

Who Stays Poor and Who Doesn't? An Analysis Based on Joint Assessment of Income and Assets

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Abstract

When designing programs to assist the poor, it is important to recognize who is most in need of government assistance. Although measures of poverty are often based on income alone, poverty measures based on both income and assets provide greater precision in the analysis of this group since accumulated assets can be liquidated to compensate for temporary shortfalls in income. The current study used the Panel Study of Income Dynamics (2007–2017) to analyze associations between different facets of poverty dynamics (i.e. poverty entry and exit) and its determinants. We explored differences in results based on whether poverty was measured by income alone, or income plus assets. The Cox proportional hazard regression was used to examine how demographic characteristics predicted poverty entry and poverty exit. Results indicated factors predicting poverty entry were not identical to those predicting difficulty of exiting poverty. Also, the risk of poverty entry and exit differed based on whether poverty was measured by income alone, or income plus assets. Thus, using income plus assets provides new perspectives into poverty dynamics which past research, based on income alone, did not provide. These new insights can be used to inform decisions about policies for poverty prevention and alleviation.

Keywords: poverty dynamics; income; assets

Introduction

The United Nations General Assembly (2018) estimated that 40 million people in the United States have incomes below the U.S. federal poverty line, and that 18.5 million were living in extreme poverty. Moreover, the United States has the highest youth poverty rate among Organization for

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Economic Co-operation and Development countries (United Nations General Assembly, 2018). Consequently, factors contributing to U.S. poverty, and its alleviation, warrant comprehensive study.

Measuring poverty status at a single point in time fails to differentiate people who remain poor from those who transition out of poverty status. It also obscures differences between people who have been chronically poor and those who recently entered poverty. Further, among people who are not currently poor, it fails to distinguish those who have never been poor from those who were once poor. Nevertheless, many studies of poverty rely on a single time point for their analyses. Various studies have acknowledged the need to measure poverty dynamics by considering time dimensions that enable observations of poverty entry and exit (Bernstein *et al.*, 2018; Platt, 2011; Smith and Middleton, 2007). This is critical for developing a more comprehensive understanding of poverty, and designing and implementing effective policies to address it.

Another significant weakness in the existing poverty dynamic literature is that it focuses on income alone, rather than both income and assets (McKernan and Sherraden, 2008). For people living below the poverty line, both income and assets (i.e. savings) determine the capacity to exit poverty. For example, for people whose income is below the poverty line by \$1,000, withdrawing \$800 from a savings account can decrease the income–poverty line gap to \$200. Withdrawing \$1,400 from a savings account would bridge the income–poverty line gap and bring the household above the poverty line by \$400. If a person’s income–poverty line gap remains but they do not have assets for future use after consuming \$1,400, they will enter poverty again. Assets have thus staved off poverty entry for a period and thus lowered the risk of poverty entry until they were consumed. Those who face continuous income shortage and whose assets are only sufficient for short-term support are therefore at higher risk of poverty entry than those whose assets provide longer term support. Measuring poverty status based on income and assets provides a meaningful assessment of both poverty exit and poverty entry (McKernan and Sherraden, 2008).

Indeed, many studies have acknowledged that whether an individual is in poverty depends on whether the value of incorporated income and assets is below the poverty line (Brandolini *et al.*, 2010; Butrica *et al.*, 2010; Chavez *et al.*, 2018; Kuypers and Marx, 2018; Short and Ruggles, 2006; Wimer and Manfield, 2015; Zagorsky, 2006). However, none of these studies utilized longitudinal analysis to observe multiple facets of poverty dynamics (i.e. poverty entry, poverty exit).

The current study addressed two significant limitations of most poverty studies to date: the use of static measures and failure to use both income and assets to measure poverty status. Specifically, we examined the impact of socio-economic determinants on each facet of poverty dynamics – that is, poverty entrance and exit – by using both income and assets to measure people’s poverty

status. This approach enabled us to identify and differentiate people facing varied facets of poverty dynamics, and to provide a more comprehensive measure of poverty status than using income alone would offer. Using both income and assets to measure poverty status provides a better prediction of poverty risk and may help identify those who need, but are often excluded from, income-assessed social benefits eligibility. Results from the current study are expected to provide insights for reforms of existing anti-poverty policies and interventions.

Poverty dynamics and its determinants

Poverty status is usually impermanent, as The Panel Study of Income Dynamics, which measured household income between 1968 and 2011, reflects. More than 60% of respondents whose household income fell below the federal poverty line for at least one year by age 60 had moved above the poverty line by the following year (Rank and Hirschl, 2015). Transitions between near-poverty and poverty status were also relatively common. Among families with income at 100–125% of the official poverty line, 27% fell below the poverty line in the subsequent year. For families with income below the official poverty line, 45% moved up to near poverty or above it in the following year, while 55% experienced persistent poverty (Hokayem and Heggeness, 2014).

Research on poverty dynamics has consistently demonstrated associations between specific demographic characteristics and poverty. People who are younger, of minority race, female, not married, less educated, unemployed, in poor health, living in a single-parent family, or living in an economically marginalized area, are more likely to enter into poverty, or less likely to transition out of it, than their counterparts (Chung and Maguire-Jack, 2020; Hokayem and Heggeness, 2014; Mauldin and Mimura, 2007; McKernan and Ratcliffe, 2002, 2005; Rank and Hirschl, 2001; Ribar and Hamrick, 2003). Reasons are attributable to the fact that people with disadvantaged demographic characteristics are less likely to gain and secure access to earnings (Nafukho *et al.*, 2004).

The measure of poverty status

With the ongoing development of financial markets in modern society, assets have increasing importance as financial resources (Miranda-Agrippino and Rey, 2014). Those with assets are better able to mitigate income shortfalls, should they occur, than those without assets. On the other hand, households that never face an income shortfall will not become poor even if they lack assets. Thus, neither income nor assets alone provide the whole picture of poverty severity (McKernan and Sherraden, 2008).

Past research has illustrated that income and assets jointly determine poverty severity (Azpitarte 2012; Chung and Maguire-Jack, 2020; Gornick *et al.*, 2009; Haveman and Wolff, 2005; Hokayem and Heggeness, 2014; Mauldin and Mimura, 2007; McKernan and Ratcliffe, 2002, 2005; Rank and Hirschl,

2001; Ribar and Hamrick, 2003). In the United States, Brandolini *et al.* (2010) reported that a portion of people who are income poor was able to move above the poverty line by consuming assets, while those with insufficient assets remain trapped below it. Kuypers and Marx (2018) found the same pattern in Germany and Belgium. Results of these studies demonstrated that, among people whose income is below the poverty line, differences in assets could influence the capacity to move above the poverty line. Thus, for the current study, we opted to incorporate both assets and income to measure poverty status.

Research gaps and the purpose of this study

Empirical studies have identified a set of individual, community, and geographical characteristics that determine poverty entry or exit. These characteristics include household structure, race and ethnicity, age, gender, physical health, geographic location, and other demographic factors (Chung and Maguire-Jack, 2020; Hokayem and Heggeness, 2014; Mauldin and Mimura, 2007; McKernan and Ratcliffe, 2002, 2005; Rank and Hirschl, 2001; Ribar and Hamrick, 2003). However, none of these studies were based on simultaneous measures of both assets and income. Meanwhile, studies of poverty that incorporated both income and assets ignored poverty dynamics, and measured static poverty based on a single time point (Brandolini *et al.*, 2010; Butrica *et al.*, 2010; Chavez *et al.*, 2018; Kuypers and Marx, 2018; Short and Ruggles, 2006; Wimer and Manfield, 2015; Zagorsky, 2006).

In light of this research gap, the current study investigated the determinants of poverty entry and exit using survival analysis, where poverty status was based on the incorporation of both income and assets relative to the official poverty line. We also measured poverty status based on income alone for comparison.

Contributions of this study

By observing poverty dynamics rather than static poverty, the current study was able to identify populations at risk of entering into poverty and those at risk of remaining in poverty after having entered it, groups that past research has been ill-equipped to identify. Effective anti-poverty interventions should focus on *poverty prevention* for those not currently poor but at risk of becoming poor, and *poverty alleviation* for those who are currently poor. By exploring the association between demographic characteristics of people and each facet of poverty dynamics (i.e. poverty entry, poverty exit), the results of this study can be used to identify populations most in need of poverty prevention, poverty alleviation, or both, and differentiate them from each other. By examining poverty status based on both income and assets, this study provides a more realistic assessment of poverty dynamics and its risk factors compared to studies that rely on income measures alone. Our results provide crucial insights that can be used to inform decisions about policies for poverty prevention and alleviation, as well as

reforms of economic need measures. The latter is essential in providing a valid assessment of social benefits eligibility for the most socioeconomically vulnerable confronted with both low income and asset shortage.

Methods

Data

The Panel Study of Income Dynamics (PSID) is a longitudinal study based on interviews with a nationally representative sample of families conducted annually between 1968 and 1997 and biennially after 1997. Wave-to-wave re-interview response rates have consistently exceeded 90%. As it was specifically designed to investigate the income and assets of American families and their demographic information in a comprehensive way, the PSID is ideally suited for this study. The observation period of 2007-2017 was chosen to observe poverty entry and exit because 95% of Americans who experience poverty are poor for 10 years or less (Rank and Hirschl, 2015). Therefore, the 2007, 2009, 2011, 2013, 2015, and 2017 waves were used for analyses. The number of total samples was 12,811, and the data set contained 43,997 observations.

Measurement of poverty status

This study measured poverty status by the relative position of the amount of incorporated income and assets to the official poverty threshold, which varies by the number of family members. The official poverty line reflects the estimated expenditures essential for daily needs, as determined by the U.S. government. Details about how the federal government establishes the official poverty line can be found at <https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html>.

Despite the imperfections of the official poverty line, it provides a uniform measure that many researchers employ for analyses of one or more facets of poverty dynamics (Chung and Maguire-Jack, 2020; Edwards, 2014; Hokayem and Heggeness, 2014; Mauldin and Mimura, 2007; McKernan and Ratcliffe, 2002, 2005; Rank and Hirschl, 2001; Ribar and Hamrick, 2003). Moreover, the official poverty line is consistently used for social benefits eligibility assessment.

While income is a flow of financial resources, assets are a store of value (McKernan and Sherraden, 2008). To enable the incorporation of income and assets, empirical studies have annuitized assets to convert them into a flow of financial resources, reflecting an assumption that people make asset withdrawals each year across their lifespans (Brandolini *et al.*, 2010; Butrica *et al.*, 2010; Chavez *et al.*, 2018; Kuypers and Marx, 2018; Short and Ruggles, 2006; Wimer and Manfield, 2015; Zagorsky, 2006).

Given different patterns of yearly asset withdrawals, various approaches to asset annuitization have been developed. Estimating a single value of annuitized assets could overestimate or underestimate how people use assets annually across their lifespan. To avoid this potential deficiency, the current study used the asset annuity approach developed by Chavez *et al.* (2018), which pinpoints the upper bound and lower bound of annuitized assets. The lower bound relies on an estimate of the amount of assets people can withdraw yearly such that they use them up at age 120, the highest life expectancy estimated by the U.S. Internal Revenue Service (Internal Revenue Service, 2019). This represents the most risk-averse strategy for annual use of assets, an index of how people cash assets for yearly use across the longest lifespan possible, and is well suited to an increasingly long-lived population. Alternatively, the upper bound incorporates a mortality probability at each age, thus annuitizing assets in a way designed to get to zero by the expected lifespan, typically shorter than age 120, and thus is more risk-tolerant. Following Chavez *et al.* (2018) for this study, we created the upper bound and lower bound of incorporated income and assets based on adding income and annuitized assets.

There is no standard interest rate for annuitized assets calculation, and Radner (1990) and Zagorsky (2006) have demonstrated that choosing an interest rate for annuitized asset calculation is arbitrary because interest rates fluctuate widely over time. While different interest rates affect annuitized assets calculation, Piketty (2014) showed that the worth of annuitized assets differs strongly by initial assets level. Following Brandolini *et al.* (2010), Kuypers and Marx (2018), Radner (1990), Van den Bosch (1998), and Weisbrod and Hansen (1968), this study assumed 2% as the interest rate for calculating annuitized assets.

In brief, this study measured poverty status by comparing the amount of incorporated income and assets to the official poverty threshold. Following Chavez *et al.* (2018), we used upper and lower bound values of incorporated income and assets to determine poverty status. To enable a comparison between financial resources with and without assets, poverty status based on income only was also presented.

Composition of assets and income

Assets used in this study measured by the PSID include seven types of assets that were calculated and added together: 1) farm or business, 2) real estate other than main home, 3) checking or saving accounts, 4) stocks, 5) vehicles, 6) individual retirement accounts, and 7) other assets. Because equity of the main home can also be used as an asset (McKernan and Sherraden, 2008), this study measured assets in two ways. One is the sum of all marketable assets less the value of all debts, where all marketable assets excluded the main home's equity. This is based on the assumption that people do not extract equity from their main

home. The other is the sum of all marketable assets less the value of all debts, where all marketable assets included equity of the main home. This represents the condition in which people cash equity from their main home and other assets for use. To measure a family's total debts, this study summed debts stemming from 1) farm or business, 2) real estate other than main home, 3) credit cards and store cards, 4) student loans, 5) medical bills, 6) legal bills, 7) loans from relatives, and 8) any other debts. The equity of the main home was measured by the value of the main home minus its mortgage.

Yearly income of a family measured by the PSID includes 1) taxable income of the family head and their spouse, 2) taxable income of family members other than the family head and their spouse, 3) transfer income of the family head and their spouse, 4) transfer income of family members other than the family head and their spouse, 5) social security income of the family head and their spouse, and 6) social security income of family members other than the family head and their spouse.

Determinants of poverty entry and exit

Following studies that analyze one or more facets of poverty dynamics (Chung and Maguire-Jack, 2020; Edwards, 2014; Hokayem and Heggeness, 2014; Mauldin and Mimura, 2007; McKernan and Ratcliffe, 2002, 2005; Rank and Hirschl, 2001; Ribar and Hamrick, 2003), we used demographic features of the household head including age, gender, race and ethnicity, self-reported health, marital status, educational attainments, employment status, family compositions, and geographical areas of households. According to the PSID, household head refers to the husband in a heterosexual married couple or to a single adult of either sex in whose name the housing unit is owned or rented. These definitions align with the Census Bureau definitions.

Individual characteristics of household head measured include age (16-24, 25-34, 35-44, 45-54, 55-64, 65-74, or older than 75), gender (male or female), race (non-Hispanic White, non-Hispanic African American, non-Hispanic others, or Hispanic), self-reported health (good, fair, or poor), marriage status (married, never married, widowed, divorced, or separated), employment status (employed or unemployed), and educational attainment (less than high school, high school, or college and above). Characteristics beyond the individual level include geographical areas of households (urban or rural areas) and family composition. Based on the status of living with children (live with or without children) and the status of living with a spouse (live with or without a spouse), there are four categories of family composition.

Analysis strategies

First, this study used univariate and bivariate analyses to describe the characteristics of the sample at the baseline wave. Second, this study performed the

Kaplan–Meier analysis to reflect the probability of surviving longer than a specific time point without encountering the event – namely entering into or exiting poverty. Results of the Kaplan–Meier analysis enabled observations of the proportion of people exiting poverty and the proportion of people entering poverty as time progressed. Subsequently, following approaches pioneered by Bane and Ellwood (1986), this study adopted the Cox proportional hazard model to capture poverty entry and exit by the hazard rate, which is the probability of experiencing poverty entry and exit once a certain number of years has elapsed, conditional on not having experienced poverty entry and exit up to that time. By using the Cox proportional hazard model, this study was able to examine how demographic characteristics predicted the hazard ratio of poverty entry and exit. A hazard ratio greater than one indicates that people with specific demographic characteristics were more likely to encounter the event than the reference group at any time point. In contrast, a hazard ratio less than one indicates that people with specific demographic characteristics were less likely to encounter the event than the reference group at any time point (Clark *et al.*, 2003).

To assess whether a relationship between a demographic characteristic and the hazard ratio of encountering the event (i.e. poverty entry or poverty exit) differed by time, we examined whether the Cox proportional hazard models used in this study satisfy the proportional hazard assumption based on the significance of the interaction between hazard ratio of a covariate and function of time as suggested (Kuitunen *et al.*, 2021; Xue *et al.*, 2013). For covariates violating the proportional hazards assumption, the interactions between the hazard ratio of those covariates and the function of time are kept in the Cox proportional hazard models to account for the time-varying effect, as suggested by Kuitunen *et al.* (2021) and Xue *et al.* (2013). These features of the Cox proportional hazard model enable the application of a relationship between a demographic characteristic and its chance of encountering an event at any time point throughout the observation period (Kuitunen *et al.*, 2021; Xue *et al.*, 2013).

Analyses using the Cox proportional hazard model consisted of two parts. The first part focused on analyzing the associations between poverty entry risk and its socioeconomic determinants among non-poor people. It enabled this study to clarify the following research question: Among the non-poor, who were more likely to experience poverty entry at any particular time during the observation period? The second part focused on analyzing the associations between the chance of poverty exit and its socioeconomic determinants among people who were in poverty. It enabled this study to clarify the following research question: Among the poor, who were more likely to experience poverty exit at any particular time during the observation period?

To account for differential probabilities of selection and subsequent attrition between the 2007 wave and the 2017 wave, this study utilized the weighting

TABLE 1. The baseline sample characteristics (N=8,289)

Variables	%/mean (SD)	Variables	%/mean (SD)
Aged*		Self-reported health*	
Aged 16-24	5.79%	Good	82.47%
Aged 25-34	16.45%	Fair	11.97%
Aged 35-44	18.54%	Poor	5.56%
Aged 45-54	21.41%	Employed*	
Aged 55-64	17.17%	Employment	69.15%
Aged 65-74	10.15%	Unemployment	30.85%
Aged 75 and 75+	10.48%	Education*	
Gender*		Less than high school	16.83%
Female	29.87%	High school	54.89%
Male	70.13%	Undergraduate or above	28.28%
Race*		Family composition*	
Non-Hispanic White	74.79%	w/o child & w/o spouse	40.2%
Non-Hispanic Black	13.96%	w/o child & w/ spouse	29.13%
Non-Hispanic others	3.22%	w/ child & w/o spouse	7.91%
Hispanic	8.03%	w/ child & w/ spouse	22.76%
Marital status*		Geographical areas*	
Married	48.76%	Rural	34.4%
Never married	22.24%	Urban	65.6%
Widowed	10.19%	Income*	76,109 (SD=2,200)
Divorced	15.76%	Assets without home equity*	263,745 (SD=25,404)
Separated	3.05%	Assets with home equity*	377,015 (SD=26,770)
Poverty rate (income only)			12.88%
Poverty rate (income and assets based on lower bound estimation)¹			12.37%
Poverty rate (income and assets based on lower bound estimation)²			11.86%
Poverty rate (income and assets based on upper bound estimation)¹			12.15%
Poverty rate (income and assets based on upper bound estimation)²			11.28%
Poverty rate (income and assets based on rainy-day estimation)¹			10.62%
Poverty rate (income and assets based on rainy-day estimation)²			10.79%

The Chi-square test was utilized to test the association between categorical variables and poverty status, and the ANOVA test was utilized to test the differences of continuous variables between the poor and the non-poor. Asterisk indicates statistical significance between sociodemographic features and poverty status by p value less than 0.05.

¹assets excluding home equity.

²assets including home equity.

at the 2007 interview and applied it to all estimates (Johnson *et al.*, 2018). Relatedly, to obtain a corrected standard error under the complex sample design of the PSID, both strata and cluster are taken into account for weighting estimation using the `svyset` and `svy` option in Stata. Statistical analyses were conducted using the Stata 13.0 MP version.

TABLE 2. The Kaplan–Meier analysis of poverty entry among the non-poor

t (years)	Income alone ^a	Lower bound ^b		Upper bound ^c	
		w/o H ^d	w/H ^e	w/o H	w/H
2	95.4%	95.9%	96.1%	95.9%	96.3%
4	92.0%	92.7%	93.1%	92.8%	93.6%
6	89.4%	90.3%	90.9%	90.4%	91.4%
8	87.3%	88.2%	89.0%	88.5%	90.0%

The value in each cell indicates the percentage of non-poor people surviving for t years without falling into poverty.

^apoverty status measure is based on income alone.

^bLower bound is the poverty status measure based on lower bound of values of incorporated income and assets.

^cUpper bound is the poverty status measure based on upper bound of values of incorporated income and assets.

^dw/o H are annuitized assets and excludes home equity.

^ew/H are annuitized assets and includes home equity.

Results

Demographic characteristics of the sample at the baseline wave

Table 1 summarizes the demographic characteristics of household heads and households at the baseline wave – namely the 2007 PSID wave. Descriptive results based on the Chi-square test and the ANOVA test were consistent across all five measures of poverty status (i.e. income only, estimation of incorporated income and assets using lower and upper bound estimation including and excluding home equity from assets), which showed that age, gender, race, self-reported health status, marital status, employment status, educational attainment, family composition, and household geographic location were significantly associated with poverty status. Also, people living in poverty had less income and fewer assets than those who were not living in poverty, which was consistent across all five measures of poverty status.

Kaplan–Meier analysis of poverty entry and exit

Kaplan–Meier analysis of poverty entry demonstrated that 95.4% to 96.3% of non-poor families in the sample sustained non-poverty status for 2 years, 92.0% to 93.6% for 4 years, and 89.4% to 91.4% for 6 years (Table 2). Among the non-poor, the probability of sustaining non-poverty status for 8 years exceeded 87%. These collective data demonstrate that the vast majority of non-poor households sustained non-poverty status during the observation period.

TABLE 3. The Kaplan–Meier analysis of poverty exit among the poor

	Income alone ^a	Lower bound ^b		Upper bound ^c	
		w/o H ^d	w/H ^e	w/o H	w/H
t (years)					
2	68.4%	68.7%	70.0%	66.4%	67.1%
4	54.0%	53.1%	52.2%	50.8%	50.3%
6	42.0%	41.7%	40.8%	40.2%	39.0%
8	33.2%	32.0%	32.3%	31.2%	30.4%

The value in each cell indicates the percentage of the poor people surviving for t years without leaving poverty.

^apoverty status measure is based on income alone.

^bLower bound is the poverty status measure based on lower bound of values of incorporated income and assets.

^cUpper bound is the poverty status measure based on upper bound of values of incorporated income and assets.

^dw/o H are annuitized assets and excludes home equity.

^ew/H are annuitized assets and includes home equity.

Kaplan–Meier analysis of poverty exit demonstrated that 66.4% to 70.0% of families in poverty in the sample remained trapped in poverty status for 2 years, 50.3% to 54.0% for 4 years, and 39.0% to 42.0% for 6 years (Table 3). Among the poor, the probability of sustained poverty for 8 years ranged from 30.4% to 33.2%. That is, about a third of households below the official poverty line remained trapped in poverty status during the observation period.

The Cox proportional model: Hazard ratio of poverty entry among the non-poor

Table 4 shows how demographic characteristics predicted the risk of entering poverty among the non-poor. For example, compared to household heads aged 16 to 24, the risk of entering poverty was smaller for older household heads (hazard ratio: 0.15–0.79, $p < 0.05$). Households with heads identified as non-Hispanic Black people were more likely to enter poverty than those whose heads identified as non-Hispanic White people (hazard ratio: 1.68–1.73, $p < 0.05$). The hazard ratio of poverty entry was also higher for households with heads identified as Hispanic than non-Hispanic White (hazard ratio: 1.64–1.80, $p < 0.05$). The health status of household heads also had an impact. Compared to households with a head who reported good health, the risk of poverty entry was higher for households with a head reporting fair health (hazard ratio: 1.38–1.62, $p < 0.05$) or poor health (hazard ratio: 1.48–1.86, $p < 0.05$). Marital status was also a valid predictor of the risk of poverty entry. Households with a head who was married had a lower risk of entering poverty than their counterparts whose head was not married (hazard ratio: 1.68–1.81, $p < 0.05$) or was separated (hazard

TABLE 4. Hazard ratio of poverty entry among the non-poor

	Income alone ^a	Lower bound ^b		Upper bound ^c	
		w/o H ^d	w/H ^e	w/o H	w/H
Aged 16-24 (reference)					
Aged 25-34	0.76*	0.79	0.79	0.60*	0.62*
Aged 35-44	0.57*	0.56*	0.52*	0.46*	0.40*
Aged 45-54	0.60	0.59	0.58	0.45*	0.44*
Aged 55-64	0.50*	0.44*	0.41*	0.36*	0.29*
Aged 65-74	0.27*	0.25*	0.21*	0.19*	0.16*
Aged 75 and 75+	0.41*	0.34*	0.27*	0.22*	0.15*
Female (reference)	0.89	0.96	0.94	0.82	0.83
Non-Hispanic White (reference)					
Non-Hispanic Black	1.68*	1.73*	1.70*	1.70*	1.73*
Non-Hispanic others	1.27	1.36	1.50	1.53	1.55
Hispanic	1.69*	1.78*	1.75*	1.80*	1.64*
Good Health (reference)					
Fair	1.32	1.38*	1.49*	1.48*	1.62*
Poor	1.48*	1.54*	1.86*	1.73*	1.75*
Married (reference)					
Never married	1.77*	1.68*	1.81*	1.75*	1.74*
Widowed	1.19	1.19	1.22	1.24	1.24
Divorced	1.84*	1.60*	1.66*	1.65*	1.59
Separated	2.10*	1.84*	2.05*	1.80*	1.90*
Employed (reference)	3.19*	3.22*	3.07*	3.04*	2.88*
Less than high school (reference)					
High school	0.53*	0.52*	0.53*	0.50*	0.46*
Undergraduate or above	0.26*	0.22*	0.21*	0.19*	0.16*
W/o child & w/o spouse (reference)					
w/o child & w/ spouse	0.69	0.51*	0.62*	0.57*	0.44*
w/ child & w/o spouse	1.30	1.40*	2.12*	1.22	1.27
w/ child & w/ spouse	1.03	0.92	1.71	0.95	0.86
Urban areas (reference)	1.30*	1.20	1.11	1.17	1.20

Asterisk indicates statistical significance by p value less than 0.05

^apoverty status measure is based on income alone.

^bLower bound is the poverty status measure based on lower bound of values of incorporated income and assets.

^cUpper bound is the poverty status measure based on upper bound of values of incorporated income and assets.

^dw/o H are annuitized assets and excludes home equity.

^ew/H are annuitized assets and includes home equity.

^fthe interaction between covariate hazard ratio (health status) and function of time are kept in the model to account for time-varying effect.

ratio: 1.8-2.10, p<0.05). Compared to households with a head who was employed, the risk of entering poverty was higher for households with an unemployed head (hazard ratio: 2.88-3.22, p<0.05). Educational attainment also affected the risk of entering poverty. Compared to the reference group without

a high school diploma, the risk of poverty entry was significantly lower for households with a head whose highest educational attainment was high school (hazard ratio: 0.46-0.53, $p < 0.05$) or college or above (hazard ratio: 0.16-0.26, $p < 0.05$). These data, presented in Table 4, demonstrate that households with a head who was younger, minority race, less healthy, non-married, unemployed, or less educated were more likely to enter poverty.

Importantly, how demographic characteristics predicted the risk of entering into poverty among the non-poor varied by the different measures of poverty (Table 4). For many of the demographic characteristics analyzed, different measures of poverty did not significantly impact the risk of poverty entry. There were some notable exceptions, however. Take family composition as an example. Among households without children, when poverty status was based on combined income and assets, the risk of entering poverty was lower for households whose head was living with a spouse than those whose head was not living with a spouse (hazard ratio: 0.44-0.62, $p < 0.05$); when poverty status was measured by income only, the difference between these groups was not statistically significant. Among households with a head not living with a spouse, when poverty status was based on income and assets using the lower bound estimation, the presence of children increased the risk of poverty entry (hazard ratio: 1.40-2.12, $p < 0.05$); when poverty status was measured by income only, the difference between these groups was not statistically significant. When poverty status was based on income only, households in rural areas were more likely to experience poverty entry than urban households (hazard ratio: 1.30, $p < 0.05$). In contrast, when poverty status was based on income plus assets, the likelihood of rural households entering poverty did not differ significantly from that of urban households.

The Cox proportional model: Hazard ratio of poverty exit among the poor

Table 5 shows how demographic characteristics predicted the chance of exiting poverty among the poor. Results demonstrated that, compared to households whose heads were aged 16 to 24, the chance of poverty exit was smaller for households with older heads (hazard ratio: 0.21-0.70, $p < 0.05$). Hispanics who entered poverty were less likely than non-Hispanic Whites to exit poverty (hazard ratio: 0.52-0.58, $p < 0.05$). Unemployment of the household head was also a valid predictor of a lower chance of poverty exit (hazard ratio: 0.65-0.68, $p < 0.05$). This study also observed that the hazard of poverty exit varied by educational attainment of household heads. Compared to households with a head without a high school diploma, the hazard of poverty exit was higher for households with a head whose highest educational attainment was a college degree or above (hazard ratio: 1.60-2.09, $p < 0.05$). In addition to household heads' demographic characteristics, the household location was a valid predictor of the risk

TABLE 5. Hazard ratio of poverty exit among the poor

	Income alone ^a	Lower Bound ^b		Upper Bound ^c	
		w/o H ^d	w/H ^{ef}	w/o H	w/H
Aged 16-24 (reference)					
Aged 25-34	0.66*	0.64*	0.62*	0.63*	0.63*
Aged 35-44	0.70*	0.64*	0.62*	0.69*	0.68*
Aged 45-54	0.55*	0.49*	0.49*	0.54*	0.53*
Aged 55-64	0.57*	0.57*	0.58*	0.58*	0.53*
Aged 65-74	0.51*	0.45*	0.46*	0.60*	0.50*
Aged 75 and 75+	0.25*	0.24*	0.26*	0.21*	0.28*
Female (reference)					
1.13	1.13	1.25	1.19	1.40*	1.36*
Non-Hispanic White (reference)					
Non-Hispanic Black	0.96	0.92	0.94	0.88	0.94
Non-Hispanic others	0.74	1.02	1.04	0.91	1.11
Hispanic	0.56*	0.54*	0.56*	0.52*	0.58*
Good Health (reference)					
Fair	0.85	0.71	0.54*	0.83	0.80
Poor	0.86	0.52	0.34*	1.00	1.04
Married (reference)					
Never married	0.68	0.62	0.67	0.67	0.72
Widowed	0.97	1.63	1.69*	2.02*	2.20*
Divorced	0.99	0.82	0.91	0.81	0.86
Separated	1.03	0.96	1.06	0.93	0.99
Employed (reference)					
0.68*	0.68*	0.68*	0.66*	0.68*	0.65*
Less than high school (reference)					
High school	1.24	1.23	1.24	1.15	1.19
Undergraduate or above	2.09*	1.83*	1.88*	1.60*	1.64*
W/o child & w/o spouse (reference)					
w/o child & w/ spouse	1.78*	1.48	1.43	1.39	1.43
w/ child & w/o spouse	1.20	1.22	1.14	1.24	1.16
w/ child & w/ spouse	1.05	0.93	1.04	0.90	0.88
Urban areas (reference)					
0.76*	0.76*	0.74*	0.73*	0.78*	0.79

Asterisk indicates statistical significance by p value less than 0.05

^apoverty status measure is based on income alone.

^bLower bound is the poverty status measure based on lower bound of values of incorporated income and assets.

^cUpper bound is the poverty status measure based on upper bound of values of incorporated income and assets.

^dw/o H are annuitized assets and excludes home equity.

^ew/H are annuitized assets and includes home equity.

^ftwo interactions between covariate hazard ratio (health status and employment) and function of time are kept in the model to account for time-varying effect.

of poverty exit. Compared to households located in urban areas, the hazard of poverty exit was lower for households located in rural areas (hazard ratio: 0.73-0.78, $p < 0.05$). The data presented in Table 5 demonstrate that households whose head was older, minority race, unemployed, less educated, or located in rural areas were less likely than their counterparts to exit poverty.

Table 5 also showed that the ways in which demographic characteristics predicted the chance of exiting poverty among the poor varied by the measures of poverty. For many of the demographic characteristics analyzed, different measures of poverty did not significantly impact the likelihood of poverty exit. Again, there were some notable exceptions. When poverty status was based on income and assets using the upper bound estimation, compared to households with a female head, households with a male head were more likely to exit poverty (hazard ratio: 1.36-1.40, $p < 0.05$); when poverty status was measured by income only, the difference between these groups was not statistically significant. When poverty status was based on income and assets using the lower bound estimation and home equity was included as an asset, the chance of exiting poverty was lower for households with a head reporting fair health (hazard ratio: 0.54, $p < 0.05$) or poor health (hazard ratio: 0.34, $p < 0.05$) compared to households with a head reporting good health; when poverty status was measured by income only, the difference between these groups was not statistically significant. Compared to households without children and without a spouse, households without children and with a spouse were more likely to experience poverty exit when poverty status was based on income only (hazard ratio: 1.78, $p < 0.05$); when poverty status was measured by income plus assets, the difference between these groups was not statistically significant.

Discussion

By adopting a dynamic poverty perspective rather than a static one, the current study identified risk factors for entering and/or remaining in poverty. The incorporation of both assets and income in this paper's measure of poverty provides a broader understanding of poverty dynamics than using income or assets alone. Based on the Cox proportional hazard models, the current study demonstrated that the factors putting people at risk of poverty entry, low chance of poverty exit, and both together differed from each other (Tables 2 and 3). However, the current social welfare system does not explicitly differentiate factors that put people at risk of poverty entry from those that increase the risk of remaining in poverty. Moreover, based on the Cox proportional hazard models, we also observed that identifying people at risk of entering poverty fails to identify the most vulnerable population, those at risk of simultaneously entering into income and asset poverty (Table 4). Similarly, those with a low chance of exiting income poverty were not entirely the same as people who were unlikely to exit poverty measured by incorporating income and assets (Table 5). These findings could have important implications for policy reforms that strive to identify the most socioeconomically vulnerable, those who face both income and asset shortages.

Changes in poverty entry and exit rate with time

Based on the results of the Kaplan–Meier analysis of poverty entry, this study found that, among people above the poverty line, nearly 90% sustained non-poverty status for the ensuing 8 years (Table 2). On the other hand, about a third of people who were below the poverty line remained in poverty for 8 years (Table 3). These results indicate that economic disadvantages were durable for a large portion of poor people facing income and/or asset insufficiency.

Associations between each facet of poverty dynamics and its determinants

By using the Cox regression model to examine associations between each facet of poverty dynamics and its determinants, this study indicated that people with disadvantaged demographic characteristics were at a higher risk of falling into poverty or lower chance of poverty exit. These demographic characteristics included being younger, female, minority race, less healthy, non-married, unemployed, less educated, a single parent, or living in rural areas (Table 4). Our findings align with previous empirical studies examining associations between one or more facets of poverty dynamics and its determinants in the United States (Chung and Maguire-Jack, 2020; Hokayem and Heggeness, 2014; Mauldin and Mimura, 2007; McKernan and Ratcliffe, 2002, 2005; Rank and Hirschl, 2001; Ribar and Hamrick, 2003). While our analyses were based on data from the United States, our results are also consistent with Andriopoulou and Tsakoglou's (2011) study based on data from 14 European countries. They also found that disadvantaged demographic characteristics were associated with a greater risk of poverty entry and a lower chance of poverty exit.

Difference in results by the content of the poverty measures

Based on the Cox proportional hazard models, the results of the current study showed that the demographic characteristics predicting the risk of poverty entry among non-poor people varied by whether poverty was measured by income alone or income plus assets (Table 4). We also observed that the demographic characteristics predicting the chance of poverty exit among people with incomes below the federal poverty line varied by whether poverty was measured by income alone or income plus assets (Table 5).

First, let us examine households that were not in poverty. Households whose heads were in fair health status were not at higher risk of becoming income poor than their counterparts with good health status (Table 4). In contrast, they were more likely to become poor as measured by income plus assets. Similarly, single-parent families with children were not at higher risk of becoming income poor compared to their counterparts without children (Table 4). In contrast, when using the lower bound estimation, we found they were more likely to become income and asset poor. Finally, households in rural areas were

more likely to become income poor than their counterparts, but were not more likely to simultaneously become income and asset poor.

Differences between income poverty and income and asset poverty were also observed among households in poverty. Among households without children, households in which the head lives with the spouse were more likely to exit income poverty than their counterparts in which the head does not live with a spouse (Table 5). However, they were not more likely to exit simultaneous income and asset poverty.

The findings of this paper collectively indicate the importance of measuring poverty status based on both income and assets. Examining income poverty alone fails to identify the most vulnerable people, those at higher risk of entering into poverty, and those with a reduced likelihood of exiting poverty. These highly vulnerable people are more likely to be identified by considering both their income and assets.

Distinct determinants of each facet of poverty dynamics and its association strength

Our findings suggested that the factors predictive of the risk of poverty entry were not identical to factors predictive of poverty exit. When both income and assets were used to measure poverty, households whose heads were non-Hispanic African Americans, non-married, single parents, or without a high school diploma had a greater risk of falling into poverty than their counterparts (Table 4). However, these demographics did not significantly predict the probability of exiting poverty (Table 5). When poverty status was measured using only income, households whose heads were non-Hispanic African Americans, non-married, or without a high school diploma had a greater risk of poverty entry than their counterparts (Table 4). In contrast, these demographics did not significantly predict the chances of exiting poverty (Table 5). These collective findings suggest that a greater risk of poverty entry rather than a lower chance of poverty exit drove high poverty rates among these groups. Consequently, policies designed to assist these groups should target approaches that prevent people from falling into poverty.

On the other hand, when both income and assets were combined to measure poverty, households with a female head or those located in rural areas had the same risk of poverty entry as their counterparts but a smaller chance of poverty exit after having entered. These findings suggest that policies designed to assist rural households and those headed by women need to target avenues out of poverty. When poverty status was measured using income alone, among poor households *without* children, those living with a spouse were more likely to exit poverty than their counterparts not living with a spouse.

Households led by people who are Hispanic, less healthy, unemployed, or without a college degree encountered both a greater risk of poverty entry and a

reduced chance of poverty exit when both income and assets were combined to measure poverty. These results reflect the way multiple disadvantages intersect with chronic poverty. Age was also associated with both poverty entry and exit. Households with older heads were less likely to enter poverty, and even less likely to exit poverty once having entered it. This suggests that poverty status becomes more fixed as age increases. When poverty status was measured using only income, households whose heads were Hispanic, unemployed, without a college degree, or located in rural areas encountered both a greater risk of entering and a reduced chance of exiting poverty.

Overall, this study demonstrated that demographic characteristics of people at risk of poverty entry were not identical to people with a low chance of poverty exit. These results suggest the need for anti-poverty programs that differentiate between preventing poverty entry and assisting with poverty exit. For people who experience multiple types of marginalization and are at higher risk of entering into and remaining in poverty, interventions addressing both prevention and alleviation may be needed.

Limitations

The approach we used to measure assets has limitations. People may choose not to annuitize their assets even when they face income poverty. For instance, people may borrow money to satisfy daily needs rather than depleting savings intended to fund their retirement or their children's college education. Moreover, as people encounter unexpected expenses, assets consumed each year tend to fluctuate with time rather than being spent evenly, as annuitizing suggests. Besides, people may not consume all assets in their lifetime. Despite these limitations, combining income and assets to measure poverty provides important insights in identifying the socioeconomically vulnerable, given differences in our results based on income alone vs. income plus assets.

Another limitation lies in the fact that the PSID data set analyzed poverty status biannually rather than annually. It is possible that the data did not identify all people entering and exiting poverty. Future research using data sets with more frequent data collection might provide additional insights. Additionally, much like other public data sets such as the Current Population Survey and the Survey of Income and Program Participation, the PSID has a problem of underreporting (Meyer *et al.*, 2009).

In terms of our statistical approach, this study did not predict poverty status using a method that assessed the transition probability of a predictor from one year to the next, and its impacts on the transition probability of poverty status from one year to the next, such as that provided by a transition model. However, survival analyses were deemed more appropriate for satisfying the main purpose of this study, which requires simultaneous observation of the event outcome status (i.e. encountering the event or not) and its survival time (the duration

between the first observation and the binary event outcome status). A measure that only assessed survival time or event outcome would not provide a complete observation of the risk of encountering the event across time. For example, only assessing the event outcome status cannot indicate how long people survived before their event outcome status was observed. On the other hand, only assessing survival time neglects the binary event outcome at the end of their survival time. Therefore, to assess the risk of encountering the event across time, simultaneously considering survival time and the event outcome is necessary. Because of these advantages, many other studies have used survival analyses for similar research topics, such as Andriopoulou and Tsakoglou's (2011) analysis of the determinants of poverty entry and exit across 14 European countries. Because no single statistical approach is perfect, future studies should use other statistical approaches to augment the results presented here.

Policy Implications

Poverty prevention and alleviation efforts should address the different needs of people most likely to become poor and remain in poverty (McKernan and Sherraden, 2008). Yet existing studies, and subsequent interventions, do not distinguish the risk of entering poverty from the difficulty of exiting poverty. Moreover, using both income and assets to measure poverty assists in identifying the most socioeconomically vulnerable people (i.e. those with low income and asset shortages). Identifying the most socioeconomically vulnerable is a critical first step to developing effective anti-poverty programs.

To prevent people from entering or remaining in poverty, it is necessary to increase access to income and asset accumulation. However, it has been observed that the socioeconomically vulnerable encountered barriers to securing access to income and asset accumulation. For people living near or below the poverty line, difficulty in obtaining stable employment is one of the reasons they experience consistent income insufficiency (Sabia and Burkhauser, 2010). Even when employed, people with disadvantaged socioeconomic status are often limited to low-paying jobs, which only modestly improve income insufficiency (Torraco, 2016). Socioeconomically vulnerable people also encounter barriers to asset accumulation. For instance, unemployed people do not benefit from retirement matching contributed by their employers (McKernan and Sherraden, 2008). Perhaps more importantly, asset eligibility criteria of public benefit programs such as Medicaid and Supplementary Security Income discourage asset accumulation (Chen and Lerman 2005; McKernan and Sherraden, 2008). Although affirmative action measures have been implemented to promote upward social mobility by broadening access to income and/or wealth accumulation, additional reforms are required to advance equity for minoritized groups, given the persistence of racial and ethnic disparities.

Conclusion

The current study observed several instances in which risk factors for entering and exiting poverty differed significantly based on whether poverty was measured by income alone, or income plus assets. Although these differences were statistically significant, in many cases, the differences observed were relatively modest. In a few instances, the differences were rather striking. Nevertheless, the novel approach used in the current study, measuring poverty entry and exit, using varying measures of poverty (income alone vs. income plus assets), provides new insights into poverty dynamics. Redefining the ways in which poverty is measured may better inform future research, leading to more effective social policies that assist the most vulnerable population: specifically, people who are at risk of entering and remaining in poverty based on both income and assets. Targeting related interventions based on different dynamic facets of poverty (i.e. poverty entry, poverty exit, or both), rather than a static poverty status, may prove more effective in preventing and reducing poverty.

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Competing Interests

The author(s) declare none

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