

Changes in the duration distribution of poverty episodes in the US since the mid-1980s *

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Abstract

This paper aims to look ‘behind’ the stability of the US poverty rate and investigate what has happened to the underlying duration distribution of poverty episodes between the mid-1980s and the end of the 2000s. More precisely, it purports to identify what parts of the duration distribution of poverty episodes have been affected the most and to what extent the observed changes may be explained by (i) changes in the population structure, (ii) changes in the composition of the poor, and (iii) changes in the effects of the characteristics of the poor.

To answer these questions, we take advantage of the distribution regression technique and extend it to the context of duration analysis with a discrete dependent variable. The method makes it possible to model the entire duration distribution of poverty episodes as a function of individual characteristics by allowing them to affect this distribution heterogeneously at different values of duration. Once the model is specified, counterfactual distributions can be constructed and used to partition the overall change in the duration distribution of poverty episodes in a set of components. Using data from the Survey of Income and Program Participation (the 1984, 2004 and 2008 panels), we show that albeit the poverty rate was relatively stable in the US over recent decades, the duration of poverty has increased over time. This increase is induced mainly by the changes in the effects of the characteristics of the poor whereas the shifts in the structure of the US population and composition of the poor have contributed to the decrease in the probabilities of having longer episodes of poverty.

Keywords: poverty duration, distributional changes, decomposition.

JEL Classification: I3, D3.

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1. Introduction

Although the absolute number of people living in poverty has been on the rise in the US, the official poverty rate did not change much over recent decades. Increasing during the periods of recession and declining during the periods of economic expansion, it was at the same level of 15 percent in the late 2000s as in the mid-1980s.¹

The temporal 'stability' of cross-sectional poverty rate does not automatically imply that the longitudinal patterns of poverty have also remained unchanged. The poverty rate does a good job in revealing the prevalence of poverty in a particular year but it tells us nothing about the composition of the poor in terms of the amount of time they have spent below the poverty line. In their seminal work Bane and Ellwood (1986) show that whereas some people have very short episodes of poverty, the majority of those who are poor at a particular point in time are in the middle of long poverty spells. Hence, the same level of static poverty may be observed under completely different distributions of poverty duration. This heterogeneity in the duration of poverty episodes is completely ignored in the evaluation of temporal trends in cross-sectional poverty rates.

This paper aims to look 'behind' the stability of the US poverty rate and investigate what has happened to the underlying it duration distribution of poverty episodes between the mid-1980s and the end of the 2000s. To be more precise, it purports to identify what parts of the duration distribution of poverty episodes have been affected the most and to what extent the observed changes may be explained by (i) changes in the population structure, (ii) changes in the composition of the poor, and (iii) changes in the effects of the characteristics of the poor.

There are a number of reasons to believe that the distribution of poverty duration has changed in the US since the mid-1980s. One of the arguments in support of this thesis is that the absolute poverty rate itself evolved differently for different population sub-groups. Whereas it has decreased among elderly, female-headed families, and people with black and Hispanic origin, white individuals and working-age population have become more prone to poverty over time.² Since individuals belonging to these groups tend to have different probabilities of exiting poverty, changes in their within-group poverty rates might imply that

¹ For a detailed description of the temporal fluctuations in the official US poverty rate see DeNavas-Walt et al. (2013).

² Trends in the poverty rate by demographic sub-groups are very well described in DeNavas-Walt et al. (2013) and Gabe (2012).

the duration of their poverty episodes also have changed.³ The study of Card and Blank (2008) provides a good example that this might be the case. Focusing on female-headed families, they find that poverty spells experienced by this specific population subgroup became shorter but more frequent between the early 1990s and the early 2000s.

Another explanation of why the distribution of time spent in poverty might have changed in the US lies in the recent demographic and labor market trends. There is well documented evidence that the proportion of foreign-born population has been rapidly increasing in the US which, in turn, has generated more racial and ethnical diversity. The country has also experienced substantial changes in family composition over the years manifesting themselves in the spread of single-parent and one-person families.⁴ Along with demographic trends, there have also been profound labor market changes. Most of them are associated with the Federal Welfare Reform of 1996 and expansions in the earned income tax credits which served as activation policies and pushed a lot of previously economically inactive individuals back into labour force (Blank, 2009; Bollinger et al., 2009). On top of these reforms, income volatility doubled (Hardy and Ziliak, 2014) and inequality in earnings and income increased in the US between the 1980s and late 2000s affecting both the upper and bottom parts of income distribution (Daly and Valletta, 2006; Hardy and Ziliak, 2014). Finally, people have become more educated over time (Meyer et al., 2012).

In order to identify whether the duration distribution of poverty episodes indeed has changed in the US over time, we first estimate the conditional hazard function of exiting poverty at different spell lengths and then use it to recover the entire unconditional distribution of time spent in poverty. Individual characteristics are introduced in the model in a flexible way which allows them to influence the distribution of poverty duration heterogeneously at different values of duration. Once the model is specified a set of counterfactual distributions can be constructed and used to partition the overall change in the distribution of poverty duration into the parts induced by the changes in the population structure, characteristics of the poor, and the effects of these characteristics. The analysis is performed on data from the 1984, 2004 and 2008 panels of the Survey of Income and Program Participation.

The contribution of this paper to the literature is twofold. First of all, it provides new evidence about the changes in the duration distribution of poverty episodes in the US since

³ For more evidence about variation in the amount of time spent in poverty by demographic subgroups see Bane and Ellwood (1986) and Stevens (1999).

⁴ See Shrestha and Heisler (2011) for more details on recent trends in the US demographic profile.

the mid-1980s. Although there is a considerably large body of literature analyzing temporal trends in U.S. income inequality and static poverty (e.g. Dickens & Ellwood, 2004; McKernan & Ratcliffe, 2005; Daly & Valetta, 2006; Meyer et al., 2012; Larrimore, 2013) little has been done to explore how longitudinal experiences of poverty have changed over time. Those studies which are available in the field focus either on changes in poverty dynamics (McKernan and Ratcliffe, 2005; Sandoval et al., 2009) or trends in the duration of poverty within specific population subgroups (Card and Blank, 2008). We extend this work by focusing explicitly on the duration distribution of poverty episodes for all grown-up population and its development over time.

Secondly, we extend the distribution regression approach to the context of duration analysis and model the entire distribution of poverty duration. Distribution regression has been previously applied for the analysis of distributional changes in wages and income (Fortin and Lemieux, 1998; Donald et al., 2000; Bonjour and Gerfin, 2001; Chernozhukov et al. 2013). Albeit being based on the estimation of the hazard function in most of the applications, it has never been used in the context of duration analysis where time is measured in discrete units and some observations are censored. The main advantage of the distribution regression approach is that it allows for heterogeneous effects of covariates at different values of dependent variable. In the context of this paper, it makes it possible to identify even minor changes in the duration distribution of poverty episodes over time and link them to the shifts in the distribution of covariates and their effects.

The paper is structured as follows. Section 2 describes data while Section 3 presents estimation strategy used for the empirical analysis. Section 4 provides the results. Section 5 concludes.

2. Data

To analyze how and why the duration distribution of poverty episodes has changed in the US, we use data from the Survey of Income and Program Participation (SIPP). The SIPP is a multiple-panel survey which covers a nationally representative sample of US non-institutionalized households whose members are interviewed at four-month intervals during two to four consecutive years. At each interview, the respondents are asked about their demographic and labor market characteristics, family composition, sources and amounts of income as well as participation in governmental programs in each of the preceding four months. The sample size in the SIPP ranges between 12000 households in the early panels and 50000 households in the most recent ones.

The main advantage of the SIPP is that it provides monthly longitudinal information on both individual attributes and income amounts. Previous research has shown that there is a lot of fluctuation in income during the year, especially among low income families. Almost half of those who fall into poverty exit it within the next four months while only few individuals remain poor for more than a year (Ruggles and Williams, 1989; Card and Blank, 2008; Anderson, 2011). These short episodes of poverty would have been missed with annual data. Another merit of the SIPP is that it measures income amounts and individual attributes at the same point in time. This is vital for correct identification of individuals' poverty status given that it depends on income of all family members and family composition. Simultaneous measurement of income and individual attributes also makes it possible to better identify the relationship between characteristics of individuals and the amount of time they spend in poverty.

In this study we use data from the 1984, 2004 and 2008 SIPP panels. The 1984 panel is the oldest SIPP panel which contains data collected between October 1983 and July 1986. The 2004 and 2008 panels are the most recently available ones with the interviews administered from February 2004 through January 2008 and from September 2008 through December 2010 correspondingly. These three panels enables us to construct and compare the duration distribution of poverty episodes which prevailed in the mid-1980s, the period of economic expansion, with two other distributions observed twenty years later, one just before the Great Recession of 2008 and the other one during and after it. We use up to 32 consecutive months of information from each panel and keep in the sample only those individuals who report complete data for all 32 months.⁵ This restriction gives all individuals the same time frame for experiencing poverty episodes and makes it possible to correct for sample attrition by applying longitudinal weights.⁶ We also keep only adult individuals (18 years and older) in the sample because poverty status of children is directly determined by income of their parents.

The poverty status of each respondent is defined using the absolute measure of poverty developed by the Census Bureau. According to it, all individuals living in a family are considered to be poor if total family income falls below the official poverty threshold.⁷ The poverty threshold is based on the minimum amount of money which is needed for a

⁵ Albeit the 1984 Panel provides up to 36 month of information for some rotation groups, for other groups only up to 32 monthly records are available.

⁶ All calculations in Section 4 are performed using longitudinal weights.

⁷ The family is defined as a group of individuals who reside together and who are related by birth, marriage or adoption. Under this definition, all family members who are not connected to each other by birth, marriage or adoption are perceived as unrelated individuals or subfamily (U.S. Census Bureau, 2001).

family of a given size and composition to buy food and other necessities.⁸ Having been established in 1964, the thresholds for all family types are regularly adjusted by the Consumer Price Index in order to account for changes in the costs of living. Albeit this poverty measure has been heavily criticized (see, among others, Garner and Short, 2010), it remains the major eligibility criteria for many governmental programs and is the most widely used definition of poverty in the US.

We define a spell of poverty as beginning in the first month total family income falls below the poverty threshold and as ending in the first month it moves above the threshold. This definition of spells implies that even small fluctuations in income might result in a transition across the poverty threshold. It usually poses a problem when the duration of poverty is studied during a single period of time. In our case the focus is on changes in the distribution of poverty duration over time. Hence, as soon as income fluctuations around the threshold remain the same in all periods, they are not expected to influence the conclusions about distributional changes in poverty duration. We take advantage of this comparability design and use reported income information for the construction of poverty status. It allows us to avoid additional assumptions about which movements to consider as genuine transitions.

Although we use family income for defining the poverty status, it is an individual and not a family that constitutes the unit of analysis. In this way we can follow individuals over time when they move from one household to another and analyze changes in the duration distribution of poverty episodes for different population subgroups. For each individual in the sample we delete the first spell of poverty (non-poverty) because of the unknown beginning time and duration (left-censored observations). The final sample of poverty spells with the observed beginnings comprises 5866 individuals (10923 spells) for the 1984 panel, 10857 individuals (16748 spells) for the 2004 panel, and 9775 individuals (14838 spells) for the 2008 panel.

3. Modeling the distribution of poverty duration

3.1. The unconditional distribution of time spent in poverty

Consider a sample of N individuals who have just fallen into poverty and can exit it at any time. Let T denote the duration of time individuals spend poor from the moment they enter poverty until the moment they exit it. If time is measured in discrete units (e.g., in days,

⁸ The corresponding poverty thresholds are attached to each family in the SIPP. Monthly thresholds are derived by dividing the annual threshold by 12.

months, years) so that $t \in \{1, 2, \dots, t_{max}\}$, the probability of exiting poverty in period t given that individual i has been poor for previous $t-1$ periods, $h(t_i)$, can be defined as:

$$h(t_i) = \Pr[T_i = t | T_i \geq t]. \quad (3.1)$$

Estimation of Equation (3.1) for the sample of individuals yields the conditional distribution of event occurrence or so called hazard function. Once the estimates of the hazard function are derived, they may be used to recover unconditional distribution of time spent in poverty. Equation (3.2) below describes the link between the conditional hazard function and unconditional probability distribution (PDF) function of T :

$$h(t) = \frac{p(t)}{S(t-1)}, \quad (3.2)$$

where $p(t)$ stands for the PDF of T , and $S(t-1)$ represents the survivor function describing the probability of being poor up to period t which can be expressed as:

$$S(t-1) = \prod_{s=1}^{t-1} (1 - h(t_s)). \quad (3.3)$$

From Equations (3.2) and (3.3) it follows that the PDF of time uninterruptedly spent in poverty can be calculated as:

$$p(t) = h(t) \cdot \prod_{s=1}^{t-1} (1 - h(t_s)), \quad (3.4)$$

with the associated cumulative distribution function (CDF) of T , $F(t)$:

$$F(t) = p(1) + p(2) + \dots + p(t) = \sum_{j=1}^t p(t_j). \quad (3.5)$$

3.2. The duration distribution of poverty episodes in the presence of covariates

The conditional specification of the hazard function makes it straightforward to model the probability of exiting poverty as a function of individual characteristics and time spent in poverty, $h_{t|X}(t_i|X_i)$:

$$h_{t|X}(t_i | X_i) = \Pr[T_i = t | T_i \geq t, X_i] = \Theta(t_i, X_i), \quad (3.6)$$

where X_i is a vector of individual characteristics, t_i measures the amount of time individual i has been poor, and Θ stands for the function linking covariates to the dependent variable. By including the time variable in the right hand side of Equation (3.6) we allow the probabilities of exiting poverty to vary at different values of t . The effect of t may be specified in various ways (e.g. in a linear or quadratic form, as an intercept, or with a set of dummies allowing for heterogeneous probabilities of poverty exit at different values of t). Similarly, the effects of covariates may be restricted to the first order estimates or be extended to higher order interactions.

Using the logit specification for our binary dependent variable model, we can re-write Equation (3.6) as follows:

$$\log h_{t|X}(t_i | X_i) = \lambda t_i + \sum_{k=1}^K X_{ik} \beta_k \quad (3.7)$$

where λ captures the effect of time spent in poverty on the probability of exiting it, and β is a vector of coefficients associated with covariates X . The logit specification of the hazard function guarantees consistent parameter estimates by satisfying two vital statistical properties: (i) it makes hazard probabilities, $h(t)$, fall between 0 and 1 so that $0 \leq h(t) \leq 1$; (ii) it guarantees that the cumulative hazard is a monotonically increasing function so that $0 \leq F(T=1) \leq \dots \leq F(T=t_{max}) \leq 1$.

To avoid extensive assumptions about the distribution of T and its interplay with the vector of covariates X , rather than estimating the effects of t and X on the probabilities of exiting poverty for all observations pulled together, we estimate a sequence of binary models at each value of t . This specification allows for a flexible identification of the baseline hazard, on the one hand and heterogeneous effects of covariates across the entire distribution of T on the other. The dependent variable Y in this case is simply a binary variable indicating whether individual i exits poverty at duration t given that this individual has been poor up to period t and the vector of covariates X_i :

$$\log y_{it} = I(\} + \sum_{k=1}^K X_{itk} S_{tk}) \quad \text{for each } t = 1, 2, \dots, t_{\max} \quad (3.8)$$

where $I(\cdot)$ is the indicator function showing whether a given observation is for period t or not, and λ is the constant capturing the effect of time spent in poverty on the probability of exiting it in period t .

Estimates from Equation (3.8) can be used to derive predicted probabilities of exiting poverty in period t for each individual i given his or her characteristics X_i , $\hat{h}_{t|X}(t_i | X_i)$:

$$\hat{h}_{t|X}(t_i | X_i) = \frac{\exp(\} + \sum_{k=1}^K X_{itk} S_{tk})}{1 + \exp(\} + \sum_{k=1}^K X_{itk} S_{tk})}, \quad \text{for each } t = 1, 2, \dots, t_{\max} \quad (3.9)$$

Equation (3.9) makes it straightforward to recover the values of conditional PDF and CDF of T for each observation in the sample:

$$\hat{p}_{t|x}(t_i | X_i) = \hat{h}_{t|x}(t_i | X_i) \cdot \prod_{s=1}^{t-1} (1 - \hat{h}_{s|x}(s_i | X_i)) \quad (3.10)$$

$$\hat{F}_{t|x}(t_i | X_i) = 1 - \prod_{t=1}^T (1 - \hat{h}_{t|x}(t_i | X_i)) \quad (3.11)$$

The unconditional PDF and CDF of T can then be derived by integrating individual estimates of $\hat{p}_{t|x}(t | X)$ and $\hat{F}_{t|x}(t | X)$ over the density of X , $g(x)$:

$$\hat{p}(t) = \int \hat{p}_{t|x}(t | X) g(x) dx \quad (3.12)$$

$$\hat{F}(t) = \int \hat{F}_{t|x}(t | X) g(x) dx \quad (3.13)$$

3.3. Decomposition of the change in the distribution of poverty duration over time

Specification of Equations (3.12) and (3.13) makes it straightforward to decompose the overall change in the marginal PDF and CDF of T between two points in time into three components capturing (i) the contribution of the shifts in the population structure, (ii) the contribution induced by the changes in the characteristics of the poor, and (ii) the contribution associated with the shifts in the effects of these characteristics.

Consider, for example, the change in the CDF of T between the 1984 and 2008 SIPP panels. Using the framework described above it can be decomposed as follows:

$$\begin{aligned}
F^{2008}(t) - F^{1984}(t) &= \int \hat{F}_{t|X}^{2008}(t|X)g^{2008}(x)dx - \int \hat{F}_{t|X}^{1984}(t|X)g^{1984}(x)dx = \\
&[\int \hat{F}_{t|X}^{2008}(t|X)g^{2008}(x)dx - \int \hat{F}_{t|X}^{2008}(t|X) \cdot \mathbb{E} \cdot g^{2008}(x)dx] + \\
&[\int \hat{F}_{t|X}^{2008}(t|X) \cdot \mathbb{E} \cdot g^{2008}(x)dx - \int \hat{F}_{t|X}^{2008}(t|X) \cdot \mathbb{E} \cdot g^{1984}(x)dx] + \\
&[\int \hat{F}_{t|X}^{2008}(t|X) \cdot \mathbb{E} \cdot g^{1984}(x)dx - \int \hat{F}_{t|X}^{1984}(t|X)g^{1984}(x)dx]
\end{aligned} \tag{3.14}$$

The first term in the right-hand side of Equation (3.14) captures the contribution of the change in the general structure of the US population between the 1984 and 2008 SIPP panels. More specifically, it takes the difference between the actual duration distribution of poverty episodes in the 2008 panel and the counterfactual distribution which would have prevailed in the 2008 panel if the population structure had remained the same as twenty five years ago. To derive such a counterfactual distribution, we take advantage of the DiNardo, Fortin, Lemieux (1996) re-weighting technique and compute a reweighting factor which allows us to impose the structure of the US population at the beginning of the 1980s on the 2008 distribution:

$$\mathbb{E} = \frac{dH^{1984}(C)}{dH^{2008}(C)} = \frac{\Pr(t = 1984 | C)}{\Pr(t = 2008 | C)} \cdot \frac{\Pr(t = 2008)}{\Pr(t = 2004)} \tag{3.15}$$

where $H^{1984}(C)$ and $H^{2008}(C)$ stand for the CDF of the vector of population characteristics C in the 1984 and 2008 SIPP panels correspondingly.

The second term in the right-hand side of Equation (3.14) captures the contribution of the changing composition of the poor to the overall shift in the duration distribution of poverty episodes. It does so by taking the difference between the reweighted duration distribution for the 2008 panel and the counterfactual distribution which would have prevailed in that panel if both the structure of the general population and composition of the poor had remained the same as in the 1984 panel. Finally, by taking the difference between this counterfactual distribution and the actual distribution of poverty episodes in the 1984 panel, the last term in Equation (3.14) captures the contribution of the change in the effects of characteristics of the poor to the overall shift in the distribution of poverty duration.

Equation (3.14) provides a framework for sequential aggregate decomposition of the temporal change in the duration distribution of poverty episodes. As any sequential

decomposition, it might suffer from the path dependency problem when results depend on the order of the terms in the right-hand side of Equation (3.14). To test whether this is the case, we also perform decomposition in the reverse order.

4. Results

4.1. Temporal changes in the duration distribution of poverty episodes in the US

Figure 4.1 below depicts three CDFs of time spent in uninterrupted spells of poverty in the mid-1980s, mid-2000s and late 2000s. The CDFs of poverty duration from the 2004 and 2008 SIPP panels lie below the CDF from the 1984 panel signifying an increase in the proportion of individuals having long spells of poverty over time. Remarkably, that the change in the distribution of time spent in poverty is found statistically significant not only between the 1984 and 2008 panels which cover different phases in the business cycle, but also between the 1984 and 2004 panels, both covering the years of economic expansion.

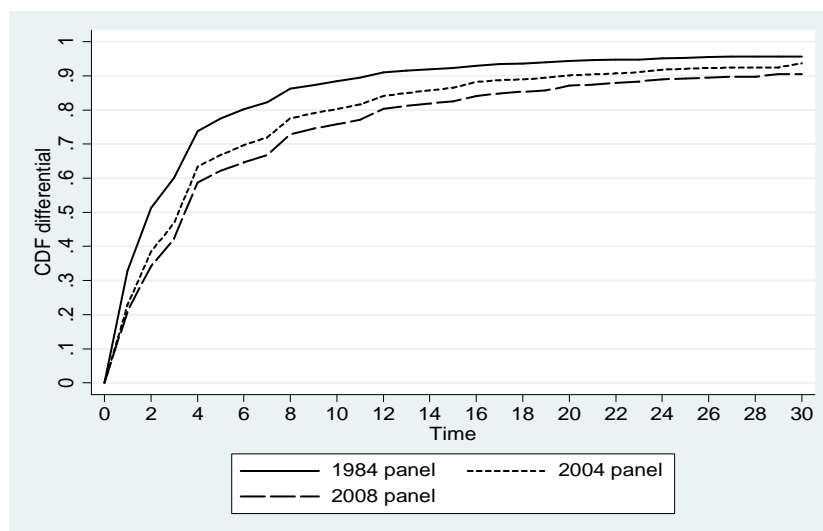


Figure 4.1. CDFs of time spent in uninterrupted spells of poverty

Note: weighted estimates. The upper limit of the CDF is not equal to one because of the small portion of spells lasting beyond the period of observation.

Figure 4.2 plots and Table 1 in the Annex quantifies the difference in the CDFs of poverty duration between the 1984 and later panels providing further evidence about the parts of the distribution where the major shifts have occurred. They show that albeit there was a downward shift in the overall CDF between the 1984 and both 2004 and 2008 panels, this shift was not the same in different parts of the distribution. The largest decline took place in the lower tail of the distribution comprising short spells of poverty. For example, the

probability that a new entrant into poverty will have a spell lasting no more than three months declined by 13.2 percentage points between the mid-1980s and mid-2000s while the probability of having a spell of poverty ended within the first 20 months decreased by only 4.2 percentage points. Because of the overall decline in the cumulative probabilities of exiting poverty, the share of those who remain poor over 30 months increased from around 4% in the 1984 SIPP panel to more than 6% in the 2004 panel. Similarly to what has already been found in Figure 4.1, a sharp decline at all points of the distribution was already observed between the mid-1980s and mid-2000s, and deepened even further towards the end of the decade.

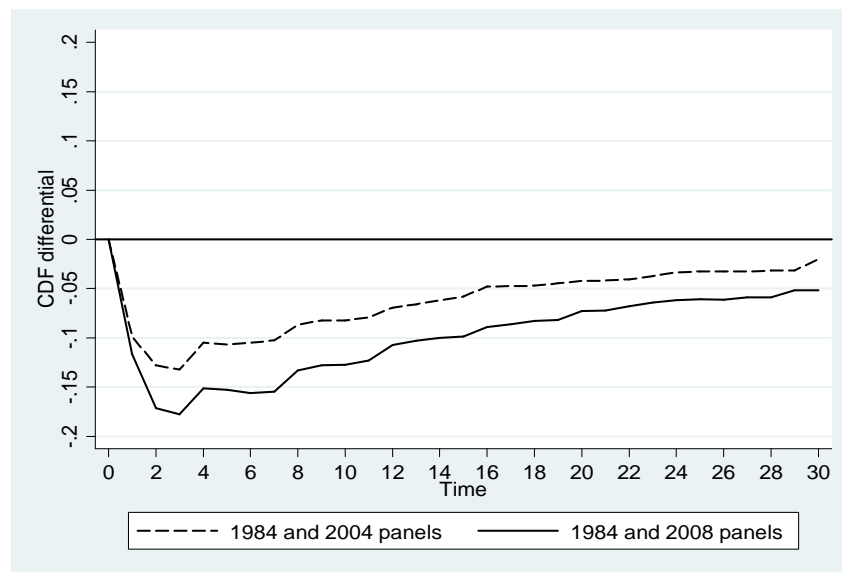


Figure 4.2. The change in the CDF of the duration of poverty episodes over time

Note: weighted estimates.

Figure 4.3 below provides complimentary evidence to what has already been depicted in Figures 4.1 and 4.2. By plotting the change in the probability density function of time spent in poverty, it shows how the probabilities of having a spell of a given duration have changed over the years. It reveals that the shift towards longer poverty episodes observed in the CDFs is driven by the decline in the probabilities of having very short spells of poverty lasting up to three months. The probabilities of having long episodes of poverty, in turn, have increased but this increase was less profound and more or less equally spread along the distribution (except of the spikes at durations of four and eight months).⁹ Comparing the

⁹ These spikes can be explained by the presence of the so called ‘seem bias’ in the SIPP panel, when individuals tend to report changes in their income situation between interviews rather than within the reference periods these interviews cover (i.e. each interview collects data for four previous months) .

differences between the 1984 and 2004 panels, on the one hand, and the 1984 and 2008 panels, on the other, we can see that they are consistent with the trends found for the CDF differentials. More specifically, the curves have a very similar shape with more profound shifts observed in the 2008 than in the 2004 panel.

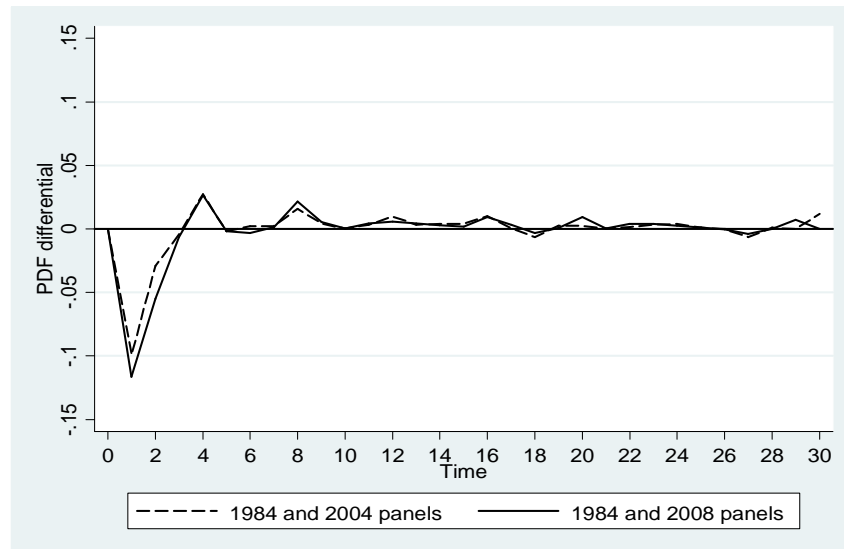


Figure 4.3. The change in the PDF of the duration of poverty episodes over time

Note: weighted estimates.

Given that the poverty rate did not change much in the US between the early 1980s and late 2000s, one might expect that an increase in the duration of uninterrupted poverty episodes was ‘compensated’ by a decrease in their frequency. Figure 4.4 below plots the CDFs of time spent out of poverty for 1984, 2004 and 2008 panels.

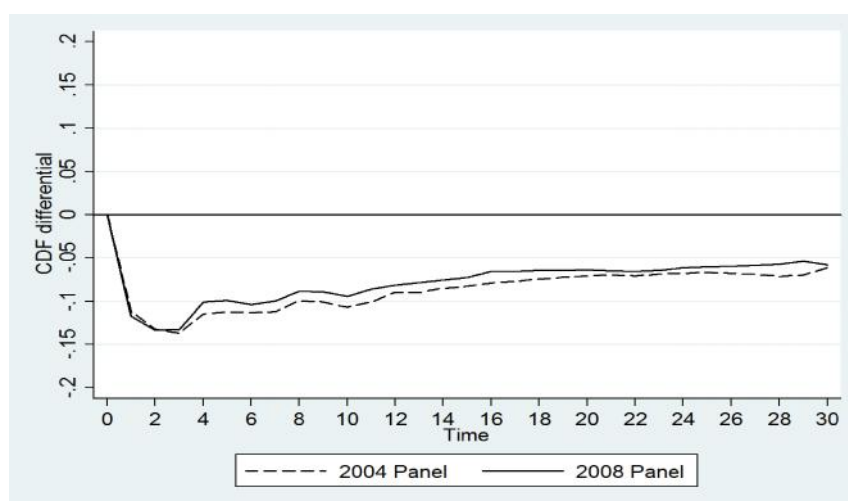


Figure 4.4. The temporal change in the CDF of time spent out of poverty

Figure 4.4 shows that the cumulative probabilities of re-entering poverty (finishing a non-poverty spell) indeed have declined over time. Comparing the estimates in Figure 4.4 with the ones in Figure 4.2 we can see that the gap between the 2004 and 2008 differentials is more pronounced for poverty than for non-poverty episodes. It implies that the deep economic crisis of 2008 hit the conditional probabilities of exiting poverty to a larger extent than the probabilities of poverty re-entry, leading to even more persistent episodes of poverty towards the end of the 2000s.

4.2. Explaining the change in the distribution of poverty duration over time

In order to understand what drives the increase in the duration of poverty over time, we perform further analysis aiming to partition the overall shift in the duration distribution of poverty episodes into three components capturing the contribution of changes in the (i) general population structure, (ii) composition of the poor, (iii) feedback effects to the characteristics of the poor.

Changes in the population structure

Table 4.1 below describes the structure of the US population in terms of the main demographic and socio-economic characteristics (age, gender, race, educational attainment, family composition) which, according to the literature, have been changing the most over recent decades. Looking at the racial and ethnical composition first, we can see that the proportion of white individuals has declined over time whereas the proportions of individuals with Hispanic or Asian origin increased. As one would expect, the population also became older over the years with the share of individuals below 35 years old declined and the proportions of all other age groups increased since the beginning of the 1980s. In terms of education, the trend is towards a sizable increase in the share of grown-up individuals with a college or higher than college diploma. In contrast, the proportions of those who have unfinished or complete high school education declined by around 11 percentage points each between the beginning of the 1980s and the end of the 2000s. Finally, the society underwent a profound decrease in the share of couple-based families with the corresponding increase in the proportions of single parent and one-person families. All trends observed between the 1984 and 2004 panels were further deepening in the 2008 panel.

Table 4.1. Changes in the structure of the US population over time

Individual characteristics	1984 Panel, %	2004 Panel,%	2008 Panel, %	Difference 1984-2004	Difference 1984-2008
<i>Race and ethnicity</i>					
Only white	81.32	72.34	69.99	-8.98***	-11.33***
Only black	10.13	10.86	10.97	+0.73	+0.84
Hispanic or Asian origin	8.55	16.80	19.04	+8.25***	+10.49***
<i>Gender</i>					
Men	46.94	46.94	47.29	0	+0.35
Women	53.06	53.06	52.71	0	-0.35
<i>Family type</i>					
Single parent	12.77	15.28	15.99	+2.51***	+3.22***
Single	15.56	21.42	22.92	+5.86	+7.36***
Couple	71.67	63.30	61.09	-8.37***	-10.58***
<i>Age</i>					
18-34	39.85	28.63	28.16	-11.22***	-11.69***
35-54	32.00	39.94	38.26	+7.94***	+6.26***
55-64	13.23	14.57	16.24	+1.34***	+3.01***
65	14.92	16.86	17.34	+1.94***	+2.42***
<i>Education</i>					
Uncompleted high school	23.57	13.47	12.00	-10.10***	-11.57***
Completed high school	37.09	26.06	25.47	-11.03***	-11.62***
College or higher	39.34	60.47	62.53	+21.13***	+23.19***

Note: Longitudinally weighted estimates based on the SIPP 1984, 2004 and 2008 panels. The differences are tested for statistical significance accounting for the complex survey design in the SIPP.

* significant at 0.001 level, ** significant at 0.01 level, *** significant at 0.05 level.

Figure 4.5 below depicts the contribution of the observed trends in the structure of the US population to the shift in the duration distribution of poverty episodes. More specifically, it plots actual duration distributions of poverty episodes in the 1984 and later SIPP panels against the counterfactual distribution that would have prevailed in these panels if the structure of the US population had remained the same as in the 1984 panel. The vertical distance between the actual distribution for the 2004 (2008) panel and counterfactual distribution yields the contribution of the changes in the population structure to the overall shift in the duration distribution of poverty episodes.

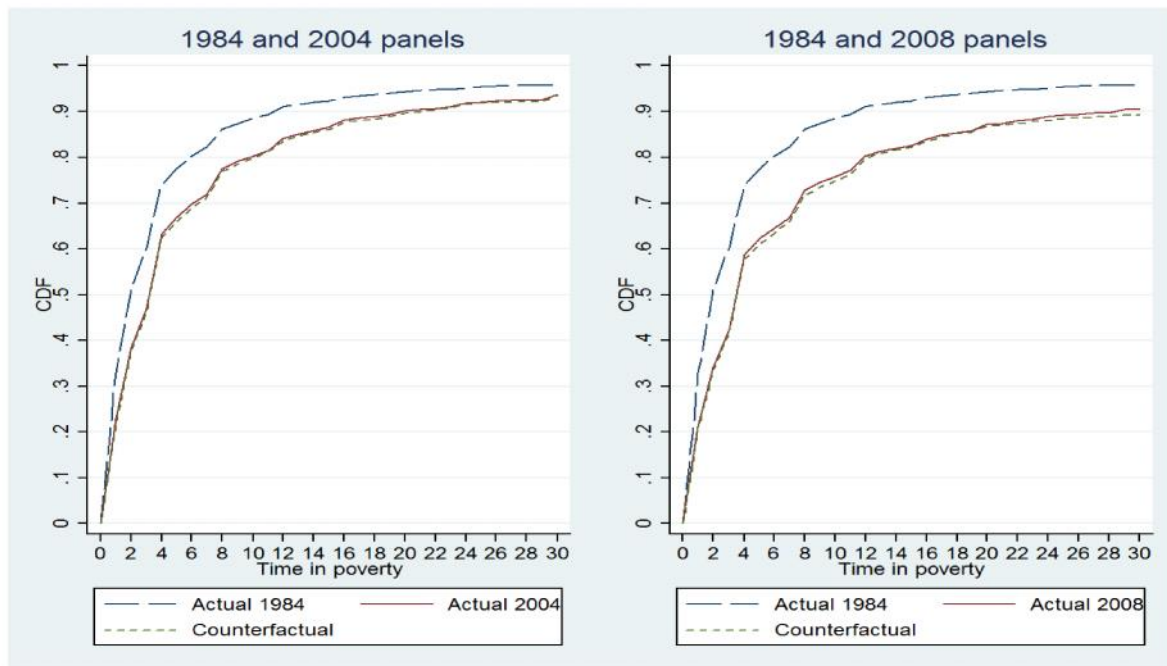


Figure 4.5. Contribution of the changes in the population structure to the shift in the CDF of time spent in poverty

The first glance at Figure 4.5 reveals a relatively small but favorable effect of the changed population structure on the duration distribution of poverty episodes. Had the demographic composition of the US population remained the same as twenty five years ago, the CDF of time spent in poverty would have been even below its actual level in both 2004 and 2008 panels. Albeit the size of the contribution is relatively small, it still signifies that the changes in the population structure have contributed to the decrease in the probabilities of having a long poverty spell.

Changes in the composition of the poor

Table 4.2 lists sample means for the characteristics of the poor in each of the three panels and provides unadjusted and adjusted differences between them.¹⁰ It shows that albeit the composition of the poor has changed over time, to a large extent this change is induced by the shift in the demographic structure of the US population. For example, one will find a decline of more than 10 percentage points in the proportion of white individuals among the poor, when no adjustment for the shift in the population structure is performed. In a similar way we can report a significant increase in the share of poor individuals living in single

¹⁰ The adjustment is performed by re-weighting poverty observations in the cleaned 2004 and 2008 SIPP panels with the weights calculated to account for the change in the population structure.

parent and single person families over time. These differences become much smaller and insignificant as soon as we adjust for the changes in the structure of the US population which took place during the same period of time.

Table 4.2. Changes in the composition of the poor over time

Individual characteristics	1984 Panel, %	2004 Panel, %	2008 Panel, %	Difference 1984-2004	Difference 1984-2008	Adjusted difference 1984-2004	Adjusted difference 1984-2008
<i>Race and ethnicity</i>							
Only white	69.01	58.85	57.49	-10.16***	-11.52***	+0.93	+1.98
Only black	19.12	16.33	15.57	-2.79	-3.55	-3.97*	-4.91**
Hispanic or Asian origin	11.87	24.82	26.94	+12.95***	+15.07***	+3.03*	+2.92**
<i>Gender</i>							
Men	42.60	42.29	45.23	-0.31	+2.63	-0.53	+1.93
Women	57.40	57.71	54.77	+0.31	-2.63	+0.53	-1.93
<i>Family type</i>							
Single parent	23.38	26.60	25.44	+3.22***	+2.06***	+1.43	+1.05
Single	24.96	33.29	33.85	+8.33***	+8.89***	+1.51	-0.33
Couple	51.66	40.11	40.71	-11.55***	-10.95***	-2.96	-0.73
<i>Age</i>							
18-34	46.69	39.37	38.36	-7.32***	-8.33***	+6.35***	+6.52***
35-54	29.33	37.97	39.85	+8.64***	+10.52***	-0.7	+1.44
55-64	11.93	12.63	13.01	+0.7*	+1.08***	-1.97*	-2.62**
65	12.05	10.03	8.77	-2.02	-3.28	-3.69***	-5.37***
<i>Education</i>							
Uncompleted high school	38.45	24.35	22.99	-14.10***	-15.46***	-5.7***	-5.18*
Completed high school	35.70	29.04	29.33	-6.66***	-6.37***	+3.44*	+4.82**
College or higher	25.85	46.61	47.68	+20.76***	+21.83***	+2.25	+0.34

Note: Weighted estimates. The differences are tested for statistical significance accounting for the complex survey design in the SIPP.

* significant at 0.001 level, ** significant at 0.01 level, *** significant at 0.05 level.

The last two columns in Table 4.2 show that, compared to the early 1980s, among the poor nowadays one could find fewer black but more Hispanic (Asian) individuals, more persons aged between 18 and 34 but fewer those of pre-retirement and retirement age. In addition, even after the adjustment for the changes in the population structure, there is still a substantial increase documented in the share of individuals with complete high school education and decrease in the proportion of those who have not finished a high school.

Figure 4.6 below shows how these changes in the composition of the poor have reflected on the duration distribution of poverty episodes. For each period, it presents four CDFs of time uninterruptedly spent in poverty: two actual distributions observed at the beginning and the end of the period, and two counterfactual distributions depicting how the

distribution in the final period would have looked like if the structure of the population had not changed (Counterfactual 1) and what this distribution would have been if, on top of the population structure, the composition of the poor also had not changed (Counterfactual 2). The contribution of the change in the composition of the poor to the overall shift in the duration distribution of poverty episodes can be defined as a vertical distance between these two counterfactual distributions.

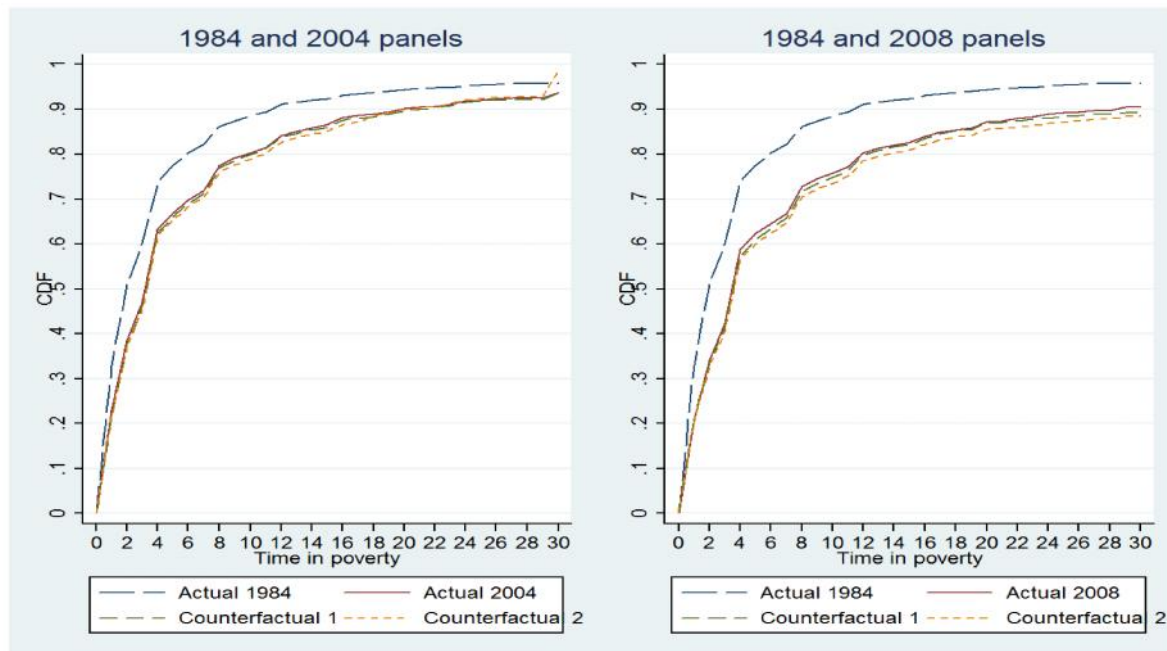


Figure 4.6. Decomposition of the change in the CDF of time spent in poverty

Figure 4.6 shows that the counterfactual CDF which would have prevailed in the 2004 panel if both the population structure and composition of the poor had remained at the level of the 1980s, to a large extent overlaps with the actual CDF of poverty duration in the 2004 panel. The difference becomes noticeable only for durations between 4 and 18 months signifying that, holding the population structure fixed at its 1980s level, the change in the composition of the poor has contributed to the decrease in the probabilities of having long poverty spells. Had the distribution of covariates remained the same in the mid-2000s as it was in the mid-1980s, the duration of poverty would have been slightly higher.

The results are more pronounced for the 1984 and 2008 panels. The vertical distance between two counterfactual distributions is bigger for these panels than for the 1984 and 2004 ones, and it especially increases at large values of duration. It means that the change in the

composition of the poor between the mid-1980s and late 2000s also contributed to a slight decline in the duration of poverty episodes.

Changes in the effects of the characteristics of the poor

Figure 4.6 above also allows us to assess the contribution of the changes in the effects of the characteristics of the poor to the overall shift in the duration distribution of poverty episodes. Following the order of the sequential decomposition presented in Equation (3.14), this contribution can be assessed as the difference between the counterfactual distribution, that would have prevailed in the 2004 (2008) panel if both the population structure and composition of the poor had been the same as in the 1984 panel, and the actual distribution observed for the 1984 panel. Comparison of the corresponding CDFs in Figure 4.6 reveals that the change in the effects of the characteristics of the poor is the major factor responsible for the increase in the duration of poverty episodes between the 1980s and 2000s. Had the returns to the characteristics of the poor remained the same over time as they used to be in the 1984 panel, the duration distribution of poverty episodes would have been more convex upwards than it actually was in both 2004 and 2008 panels.

By presenting the coefficients from the equations of exiting poverty estimated separately for each panel, Table 2 in the Annex helps to identify individuals with which characteristics have become more / less prone to long poverty episodes over time. In order to make results presentable, we estimated the model for all individuals pulled together regardless of the amount of time they spent in poverty. To account for the differences in the amount of time spent in poverty, along with individual characteristics we also included dummies for the duration of poverty episodes in the equations (see Equation 3.7).

Comparing the estimates between the 1984 and more recent SIPP panels (columns 4 and 5 in Table 2 in the Annex), we can conclude that the tendency towards longer poverty episodes which was found in Section 4.1 is also confirmed from the model estimates. The probabilities of exiting poverty have declined significantly for the durations up to eight months which is in line with the shift of the mass of the duration distribution of poverty episodes to the right in Figure 4.1. The differences between the panels in the estimated coefficients associated with the characteristics of the poor reveal that individuals of the pre-retirement and retirement age improved their chances to have shorter poverty spells over time whereas individuals who do not have at least a college diploma tend to stay in poverty longer nowadays than they used to twenty five years ago. It is also worth mentioning that male became better off than female over time. The difference is not found statistically significant

between the 1984 and 2008 panels but the coefficient still remains significant in the 2008 panel as opposed to the 1984 panel.

Comparison of the estimates between two most recent SIPP panels (column 6 in Table 2 in the Annex) reveals an increase in the probabilities of exiting poverty for the individuals over 65 during the period of Great recession. Albeit they still have lower chances to exit poverty compared to the group of 35-54 years old, the differential decreased between the 2004 and 2008 panels. In contrast, individuals living in single parent families became more prone to longer episodes of poverty during the years of the Great recession as compared to the pre-recession period.

Figures 4.7 and 4.8 shed further light on the contribution of the changes in the effects of covariates to the overall shift in the duration distribution of poverty episodes. They do so by plotting estimated CDFs of time spent in poverty for specific types of individuals within each SIPP panel. In contrast to the results presented in Table 2 in the Annex, the estimation here is based on the distributional approach which allows the effects of covariates to vary at different values of duration. In addition, since estimates of the CDFs are non-linear functions of covariates and associated with them coefficients, estimation of CDFs for a given set of covariates eases interpretation of the results (Donald et al., 2000). We start such estimation for a reference type of individuals (white male aged 35-54 with higher education and living in a couple) and then explore how the duration distributions of poverty episodes change when we change values of certain covariates. To be more precise, we explore differences in the development of the CDFs over time for individuals of different age, gender, race, educational and family background.

Figure 4.7 shows that there is almost no difference in the temporal changes of the CDF functions for individuals of 35-54 years old (the reference type) and those aged between 18 and 34. Both groups experienced a decline in the cumulative probabilities along the distribution with the most profound changes taking place up to the twentieth months of being in poverty. Compared to the two groups mentioned above, the temporal change in the duration distribution of poverty episodes is smaller for individuals between 55 and 64 years old. Albeit the duration of poverty also has increased for this group, the size of the increase was smaller. Those who are above 65 also experienced a downward shift in the CDF of time spent in poverty between the 1984 and later panels but that shift was somewhat proportional along the distribution.

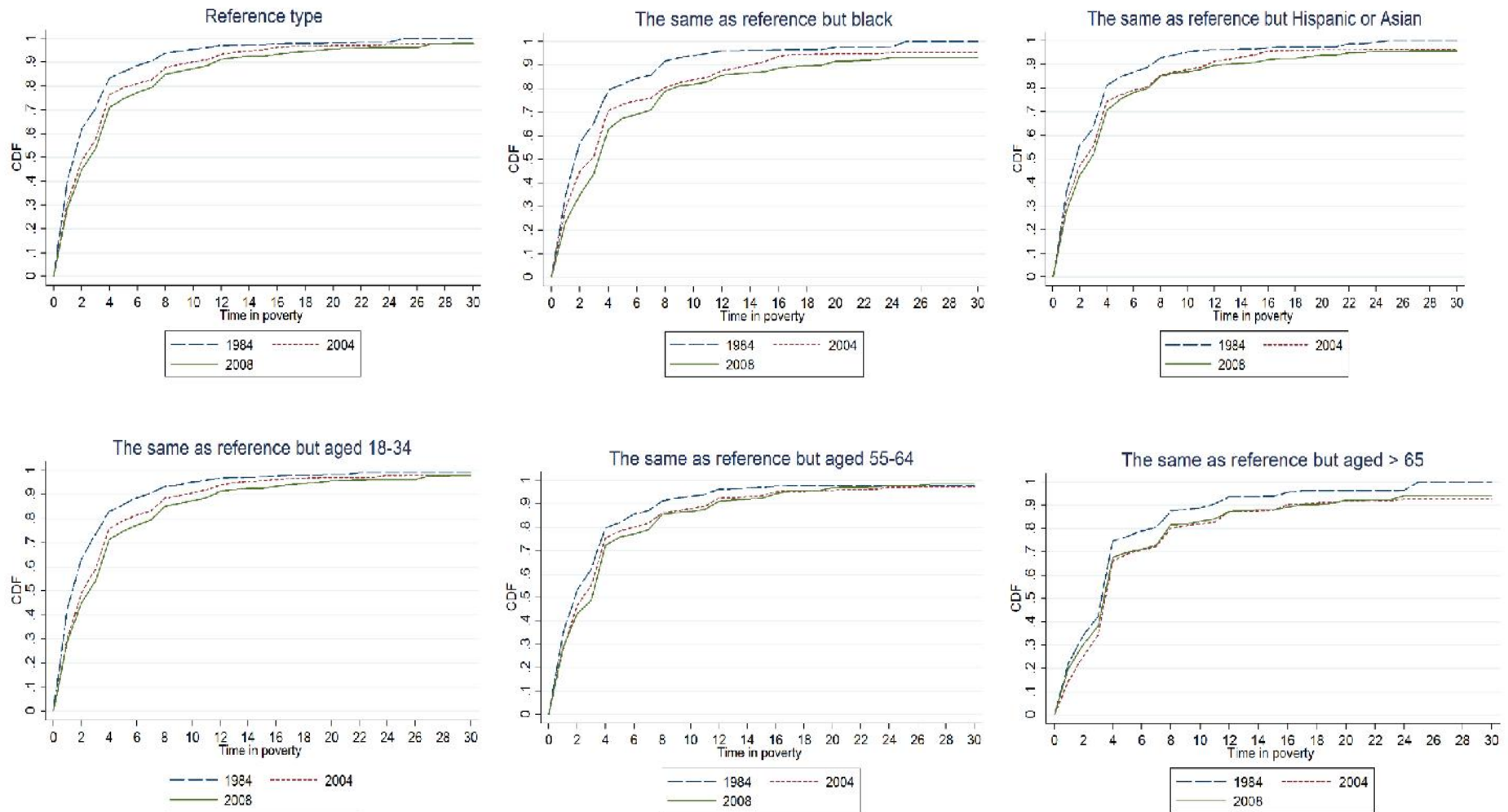


Figure 4.7. Race and age differentials in the development of the duration distribution of poverty episodes over time

Note : Simulated on the basis of weighted SIPP estimates. Reference individual: white male aged 35-54 with higher education and living in a couple.

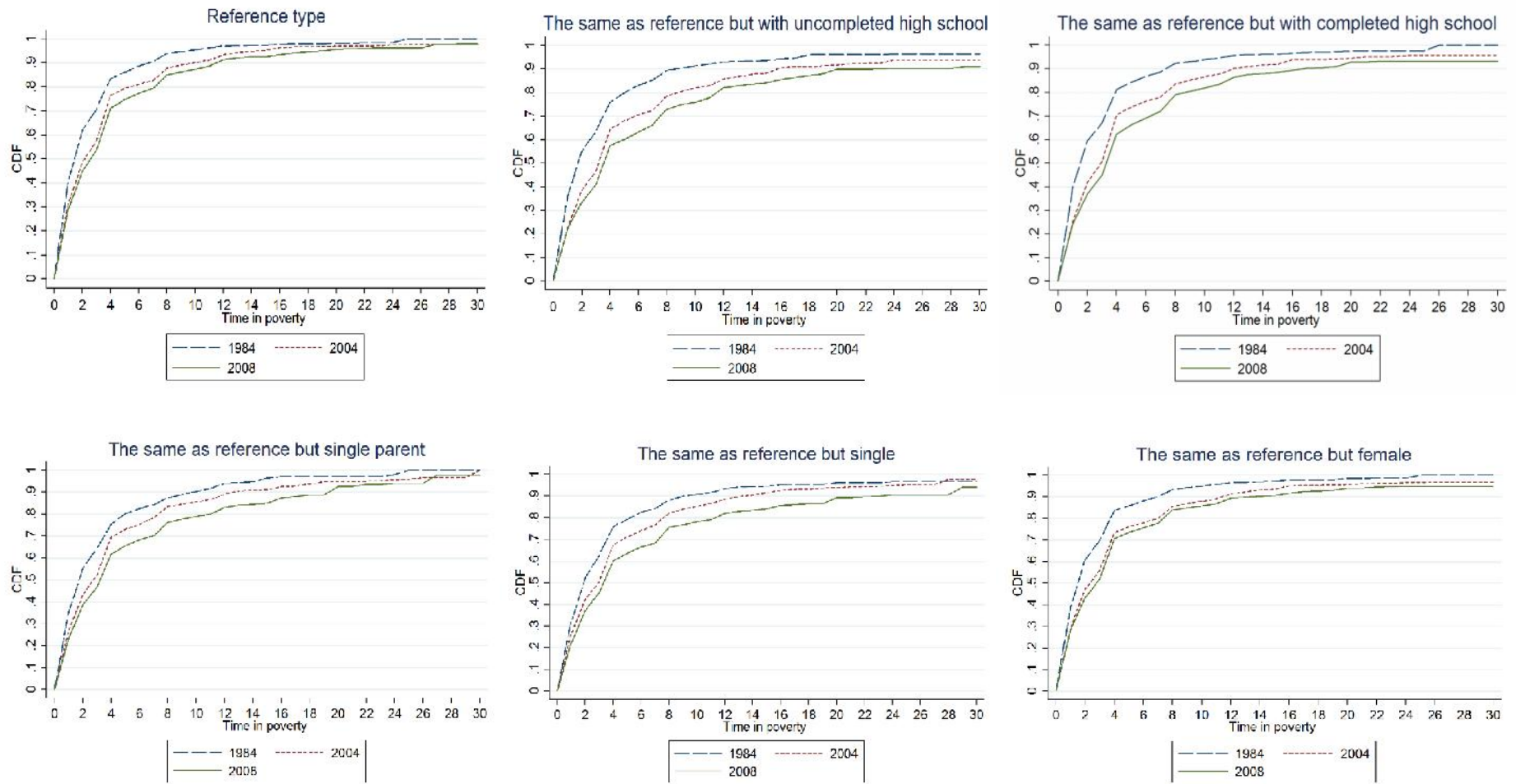


Figure 4.8. Gender, educational, and family differentials in the development of the duration distribution of poverty episodes over time

Note : Simulated on the basis of weighted SIPP estimates. Reference individual: white male aged 35-54 with higher education and living in a couple.

Comparison of the trends for different race categories reveals a very small difference in the temporal shifts in the duration distributions of poverty episodes between white individuals (reference type) and those with Hispanic or Asian origin. In contrast, the difference between white and black people is substantial. The cumulative probabilities of exiting poverty have dropped to a larger extent for black individuals than for their white counterparts over time.

Figure 4.8 presents similar differentials in the development of the CDFs of time spent in poverty for individuals of different gender, educational and family background. It shows that individuals with both uncompleted and completed high school education experienced substantially larger increase in the probabilities of having longer poverty spells than those with at least a college diploma. Looking at the differences in the development of the CDFs of poverty duration for individuals living in different types of households, one can see that the shift between the 1984 and later panels was more profound for single parent and single person families than for couples. Albeit the cumulative probabilities for different family types were developing in a similar way up to the duration of six months, afterwards the drop was more sizable for single parent and single person families than for individuals living in couples. Finally, comparing the trends for male (reference type) and female individuals we can conclude that female became more prone to longer poverty episodes than male over time.

4.3. *Robustness check*

Figure 4.7 below depicts the results of the reverse-order decomposition of the overall change in the CDF of poverty duration between the 1984 panel on the one hand and 2004 and 2008 panels on the other hand. In this version of decomposition, after accounting for the change in the structure of the US population over time (Counterfactual 1), we first derived the contribution of the changes in the effects of the characteristics of the poor to the shift in the entire duration distribution of poverty episodes (Counterfactual 2) and only then the contribution of the changes in the composition of the poor.

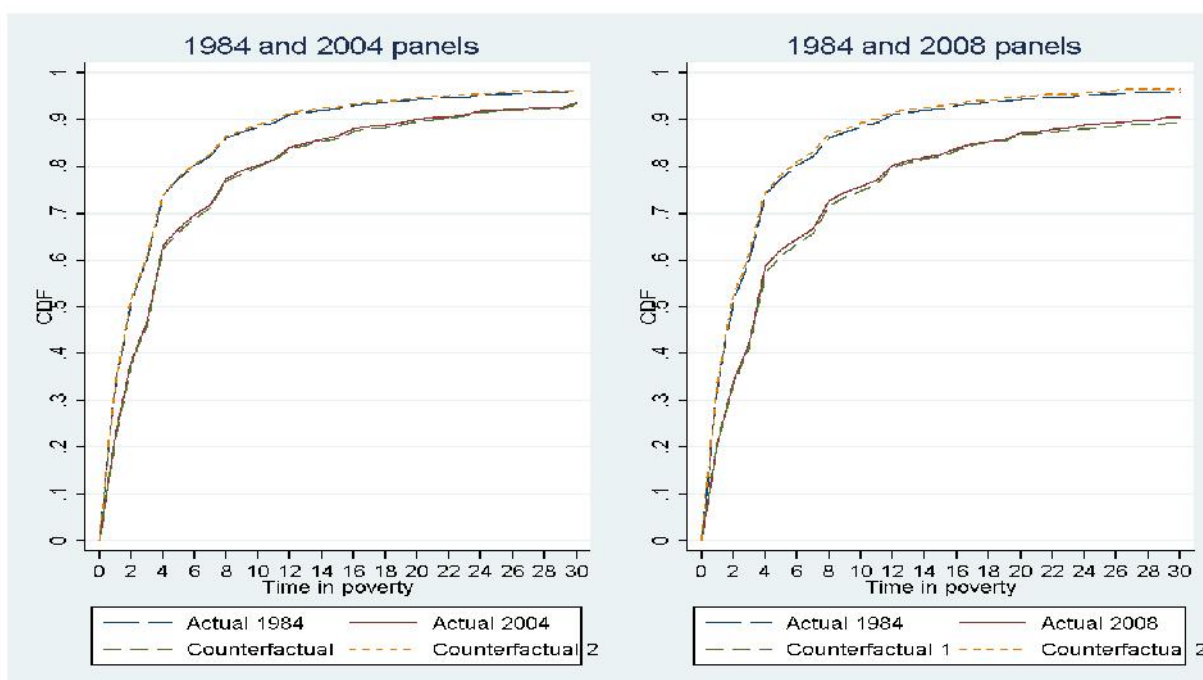


Figure 4.7. Reverse order decomposition of the change in the CDF of poverty duration

The results of the reverse order decomposition confirmed our previous findings by showing a relatively large contribution of the changes in the effects of covariates to the decrease in the cumulative probabilities of exiting poverty over time. The contributions of the shifts in the population structure and composition of the poor, in turn, are relatively small but inducing an upward shift in the CDF of time spent in poverty. Similarly to Figure 4.6, the findings hold for both 2004 and 2008 panels signifying robustness of decomposition results.

5. Conclusions.

Using data from the SIPP, in this paper we analyze and explain the change in the duration distribution of poverty episodes between the early 1980s and late 2000s in the United States. To do that, we take advantage of the distribution regression technique and extend it to the duration analysis with a discrete dependent variable. The main advantage of the method is that it allows us to construct the entire duration distribution of poverty episodes in the presence of covariates and decompose its temporal change into the contributions induced by the changes in: (i) the structure of the US population, (ii) the characteristics of the poor, and (iii) the effects of these characteristics.

The results show that albeit the official poverty rate was relatively stable in the US between the early 1980s and late 2000s, the duration of poverty has increased. The major

decline in the duration distribution of poverty episodes has happened in its lower tail comprising short spells of poverty. In contrast, the probabilities of having longer spells of poverty have increased over time.

The decomposition results suggest that the shift in the duration distribution of poverty episodes is mainly induced by the changes in the effects associated with the characteristics of the poor. At the same time, changes in the structure of the US population and composition of the poor have relatively small but resulting in the decrease in the duration of poverty contributions. Looking across population sub-groups, the largest increase in the duration of poverty over time was experienced by black individuals, women, persons with uncompleted or complete high school education, and those living in single parent or single person households. The duration of poverty has also increased for all other population sub-groups, but to a smaller extent.

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Table 1. Changes in the duration distribution of poverty episodes over time

Duration	CDF, 1984 Panel	CDF, 2004 Panel	CDF, 2008 Panel	Difference 1984-2004	Difference 1984-2008
0	0	0	0	0	0
1	0.328	0.229	0.211	-0.099	-0.116
2	0.512	0.384	0.341	-0.128	-0.171
3	0.601	0.469	0.423	-0.132	-0.177
4	0.738	0.633	0.587	-0.104	-0.151
5	0.775	0.668	0.622	-0.106	-0.152
6	0.802	0.697	0.645	-0.104	-0.156
7	0.822	0.719	0.667	-0.102	-0.154
8	0.862	0.775	0.729	-0.086	-0.133
9	0.873	0.790	0.745	-0.082	-0.127
10	0.885	0.803	0.758	-0.082	-0.127
11	0.894	0.815	0.771	-0.079	-0.123
12	0.910	0.841	0.803	-0.069	-0.107
13	0.915	0.849	0.812	-0.065	-0.103
14	0.919	0.857	0.819	-0.062	-0.100
15	0.923	0.865	0.825	-0.057	-0.098
16	0.930	0.882	0.841	-0.047	-0.089
17	0.934	0.887	0.848	-0.047	-0.085
18	0.936	0.889	0.853	-0.047	-0.082
19	0.939	0.894	0.857	-0.044	-0.082
20	0.944	0.901	0.871	-0.042	-0.072
21	0.946	0.904	0.874	-0.041	-0.072
22	0.948	0.907	0.879	-0.040	-0.068
23	0.948	0.910	0.883	-0.037	-0.064
24	0.951	0.918	0.889	-0.033	-0.061
25	0.953	0.920	0.892	-0.032	-0.060
26	0.956	0.923	0.894	-0.032	-0.061
27	0.956	0.924	0.897	-0.032	-0.059
28	0.956	0.925	0.897	-0.031	-0.059
29	0.956	0.925	0.905	-0.031	-0.051
30	0.956	0.936	0.905	-0.020	-0.051

Note: Longitudinally weighted estimates based on the SIPP 1984, 2004 and 2008 panels.

Table 2. Model estimates for poverty exits

	1984 Panel, %	2004 Panel,%	2008 Panel, %	Difference 1984-2004	Difference 1984-2008	Difference 2004-2008
	(1)	(2)	(3)	(4)	(5)	(6)
Duration dummies						
1 month	-0.407***	-0.995***	-0.956***	-0.588***	-0.549***	0.039
2 months	-0.639***	-1.074***	-1.275***	-0.435***	-0.636***	-0.201**
3 months	-1.150***	-1.532***	-1.583***	-0.382***	-0.433***	-0.051
4 months	-0.266***	-0.513***	-0.573***	-0.247*	-0.307***	-0.060
5 months	-1.439***	-1.932***	-2.008***	-0.493***	-0.569***	-0.076
6 months	-1.610***	-2.000***	-2.247***	-0.39***	-0.637***	-0.247
7 months	-1.786***	-2.225***	-2.208***	-0.439*	-0.422*	0.017
8 months	-0.828***	-1.053***	-1.131***	-0.225	-0.303*	-0.078
9 months	-2.021***	-2.256***	-2.261***	-0.235	-0.24	-0.005
10 months	-1.845***	-2.379***	-2.505***	-0.534*	-0.66**	-0.126
11 months	-1.967***	-2.238***	-2.288***	-0.271	-0.321	-0.05
12 months	-1.302***	-1.537***	-1.303***	-0.235	-0.001	0.234
13 months	-2.309***	-2.429***	-2.325***	-0.12	-0.016	0.104
14 months	-2.614***	-2.424***	-2.820***	0.19	-0.206	-0.396
15 months	-2.532***	-2.701***	-2.880***	-0.169	-0.348	-0.179
> 15 months	-2.444***	-2.503***	-2.562***	-0.059	-0.118	-0.059
Age 18-34	0.019	-0.003	-0.043	-0.022	-0.062	-0.04
Age 55-64	-0.195***	-0.064	-0.039	0.131*	0.156*	0.025
Age > 65	-0.490***	-0.430***	-0.267***	0.060	0.223**	0.163*
Only black	-0.184*	-0.205***	-0.300***	-0.021	-0.116	-0.095
Hispanic or Asian	-0.124*	-0.087	-0.026	0.037	0.098	0.061
Male	0.036	0.130***	0.077**	0.094***	0.041	-0.053
Single parent	-0.279***	-0.196***	-0.276***	0.083	0.003	-0.08*
Single	-0.297***	-0.235***	-0.348***	0.062	-0.051	-0.113
Uncompleted high school	-0.265***	-0.380***	-0.431***	-0.115*	-0.166**	-0.051
Completed high school	-0.100**	-0.193***	-0.228***	-0.093*	-0.128*	-0.035
N of observations	41366	85332	82771	-	-	-

Note: weighted estimates based on the SIPP data. All coefficients are logit estimates. Standard errors are corrected for clustering of individuals within families. * stands for the significance at .10 level, ** stands for the significance at .01 level, *** stands for the significance at .001 level.