poverty thresholds provide income levels so that households with different characteristics are able to purchase a minimally sufficient level of consumption. Household characteristics such as the age of the household head, the number of resident family members, and the number under 18 years old determine the minimally adequate income needs of households. In the HRS, family size and composition are reported at the time of the interview. There are 48 categories of family composition which are associated with a different minimally adequate income.

The HRS reports two measures of total income. The first measure of total household income conforms to the Census definition of income. In particular, total household income is the sum of earnings, retirement income from pensions and social security, income from interests, dividends, rents, royalties and estates, alimony, supplemental security income, and government transfer income of non-institutionalized core (i.e., survey respondent and the spouse) and non-core (i.e., all other) family members, excluding the value of food stamps and capital gains and losses. On the other hand, in addition to the cash incomes of non-institutionalized core and non-core family members, the second measure takes into account incomes of those members who reside in nursing homes at the time of the interview. In line with previous studies, our analysis uses the cash incomes of non-institutionalized core and non-core family members.[9]

Since comparisons over distributions with different number of periods do not make sense in a dynamic setting, we will use a balanced panel of households observed during the five waves of the HRS. Our sample covers the period of 2001 through 2009, and it consists of 6,776 households. The sample is composed of 5,171 White, 1,014 Black, and 591 Hispanic households. In the HRS, respondents may identify their race as "other" if they do not consider themselves as White, Black or Hispanic. Since the number of households that fall into this category is very small (96 households), we exclude households from other races from the analysis. We use survey weights so that the sample weights represent the population.

GDC Index

There are several advantages of the GDC poverty index. First, it incorporates three important dimensions of poverty measurement—incidence, intensity, and inequality—proposed by the seminal work of Sen (1976) into a dynamic framework, and can be decomposed into its components. Second, it provides a comprehensive approach to intertemporal poverty

[9] All nominal measures are adjusted for inflation and expressed in 2010 dollars.

measurement by providing other intertemporal indices that are widely used in the earlier literature such as Foster (2007, 2009) and Bossert et al. (2010), as special cases of the GDC index. Third, it provides the flexibility to choose the degrees of poverty and inequality aversion when calculating aggregate measure of poverty. This is important since policymakers can implement effective policies to fight poverty by constructing an aggregate poverty measure that best describes the societal aversion to poverty.

GDC index follows the "spells approach" to construct an intertemporal poverty measure. First, it develops an individual intertemporal index given the income profile of each individual and the poverty lines. This measure indicates the degree of intertemporal poverty level for each individual.[10] Second, an aggregate intertemporal poverty level for a particular society is constructed from the individual intertemporal indices.[11] Thus, the measure is sensitive to the individual poverty trajectories, and to the durations of consecutive periods (i.e., poverty spell) during which the income falls below the poverty line. As opposed to most of the previous measures of intertemporal poverty based on the "spells approach," the aggregate index is sensitive to the distribution of individual intertemporal poverty indicators, and it reflects the society's preference about the distribution of intertemporal poverty deprivations. Particularly, the society prefers an equal distribution of individual poverty deprivations among the poor population.

More specifically, the aggregate intertemporal poverty index $P(\boldsymbol{Y}; \boldsymbol{z})$ is as follows given that there are N individuals, and T periods:

[10] Among the properties that should be satisfied by the individual intertemporal poverty indices are intertemporal continuity, focus, monotonicity, scale invariance, poverty spell duration sensitivity and regressive transfer axioms (for an explanation of these axioms, see Gradin, Del Rio, & Canto 2012, p. 336–337).

[11] Aggregate intertemporal axiom must satisfy continuity, anonymity, symmetry, replication invariance, and preference for intertemporal poverty equality among poor individuals (equivalent to the Pigou-Dalton principle of transfers used in income inequality literature. For further discussion, see Gradin, Del Rio, & Canto,2012, p. 338).

$$P(\boldsymbol{Y};\boldsymbol{z}) = \begin{cases} \frac{1}{N}\sum_{i=1}^{N}(p_i)^{\alpha} & if\ \alpha > 0 \\ \frac{q}{N} & if\ \alpha = 0 \end{cases} \quad (1)$$

where $p_i = \left(\frac{1}{T}\sum_{t=1}^{T} g_{it}^{\gamma}\left(\frac{s_{it}}{T}\right)^{\beta}\right)$ and $g_{it}^{\gamma} = \begin{cases} \left(\frac{z_{it}-y_{it}}{z_t}\right)^{\gamma} & if\ y_{it} < z_t \\ 0 & otherwise \end{cases}$

are the individual intertemporal poverty index, and the normalized poverty gap to the power of γ for individual *i,* respectively. y_{it} is the non-negative income of individual *i* at time t, and z_{it} is the poverty threshold at time t for household i. $\left(\frac{s_{it}}{T}\right)^{\beta}$ is the weight based on the duration of the corresponding poverty spell (s_{it}), and q is the number of intertemporally poor individuals (i.e., $g_{it}^{\gamma} > 0$).

There are three important parameters in equation (1) which are α, β, and γ. γ captures the sensitivity of individual poverty indicators to variability of poverty gaps over time. When $\beta > 0$, then the relative weight of larger spells of poverty increases, since persistent poverty aggravates the individual poverty experience. Thus, higher values of β is associated with larger penalty to longer spells of poverty. When $\alpha > 1$, then the aggregate intertemporal index becomes sensitive to the distribution of intertemporal individual poverty experiences within the poor population. This reflects the societal preference of equal distribution of individual poverty deprivations among the poor (Gradin et al., 2012; Hoy & Zheng, 2008). The higher the α, the higher the degree of aversion to inequality of intertemporal poverty across individuals.

When $\beta = 0$ and $\alpha = 1$, then the index collapses to Foster's (2007, 2009) measure of poverty. Therefore, Foster's intertemporal index is insensitive to spell duration and inequality of individual poverty experiences among poor individuals. When $\beta = 1$ and $\alpha = 1$, then the GDC

index collapses to Bossert et al. (2010) index. The Bossert et al. measure weighs normalized poverty gaps proportionally to their spell duration, and it averages the individual intertemporal poverty indices across population. Thus, their measure is inequality-insensitive like that of Foster (2007, 2009).

The GDC index can attain a value between 0 and 1. In the extreme case of no poverty across time and individuals, then P=0. On the other hand, if everyone is poor with zero income in each period, then the P=1.

Another important feature of the GDC index is decomposability. In a similar fashion to the Foster et al. (1984) measure of poverty, the GDC index can be decomposed into incidence, intensity, and inequality components. When $\alpha = 2$, the aggregate intertemporal poverty index can be decomposed as:

$$P(\boldsymbol{Y}; \boldsymbol{z}) = H\left(I^2 + Var_p\right)$$

where *H* is the proportion of individuals ever poor, and $I = \bar{p} = \frac{1}{q}\sum_{i=1}^{q} p_i$ is the average intensity of poverty. The last term shows the variance of p; $var_p = \frac{1}{q}\sum_{i=1}^{q}(p_i - \bar{p})^2$.

Gradin et al. (2012) apply TIP curves originally developed by Jenkins and Lambert (1997) to the intertemporal context, and call it intertemporal TIP (iTIP) curve. TIP stands for the three I's of poverty: incidence, intensity, and inequality. Parallel to Jenkins and Lambert's TIP curve, iTIP is based on the vector of ordered intertemporal individual poverty experiences. (For example, it plots the cumulative sum of poverty gaps divided by the number of households against the cumulative population share.) Besides showing the incidence, intensity, and inequality of poverty, iTIP curves help us in partially ordering the poverty experiences of different groups in a population.

Finally, we perform an analysis to investigate the poverty reducing effects of the SNAP. In particular, we compare the poverty levels, intertemporal incidence, average intensity, and inequality of poverty experiences without and with public assistance. We conduct two types of tests to examine the statistical significance of the difference (i.e., household income excluding the value of food stamps and the household income including the value of food stamps). First, we perform a paired t-test for dependent samples to examine the statistical significance of the change in individual poverty indicators. Second, we use the bootstrapping method of Biewen (2002) to construct 95 percent confidence intervals of differences in H, I, and Var_p. One appealing feature of this method is that it takes into account the longitudinal correlation in panel data without explicitly dealing with its covariance structure. Our bootstrapped confidence intervals are based on 10,000 bootstrap replications.

RESULTS

Panel A in Table 1 provides summary measures of various household characteristics for years 2001 and 2009. In 2001, average household age and size was around 63 years and 2.06, respectively. Since we follow the same households over time, the average age increased to around 72 years and household size shrank to 1.94 in 2009. Average household size differed across different races both in 2001 and 2009. Particularly, mean household size was greater in Hispanic and Black households compared to White households. Additionally, median household income was lower in 2009 ($38,440) compared to 2001 ($51,686), and that pattern existed for all races.

Panel B in Table 1 shows the percentage of households who receive income from various sources of income. There has been an increase in the percentage of households receiving retirement income from Social Security (85 percent in 2009) and pensions (41 percent in 2009)

and a corresponding decline in the share of households who had earnings income (32 percent in 2009). Increase in retirement income from Social Security was more pronounced among Black and Hispanic households than the increase in pension income. Additionally, share of households who had income from various government transfers such as food stamps, veteran's benefits and other welfare payments rose from 9.48 percent to 13.2 percent in 2009. This rise can be attributed mainly to the higher percentage of Hispanic and White households collecting government transfers in 2009. On the other hand, the share of households receiving Supplemental Security income (SSI) declined from 3.83 percent in 2001 to 3.64 percent in 2009.

[INSERT TABLE 1 ABOUT HERE]

We present results for different values of sensitivity parameters in the GDC index. In particular, we hold the values of two sensitivity parameters constant in order to isolate the effect of changes in the third parameter. Besides the decomposition analysis for different groupings of households based on race and ethnicity, we look at two specific cases. First, sensitivity to spell duration and the differences in poverty gaps are muted (i.e., $\gamma=\beta=0$) in order to measure the sensitivity of aggregate intertemporal poverty to the inequality among the poor (i.e., $0 \leq \alpha \leq 6$) . Second, we investigate the sensitivity of aggregate intertemporal index to the poverty spell duration (i.e., $0 < \beta \leq 1$) by setting $\gamma=0$ and $\alpha=1$.

Figure 1 shows the percentage of households in each racial group who spend different periods of time in poverty. We observe that Whites are less likely to fall into poverty as opposed to Blacks and Hispanics. For example, the percentage of White households who experience poverty for one period is 9.42 percent, whereas it is twice that among Blacks and Hispanics (19.65 percent and 18.77 percent, respectively). These estimates are similar to the Census Bureau estimates based on cross-sectional data (Census Bureau, Historical Poverty Tables).

[INSERT FIGURE 1 ABOUT HERE]

Large differentials in poverty rates continue once the fraction of time spent in poverty increases. The percentage of White households living in poverty declines sharply as the duration of poverty increases, whereas the poverty rate for Blacks and Hispanics remains high. In particular, the percentage of Black and Hispanic households who live in poverty during the entire period of analysis is 6.49 percent and 8.23 percent, respectively. Another way of summarizing the information in Figure 1 is to look at the incidence of poverty during the analysis period. The second column in Table 2 reports that 16.1 percent of White households fall into poverty in at least one period, whereas the proportions of Black and Hispanic households who are ever poor are higher at 49.8 percent and 55.2 percent, respectively.

[INSERT TABLE 2 ABOUT HERE]

Figure 2 shows the aggregate poverty index of each racial group relative to the unweighted average of the measure across all races (i.e., all races have the same weight regardless of their population size), and it provides information on the distribution of intertemporal poverty across the intertemporally poor population. When the poverty index becomes sensitive to the inequality of time spent in poverty among the poor households, we observe that aggregate poverty index for Black and Hispanic households both increases, but at a faster pace for Hispanic households. This pattern continues when the sensitivity measure α rises gradually from two to six. When $\alpha=2$, the aggregate poverty index for Black and Hispanic households is at least three times the index for all races. On the other hand, the results in Figure 2 indicate that the periods of time spent in poverty are more equally distributed among the ever poor White households since the aggregate poverty index relative to the overall mean declines as the aversion to the inequality increases.

Columns 5 and 1 in Table 2 report the variance of individual intertemporal poverty indicator (p) given that $\alpha = 2,\ \beta = \gamma = 0$, and the average duration of poverty spell for all races. The average duration of poverty spell is more than two periods for all races except for the Whites. In addition to the higher mean duration of poverty, inequality of poverty duration as captured by the variance of p is also higher among Black (0.085) and Hispanic (0.083) households as opposed to White (0.061) households. In a more complicated case where the intensity of poverty and the length of poverty spells are incorporated in measuring the aggregate poverty index (i.e., $\gamma = 2$ and $\beta = 1$), differentials in aggregate poverty index between Black or Hispanic households and White households continue to be significant (see column 6). We observe similar trends in the average intensity of poverty duration and its inequality (see columns 7 and 8). Additionally, the overall measure (0.0020) is much lower compared to the poverty index for Black (0.0075) and Hispanic (0.0080) households.

[INSERT FIGURE 2 ABOUT HERE]

In order to see the impact of higher weights on longer poverty spells, Figure 3 assigns different values to β given that γ=0 and α=1. In a similar fashion to Figure 2, this figure plots the values of aggregate intertemporal poverty for each racial group relative to the overall mean as β increases gradually from 0 to 1. We observe that when poverty spells with longer durations are weighted heavily, the aggregate poverty index relative to the overall mean increases faster for Hispanic and Black households. On the other hand, it declines slowly for White households. When longer spells of poverty are penalized heavily, the poverty index for minority groups increases faster.

[INSERT FIGURE 3 ABOUT HERE]

In line with Figure 2, Figure 4 provides information on the change in the relative measure of aggregate poverty index as the sensitivity of the measure to the inequality of duration increases. However, in this case, the measure also takes into account the poverty gaps and their distribution over time for each individual (γ=2). As the poverty gaps and their intertemporal distribution are taken into account, relative poverty for Black and Hispanic households increases. For example, when α=2 and γ=2, the poverty indices for Black and Hispanic households are about four times the overall poverty. However, when α=2 and γ=0, the poverty indices are about three times the overall poverty (see Figure 2). Despite rising relative aggregate measures of Blacks and Hispanics, incidence of poverty among White households is not aggravated by intensity and inequality. Hence, the accumulation of "poverty-reducing" features among Whites leads to a decline in their relative poverty measure, whereas "poverty-increasing" features aggravate the relative poverty experience of Blacks and Hispanics.

[INSERT FIGURE 4 ABOUT HERE]

Finally, Figure 5 plots the iTIP curves when γ=2 and β=1, and it allows us to rank races according to their intertemporal poverty regardless of the choice of α given that α >1. iTIP curves summarize the incidence, intensity, and inequality of poverty. First, the length of the non-horizontal part of the iTIP curve shows the incidence of poverty for each racial group. Incidence measures indicated by the curves correspond to values shown in Table 2, column 2. More specifically, White households have a lower incidence of poverty compared to Hispanic and Black households. iTIP curves become horizontal when incomes are at least as large as the poverty line. In our analysis, iTIP curves for Blacks and Hispanics become horizontal at around p>0.5, whereas the iTIP curve for Whites becomes horizontal at around p>0.16. Second, the height of the iTIP curve summarizes the intensity of poverty for each group. Intensity of poverty

is considerably lower among White households relative to Black or Hispanic households. Lastly, curvature of the non-horizontal portion of the curve (i.e., concavity of the non-horizontal segment of the iTIP curve) summarizes the inequality aspect of poverty.

When the iTIP curves do not intersect for all $p\epsilon[0,1]$, we can use the property of iTIP dominance to order the poverty experiences of various subgroups. This unanimous poverty ordering is based on a wide class of poverty indices (Jenkins & Lambert, 1997). According to our findings, the iTIP of Blacks and Hispanics strictly dominates the iTIP of Whites. There is some overlap in the curves of Hispanics and Blacks for around 20 percent of the population, so ranking them based on the level of their aggregate intertemporal poverty is not clear. However, Whites have the lowest level of aggregate intertemporal poverty of all the races.

[INSERT FIGURE 5 ABOUT HERE]

Effectiveness of Supplemental Nutrition Assistance Program

In this section, we perform a descriptive analysis to investigate the poverty reducing effects of the SNAP. The percentage of households receiving nutrition assistance varies significantly across races, but it increases for all households during the analysis period. The percentage of White households participating in the program is lower (1.7 percent in 2001 and 3.76 in 2009) compared to Black households (12.75 percent in 2001 and 13.69 percent in 2009), and Hispanic households (10.88 percent in 2001 and 17.05 percent in 2009). But, to what extent does the rising percentage of households receiving supplemental nutrition assistance affect the overall poverty experiences of different ethnic groups?

[INSERT TABLE 3 ABOUT HERE]

Table 3 reports the results from the paired t-test for dependent samples as well as the average poverty gaps per poor household. On average, the poverty gap declines by 5 percent for

all households, with the largest decline (7 percent) experienced by Black households (see columns 1 and 2). Columns 3, 4, and 5 report the differences in individual intertemporal poverty indicators (p) without and with the SNAP with varying degrees of sensitivity to the variation in poverty gaps and spells of poverty duration. Results indicate that the differences in poverty measures are statistically significant for all races at 1 percent significance level. Thus, SNAP might have poverty reducing effects. Since the income measure without SNAP does not take into account the labor supply effects of this assistance program, the estimates may represent an upper-bound for the effectiveness of the program (Danziger et. al., 1981). Nevertheless, most studies that looked at the labor supply effects of food stamps concluded that the program has small behavioral response (the maximum estimate for work disincentive was one-hour per week) or no labor supply effects, which may be due to the small benefit size relative to income (Currie, 2003; Hoynes & Schanzenbach, 2010).

[INSERT TABLE 4 ABOUT HERE]

Table 4 reports the bootstrapped confidence intervals for the differences in the proportion of households ever poor (H), differences in average intensity (I), and the differences in inequality (Var_p) without and with the SNAP. Results indicate that increasing incidence of program participation did not lead to significant changes in the proportion of households ever poor for any of the racial groups. That is, the decreases in the proportion of households ever poor as a result of program participation are not significant at the 95-percent level. However, the program participation was effective in reducing the average intensity of poverty and inequality of poverty among poor households. The differences are statistically significant at the 95-percent level for all racial groups.

DISCUSSION

Poverty estimates produced by the Census Bureau and the prior research that looked at the U.S. poverty experience provided static snapshot measures of poverty. Banerjee's (2012) examination of changes in poverty rates for households where the head of the household is over 50 years old, based upon data from the HRS, is valuable in its consideration of a number of demographic factors that contribute to poverty. However, the study examines poverty status at discrete points in time and does not account for intensity or duration of poverty across the age cohorts studied. Static measures may not fully capture the poverty experience of individuals to the extent that poverty persistence matters.

With its dynamic framework, our study offers a purposeful contribution to the literature on poverty analysis within the older population. In so doing, we have integrated the methodologies that have established both a dynamic and comprehensive framework for the longitudinal measurement of poverty among older American households. We have applied the dynamic theoretical framework established in Gradin, et al. (2012), while also incorporating the concepts of individual and aggregate intertemporal poverty established in Foster (2007, 2009) and Bossert (2010), together with the dimensions of incidence, intensity, and inequality proposed in Sen (1976).

Even though one-period poverty measures from our study (i.e., 19.65 percent for Blacks, 18.77 percent for Hispanics, and 9.42 percent for Whites) are similar to that of the Census Bureau estimates (i.e., 21 percent for Blacks, 18.2 percent for Hispanics, and 9 percent for Whites), our estimates of intertemporal poverty are considerably higher than the official measures. In particular, intertemporal poverty for Blacks (49.8 percent) and Hispanics (55.2 percent) are more than twice the cross-sectional poverty based on the Census Bureau Historical Poverty Tables.

There also exists a substantial difference between the static and dynamic measures of poverty for White households (9 percent and 16.1 percent, respectively). The results of this analysis have yielded information about the poverty experience of older adults that captures measurable distinctions in terms of incidence, intensity, and inequality across race and ethnicity.

Previous literature reported the significant and favorable expansion of social safety net programs during the Great Recession (Moffitt, 2013). Even though families with higher family earnings benefitted more from the expansions in the Earned Income Tax Credit program, those at the bottom of the income distribution (particularly elderly nonworkers) saw increased transfers from the SNAP and Unemployment Insurance. In our investigation of the SNAP's effect on the poverty experiences of older households, we found that the program was associated with lower intensity and inequality of poverty but not lower intertemporal incidence of poverty. Households experienced an improvement in poverty gaps from 4 percent to 7 percent of the initial poverty gaps when the income measures included the value of food stamps. Statistically insignificant difference in incidence of poverty can be attributed to the inverse relationship between SNAP benefits and household net income. Adding benefits may remove a small number of households out of poverty (Tiehen et al., 2012).

One might argue that our investigation remains mainly a descriptive analysis since it does not take into account the labor supply effects of program participation. However, we believe that this does not present a major problem since we think that labor supply effects do not play an important role for our population. Previous studies reported no or very small labor supply effects of program participation with the best estimates suggesting a decline of one-hour in labor supply in one week (Currie, 2003; Moffitt, 2013). Additionally, nutrition assistance provides small benefit levels relative to household income.

CONCLUSION

The Post World War II era witnessed a dramatic decline in elderly poverty rates in the U.S. Today, poverty rates among older adults are similar to that of the working-age population. However, our findings indicate that elderly ethnic minorities are still vulnerable due to the presence of chronic poverty. We find that not only is the incidence of intertemporal poverty high among Black and Hispanic households, but also their poverty experience is more intense and lasts longer compared to that of White households. If appropriate policies are not undertaken, many elderly households will suffer during their retirement and will be vulnerable to adverse economic changes due to their lower chance of escaping from it.

Overall, we find that the SNAP program helped alleviate poverty in our analysis period, which covers the Great Recession. Specifically, the finding that the receipt of SNAP benefits appears to have a significant impact on intensity and inequality of time spent in poverty for poor households suggests the critical importance of the program among the older population. This finding can be partly attributed to the increased SNAP benefits under the American Recovery and Reinvestment Act. In fact, the USDA data show that participation in the program increased by 6.8 percent in fiscal year 2008 and by 9.0 percent in fiscal year 2009, while the annual percent change in benefits per person rose by 4.4 percent and 12.6 percent, respectively, over these fiscal years. Despite the improvements in intensity and inequality of poverty, the recent program improvements, however, fell short of reducing intertemporal incidence of poverty among the elderly population.

As the sensitivity of the aggregate poverty index to the components of poverty increases, we continue to observe substantial differences in poverty levels across race and ethnicity. If the

degree of poverty aversion (sensitivity to large poverty gaps), and/or inequality aversion (sensitivity to the distribution of poverty indicators across households) are high in a society, then the policymakers should implement more aggressive policies to fight poverty that target the specific groups who suffer most.

The focus of our study was on the measurement of intertemporal poverty among the older population from different races. A meaningful extension of this descriptive study would be the investigation of factors that contribute to the racial gaps in poverty rates. In particular, an investigation of racial differentials after controlling for observable and unobservable factors offers the potential to build upon and further enhance the literature in the context of a dynamic intertemporal framework.

REFERENCES

Banerjee, S. (2012). Time Trends in Poverty for Older Americans Between 2001–2009. *Employee Benefit Research Institute Notes,* 33(4), 10–17.

Biewen, M. (2002). Bootstrapinference for inequality, mobility and poverty measurement. *Journal of Econometrics.* 108,317–342.

Bossert, W., Chakravarty, S. R., & D'Ambrosio, C. (2012). Poverty and Time. *Journal of Economic Inequality*, 10, 145–162.

Bradbury, B., Jenkins, S. P., & Micklewrite, J. (eds.) (2001). The Dynamics of Child Poverty in Industralised Countries. Cambridge University Press, Cambridge, UK.

Brady, D. (2003). Rethinking the Sociological Measurement of Poverty. *Social Forces*, 81(3),715–752.

Caswell, J. A., & Yaktine, A. L. (2013). Supplemental Nutrition Assistance Program: Examining the Evidence to Define Benefit Adequacy. Washington, DC: The National Academies Press.

Choi, E-Y. & Sharpe, D. L. (2005). Transition to Poverty among the Elderly: Evidence from the Health and Retirement Study. *Consumer Interests Annual,* 51, 43–53.

Currie, J. (2003). U.S. Food and Nutrition Programs. In R. Moffitt (ed.). Means-tested transfer programs in the United States. University of Chicago Press, Chicago, IL, 199–289.

Dahl, M., DeLeire, T., & Mok, S. (2014). Food Insufficiency and Income Volatility in U.S. Households: The Effects of Imputed Income in the Survey of Income and Program Participation. *Applied Economic Perspectives and Policy*, 36(3), 416–437.

Danziger, S., Haveman, R., & Plotnick, R. (1981). How Income Transfer Programs Affect Work, Savings, and the Income Distribution: A Critical Review. *Journal of Economic Literature.* Vol. XIX, 975–1028.

DeNavas-Walt. & Proctor, B. D. (2014). Income and Poverty in the United States: 2013. Current Population Reports.

Dutta, I., Roope, L., & Zank, H. (2013). On intertemporal poverty measures: The role of affluence and want. Springer, *Social Choice and Welfare*, 41, 741–762.

Finnie, R. & Sweetman, A. (2003). Poverty dynamics: Empirical evidence for Canada. *Canadian Journal of Economics*, 36(2), 291–325.

FNS. (2014). Supplemental Nutrition Assistance Program participation and costs. Retrieved July 29, 2015 from http://www.fns.usda.gov/pd/SNAPsummary.htm.

Foster, J. E. (2009). A class of chronic poverty measures. In T. Addison, D. Hulme, & R. Kanbur, (eds.). Poverty Dynamics: Interdisciplinary Perspectives. Oxford University Press, Oxford, UK. 59–76.

Gradin, C., Del Rio, C., & Canto, O. (2012). Measuring Poverty Accounting for Time. *The Review of Income and Wealth*, 58(2), 331–354.

Hoy, M. & Zheng, B. (2011). Measuring Lifetime Poverty. *Journal of Economic Theory*, 146, 2544–2562.

Hoynes, H. W. & Schanzenbach, D. W. (2010). Work Incentives and Food Stamp Program. Working Paper No. 16198. Cambridge, MA: National Bureau of Economic Research.

Jenkins, S. & Lambert, P. J. (1997). Three I's of Poverty curves, with an analysis of UK poverty trends. Oxford Economic Papers, 49, 317–327.

Johnson, R., Mermin, G. B. T., & Ucello, C. E. (2005). When the Nest Egg Cracks: Financial Consequences of Health Problems, Marital Status Changes, and Job Layoffs at Older Ages. Working paper No 2005–18. Chestnut Hill, MA: Center for Retirement Research at Boston College.

Moffitt, R. A. (2013). The Great Recession and the Social Safety Net. *Annals of the American Academy of Political and Social Science*, 650, 143–166.

Pilkauskas, N. V., Currie, J. M., & Garfinkel I. (2012). The Great Recession, Public Transfers, and Material Hardship. *Social Science Review*, 86(3), 401–427.

Roope, L. & Peters, S. (2013). Intertemporal poverty in Great Britain. *Economics Discussion paper Series, EDP–1327*. The University of Manchester.

Rose, D., Gundersen, C., & Oliveira, V. (1998). Socio-economic determinants of food insecurity in the United States: Evidence from the SIPP and SCFII datasets. (Technical Bulletin No. 1869). U.S. Department of Agriculture, Economic Research Services.

Sen, A. (1976). Poverty: An Ordinal Approach to Measurement. *Econometrica*, 44(2), 219–231.

Siegel, J. (1996). Administration on Aging, U.S. Department Health and Human Services. Aging into the 21st century. HHS-100-95-0017. Washington, DC.

Tiehen, L., Jolliffe, D., & Gundersen, C. (2012). Alleviating Poverty in the United States: The Critical Role of SNAP Benefits, United States Department of Agriculture. *Economic Research Report*, Number 132, April 2012.

United States Census Bureau. Poverty Status of People, by Age, Race, and Hispanic Origin: 1959-2013. Available at https://www.census.gov/hhes/www/poverty/data/historical/people.html.

Ziliak, J. P. (2011). Recent Developments in Antipoverty Policies in the United States. University of Kentucky Center for Poverty Research Discussion Paper Series, DP2011–05. Retrieved July 30, 2015 from http://www.ukcpr.org/Publications/DP2011-05.pdf.

Table 1: Descriptive Statistics

	2001				2009			
	All	Black	Hispanic	White	All	Black	Hispanic	White
Panel A[1]								
Age	63.4	63.3	62.6	63.6	71.7	71.5	70.9	71.8
Median Household Income ($)	51,686	33,325	31,325	56,108	38,440	22,728	23,568	41,508
Household size	2.06	2.28	2.78	1.98	1.94	2.18	2.60	1.87
Median Poverty line	12,867	14,287	14,651	12,867	12,968	12,968	14,366	12,968
Panel B[2]								
Income Sources (%)								
Social Security	53.4	49.9	48.5	54.4	85.3	81.5	80.6	86.0
Pension	37.0	27.8	17.5	39.5	41.4	27.1	20.9	44.5
Govt. Transfers	9.48	19.7	14.4	8.02	13.2	20.4	23.6	11.5
SNAP	3.29	12.7	10.8	1.70	5.59	13.6	17.0	3.76
SSI	3.83	11.7	16.7	1.92	3.64	11.4	14.8	1.91
Earnings	52.8	49.4	46.7	53.8	31.6	27.5	21.6	32.9
Sample size (N)	6,776	1,014	591	5,171	6,776	1,014	591	5,171

Notes: [1] Panel A provides averages and median values of various household characteristics.
[2] Panel B shows the percentage of households who receive income from various sources.

Table 2. Decomposition of Aggregate Intertemporal Poverty (P) into Incidence, Intensity, and Inequality Components by Race

Race	Mean Duration of Poverty Spell	Percentage of Households Ever Poor (Incidence)	$\alpha=2, \gamma=\beta=0$			$\alpha=2, \gamma=2, \beta=1$		
			Poverty Index (P)	Average Intensity of Poverty duration	Var (p) (Inequality)	Poverty Index (P)	Average Intensity of Poverty duration	Var (p) (Inequality)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
White	1.64	16.16	0.032	0.372	0.061	0.0009	0.0333	0.0047
Black	2.03	49.89	0.161	0.488	0.085	0.0075	0.0583	0.0117
Hispanic	2.08	55.24	0.183	0.499	0.083	0.0080	0.0585	0.0110
All	1.79	21.84	0.053	0.416	0.072	0.0020	0.0424	0.0072

Notes: Income measure excludes the value of food stamps.

Table 3. Difference between individual poverty indicators (p) without and with SNAP

	Mean Poverty gap per poor HH w/o SNAP ($\gamma=1, \beta=1$) ($)	Mean Poverty gap per poor HH with SNAP ($\gamma=1, \beta=1$) ($)	Difference[1] when $\gamma=1, \beta=1$	Difference when $\gamma=2, \beta=1$	Difference when $\gamma=1, \beta=2$
	(1)	(2)	(3)	(4)	(5)
White	1,680	1,619	0.00112*** (0.00026)	0.00059** (0.00020)	0.00094*** (0.00016)
Black	2,879	2,664	0.00670*** (0.00087)	0.00425*** (0.00072)	0.00631*** (0.00078)
Hispanic	3,000	2,824	0.00678*** (0.00146)	0.00367*** (0.00107)	0.00645*** (0.00118)
All	2,137	2,028	-	-	-

Notes: [1]Difference indicates the difference between p value without SNAP and p value with SNAP.
Standard errors are stated in parenthesis. *p<0.05 **p<0.01, ***p<0.001.

Table 4. Difference between estimates without and with SNAP, 95-percent confidence intervals

		Difference[1] when γ=1, β=1	Difference when γ=2, β=1	Difference when γ=1, β=2
White				
	Proportion Ever Poor (*H*)	0.002524 [-0.001115 ; 0.005969]	-	-
	Average Intensity (*I*)	0.010787 [0.007927 ; 0.013370]	0.006635 [0.004267 ; 0.008611]	0.006574 [0.004651 ; 0.008294]
	Inequality (Var_p)	0.000638 [0.000135 ; 0.001087]	0.000521 [0.000117 ; 0.000864]	0.001303 [0.000609 ; 0.001865]
Black				
	Proportion Ever Poor (*H*)	0.006591 [-0.002435 ; 0.014480]	-	-
	Average Intensity (*I*)	0.016246 [0.012013 ; 0.020125]	0.011609 [0.007540 ; 0.015250]	0.014272 [0.010028 ; 0.018104]
	Inequality (Var_p)	0.002563 [0.001272 ; 0.003709]	0.001826 [0.000374 ; 0.002937]	0.003752 [0.001766 ; 0.005314]
Hispanic				
	Proportion Ever Poor (*H*)	0.007048 [-0.009322 ; 0.020421]	-	-
	Average Intensity (*I*)	0.016901 [0.010684 ; 0.021945]	0.009060 [0.005432 ; 0.012428]	0.015985 [0.008759 ; 0.021864]
	Inequality (Var_p)	0.001677 [0.000654 ; 0.002700]	0.001154 [0.000004 ; 0.002017]	0.003846 [0.001739 ; 0.005591]

Notes: [1]Difference indicates the difference between the estimate without SNAP and with SNAP. Bootstrapped Confidence Intervals are stated in parenthesis.

Figure 1. Distribution of Individual Intertemporal Poverty indices by race ($\alpha=\beta=\gamma=0$)

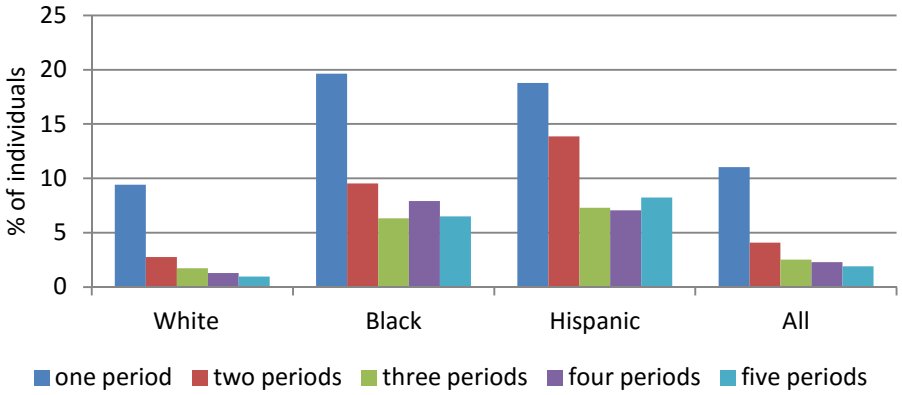
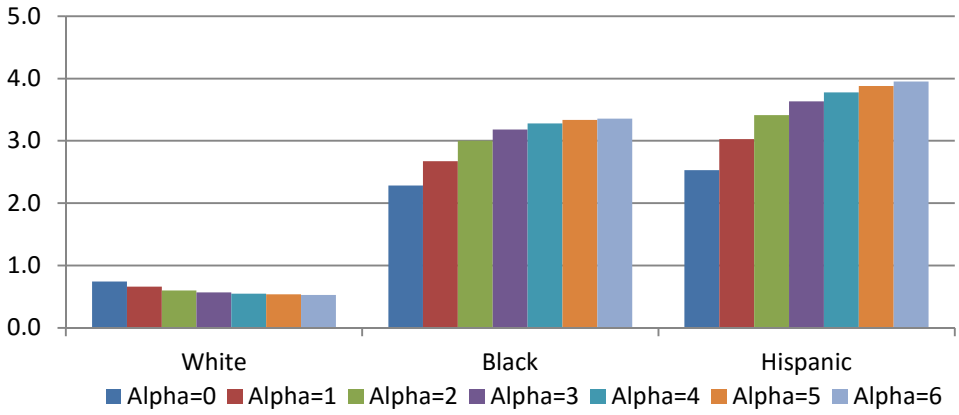
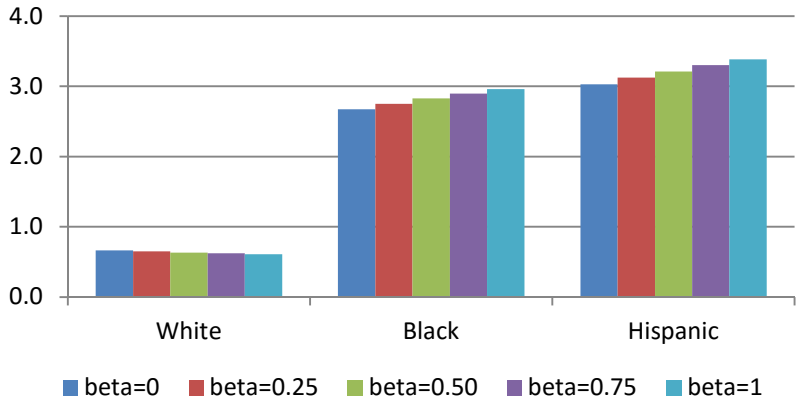


Figure 2. Aggregate Intertemporal Poverty Index Sensitivity to Inequality Among the Ever Poor by Race ($\gamma=\beta=0$)



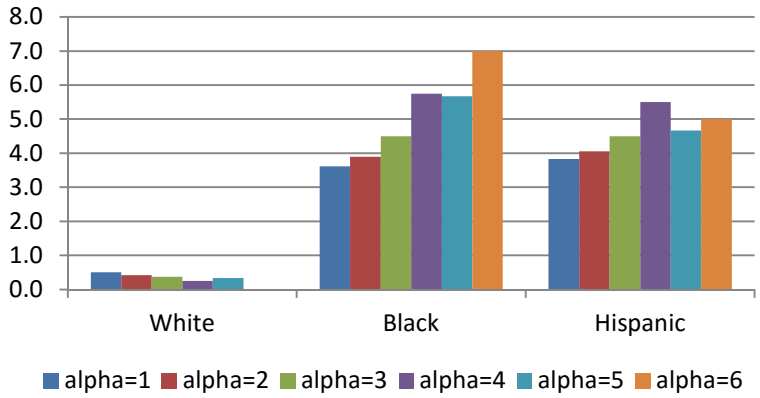
Notes: Vertical axis shows values relative to the unweighted average of the index across races.

Figure 3. Aggregate Intertemporal Poverty Index Sensitivity to Poverty Spell Duration by Race (γ=0, α=1)



Notes: Vertical axis shows values relative to the unweighted average of the index across races.

Figure 4. Aggregate Intertemporal Poverty Index Sensitivity to Inequality Among the Ever Poor by Race (γ=2,β=1)



Notes: Vertical axis shows values relative to the unweighted average of the index across races.

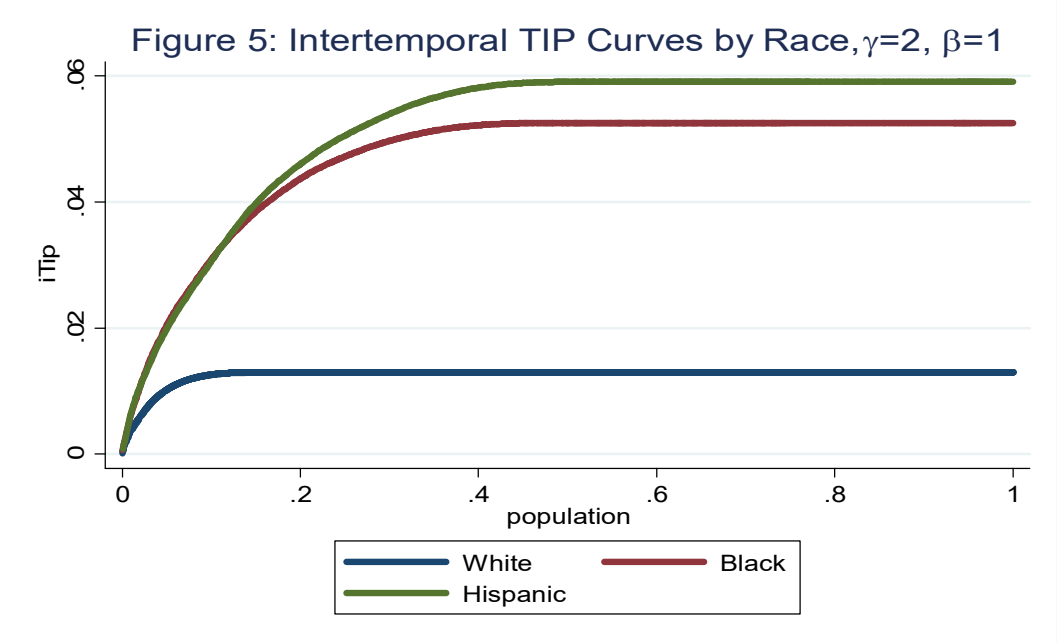


Figure 5: Intertemporal TIP Curves by Race, γ=2, β=1
iTip
0
.02
.04
.06
0
.2
.4
.6
.8
1
population
White
Black
Hispanic