

UNIVERSITY OF KENTUCKY

# Deep and Chronic Poverty in the P.S.I.D.

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Assessing the Panel Survey of Income Dynamics Using  $P\alpha$  &  $K\alpha$  Indices

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Spring, 2014

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## **Executive Summary**

Poverty, while an intuitive concept, proves harder to specify and measure, especially over time. Foster, Greer and Thorebecke (1984) introduced an axiomatically sound, and commonly used poverty index  $P_\alpha$  that is later developed by Foster (2009) to include time spent in poverty. I use their dual-cutoff spells approach to determine the occurrence, depth, and severity of poverty in a longitudinal dataset.

Using the Panel Survey of Income Dynamics over the timeframe 1990-2010, high-risk populations are explored further, especially African Americans, unmarried females, and those without a high school diploma. I explore the proportions of poverty incidence to find head of households without a diploma comprise a decreasing share over time (true of both the general public and the poor). The average years of education has steadily risen for both the poor and nonpoor.

Of those in poverty, African Americans and single females are disproportionately represented as are individuals who have children. These predictors generally correspond to deep poverty, although duration alters the portrait of severity. Single females have lower duration adjusted percentage shortfalls (gap) and severity (gap<sup>2</sup>) than their counterparts. A very small portion of the poor population is in poverty more than 90% of the time. When duration is considered, having children corresponds to the deepest, chronic poverty, followed by African American.

My results are limited mostly by the measurement of resources and cost of living adjustments. Recommendations include changing the source(s) of income and leveraging the nongovernmental/private industry ability to target programs to subpopulations in the most need.

## Introduction

Poverty is defined as, “the state or condition of having little or no money, goods, or means of support.” Other descriptions include a caveat of not having enough resources to meet socially acceptable needs (dictionary.com). While straightforward enough as a human rights concept, the determination of *who* meets the poverty condition and *how* their status is measured proves much more complex. Defining a basic needs consumption basket becomes pivotal to poverty measurement, as does treatment of income and wealth over time.

There are a number of ways to determine if one is in poverty. Depending on the method of specification and aggregation of purchasing power, different pictures may be drawn from the same population. For example, *material hardship* quantifies a lack of goods and services; modeling *consumption* estimates the resources available to purchase those goods and services (Ouellette et al., 2004). There is substantial disagreement surrounding a robust, multidimensional formula to quantify *hardship* (Green, 2009; Mayer & Jencks, 1989). A majority of poverty research, therefore, applies minimum thresholds after monetizing resources and benefits.

Poverty status may result from falling below an absolute threshold, such as a minimum basic needs equivalent, or relative to others in the population, like 50% of a nation’s median income. Simplifying poverty status to falling below either of these thresholds, while intuitive and easily observed, is often criticized for not capturing the true extent of deprivation (Verma & Gagliardi, 2014; Ziliak, 2006). Supplemental evidence is needed to uncover those “deep” in poverty—falling far below the threshold—or consistently experiencing deprivation, the chronically poor.

Introducing the concept of time further compounds the difficult assessment of poverty. Analysts stress the importance of treating short durations differently from long ones, as the chronically poor are characteristically different than the transient poor (Rodgers & Rodgers, 1993; Ulimwengu & Kraybill, 2004; Cellini et al., 2008). That said, there is no clear consensus on a chronic cutoff either. Some describe it as experiencing poverty in five or more years, others more broadly to capture lifetime severity or intergenerational effects. Since there is no agreed upon formula for multidimensional poverty, one-dimensional chronic measures should at the very least capture the severity and duration of poverty (Hulme et al., 2001).

How resources are dealt with over time then becomes essential since liquidating assets or savings might prevent a family from experiencing poverty, despite their total income for that year. Although most working age individuals close to the poverty line have few assets and small savings relative to wages, fluctuations in *transfer* income are an important dynamic for poor families (Band & Ellwood, 1986; Meyer & Wallace, 2009).

## **Literature Review**

For measurement purposes, entering, exiting, and living in poverty ought to satisfy a set of commonly upheld axioms. The more axioms a measure satisfies, the more it should capture the poverty landscape, forming a more complete snapshot of the poor. Unfortunately, no single poverty measure satisfies all proposed inter-temporal axioms and no complete theory exists yet (Cellini et al., 2008). Thus, it is important to recognize model constraints and data limitations when analyzing poverty measurements and/or describing results (Porter & Quinn, 2014).

### ***Poverty Occurrence***

Most individuals will encounter poverty at least once in their lifetime, though it is likely to be short lived. Bane and Ellwood (1986) examine poverty entrance, exit, and duration to find the longer a person is in poverty, the harder it is for them to exit. Their conclusions, along with those of other empirical studies, highlight the disproportionate impact of *chronic* poverty for certain subpopulations, namely: African Americans, female-headed families, and individuals with less than 12 years of education (Rank & Hirschl, 2001; Cellini et al., 2008). While children also have a high risk for chronic poverty, their experience generally mirrors their parents/family (Bane & Ellwood).

Consistent with human capital theory, education is negatively correlated with chronic poverty (Rodgers & Rodgers, 1993). African Americans and female-headed families, however, are disproportionately more likely to re-enter poverty, experience longer durations, and have lower likelihoods of exit (Rank & Hirschl, 2001; Cellini et al., 2008). While the number of Caucasians in poverty usually exceeds the number of African Americans at any point in time, African Americans comprise a larger segment of the chronically poor. Predictably then, female African American head of households without a high school diploma experience more intense poverty than their counterparts (Rodgers & Rodgers, 1993).

### ***Treatment of Resources***

There are two primary methods used in assessing poverty dynamics (measuring resources over time): tabulation and permanent income. The tabulation, or spells, approach counts a person in poverty when their resources fall below a threshold in an observed period. Tabulation restricts resources to the period of measurement and does

not allow wealth to transfer across periods. The spells methodology is often used to examine poverty duration but can also estimate entry / exit probabilities through hazard rate regression estimation (Cellini et al., 2008; Rank & Hirschl, 2001).

In stark contrast, a permanent income approach smoothes the individual's resources over their life and considers them in poverty only when income drops below their [permanent] income-to-needs ratio. While permanent income is useful for regression modeling of poverty, it does not incorporate events or shocks, such as divorce or disability, which may displace a person into poverty (Cellini et al., 2008).

### **Poverty Indices**

A spells approach is utilized in Foster, Greer and Thorebecke's (1984) axiomatically sound poverty index. Used for cross-sectional analysis, it is typically notated as *FGT* or  $P_\alpha$  in the form:

$$(1) \quad P_\alpha(y; z) = \frac{1}{n} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right)^\alpha \quad \text{if } Y_i \leq Z_i$$

$z$  = appropriate poverty threshold,  $y$  = resource measured,

$n$  = sample number,  $q$  = number of poor families, and

Alpha ( $\alpha$ ) is a non-negative number symbolic of poverty *aversion*, where higher values emphasize the poorest of the poor (Foster, Greer & Thorebecke, 1984). When  $\alpha = 0$ ,  $P_\alpha$  reduces to the common interpretation of poverty: a rate or *headcount ratio* ( $q/n$ ). When  $\alpha = 1$ , the equation represents the *per capita income gap*, or the average percentage shortfall from the poverty line. Lastly, when  $\alpha = 2$ , the index represents the average income *gap-squared*, placing more emphasis on those well below the thresholds (Foster, 2009). Ziliak notes the, "squared poverty gap is an intuitive index that provides greater detail on the inequality of poverty," (Ziliak, 2006).

Foster (2009) later incorporates time into the static  $P_\alpha$  measure to create a dynamic  $K_{\alpha,D}$  – where D is a *duration line* specified as the percentage of observations spent in poverty. Equation (2) represents the duration-adjusted index:

$$(2) \quad K_{\alpha,D}(y; z; t) = \frac{1}{nT} \sum_{t=1}^T \sum_{i=1}^q \left( \frac{z_t - y_{i,t}}{z_t} \right)^\alpha$$

Where  $\mathbf{y}$ ,  $\mathbf{z}$ ,  $\mathbf{n}$ , and  $\mathbf{q}$  are defined as in (1)

And  $\mathbf{T}$  = total number of periods.

This “dual-cutoff spells” approach mandates resources be spent in the same period as measured (not transferred across periods), and equally weights all spells (no special treatment for early, late or contiguous spells). The index sums  $P_\alpha$  values for each period a unit meets the duration condition. Both  $P_\alpha$  and  $K_{\alpha,\tau}$  measures are decomposable, allowing for closer examination of subpopulations.

## Problem Statement

The United States Census Bureau releases annual poverty statistics, mainly headcount ratios, using the March Current Population Survey [CPS]. Aside from measurement and threshold quibbles, incidence rates inherently only scratch the surface of poverty depth. Although it is useful to count the number of people in poverty, one should also factor in “*by how much*” they fall short, and “*for how long*” they are suffering. Foster’s duration-adjusted index is a vetted measure that simultaneously includes both aspects.

Using the FGT (1984) and Foster (2009) indices, I examine the depth and chronicity of poverty in a longitudinal dataset, especially for high-risk populations (African Americans / female headed families / no high school diploma). Particularly:



- i. What portion of overall poverty does each group contribute (rate & gap)?  
How *deep* was each group's poverty experience (gap<sup>2</sup>)?
- ii. What are the rate and gap index trends over time and across subgroups?
- iii. How do poverty rates and gaps change for different poverty *durations*?  
Does  $K_\alpha$  change the poverty portrait painted by  $P_\alpha$  for subgroups?

## Research Design

### *Instrument and Variables*

The Panel Survey of Income Dynamics [PSID] is a unique longitudinal survey, beginning in 1968, following sample persons and their split-off families. While it was administered annually until 1997, information is now collected every other year. The original survey employed probabilistic sampling for cohorts and follows only individuals related to sample persons, so weights can be applied for national representation (Rank & Hirschl, 2001). I use *family weights* provided in the sample. Family weights average individual [member] weights, account for non-response, and are appropriate for both cross sectional and longitudinal examination.

Using the PSID, heads of households are identified to proxy a family's poverty status. Poverty status, a dichotomous variable, is determined in the same conventional manner as the U.S. Census Bureau: all sources of family income and cash transfers are included, but taxes, credits, in-kind, and non-liquid benefits are excluded. All transfer and taxable income sources are considered in the pre-tax family resource total  $y$ . A family experiences a poverty spell when their total resources ( $y$ ) fall below the appropriate poverty line  $z$  (Census weighted-average, size-appropriate family thresholds).

### ***Group Identification***

It is critical for subgroups to be consistently identified across all data years. Single females are recognized as unwed head of households, regardless if they are living with a cohabitating partner (i.e. live-in boyfriend). The condition “with children” is met only when one or more children are living in the family unit. Individuals without a high school diploma are included only if it is *known* they did not achieve this, or have a GED equivalency (i.e. not included if response was unknown, refused, or out-of-country education). African Americans are identified if the head of household is “black.”

### ***Time Considerations***

Data points skip every other chronological year and capture an income time frame spanning 1990 – 2010. A family may experience eleven total poverty spells (T=11) in this twenty year span. Although a forced constraint after 1997, skipping every other year also improves the likelihood that resources will not transfer across observations. Because twenty years separates the first and last observations, it is important to adjust all money for inflation. Both the poverty thresholds and family income are converted to constant 2010 dollars using CPI indices provided by the Census Bureau. Inflation adjusted poverty thresholds used in this analysis are listed in *Appendix A*.

Tracking families over time in the PSID requires merging datasets for families and individuals. Careful attention is paid to this step and follows a strategy provided by the University of Michigan’s Institute for Social Research, administrator of the survey. Family data is first merged with individual data on a year by year basis; followed by a

panel merge matching two identifier variables. This method follows the head of household to represent a family unit across time.

Duration, or the percent of time spent in poverty, is also considered. It is important to note duration does not require a unit remain in the dataset for all observations. Rather,  $D$  is taken as the percent of a person's *observed periods* spent in poverty.

## **Results & Discussion**

### ***Descriptive Qualities***

There are some noticeable, though not surprising, traits about the panel dataset. In general, the average age (49 years) of family heads and the number of family members (approximately 2.3 people) are very close for both the poor and non-poor.

The average years of education for those in poverty has steadily risen from 10.0 years in 1990 to 11.7 years in 2010. There is an upward trend in educational attainment for the non-poor and general populations as well, each gaining an average of one grade level over this twenty year span.

The poor have more children on average than others and are much more likely to be female. Thus, subpopulations “with children” (including male head of households), “single female with children” and “African American single female with no diploma and children” are created. Part of my aim in choosing these subcategories is to test the “feminization” of poverty.

### ***P<sub>0</sub>, P<sub>1</sub>, and P<sub>2</sub>***

Using equation (1), the  $P_\alpha$  index for families in poverty is calculated, per year. Table 1 lists the  $P_\alpha$  index values for anyone in poverty. Poverty rates ( $P_0$ ) are slightly

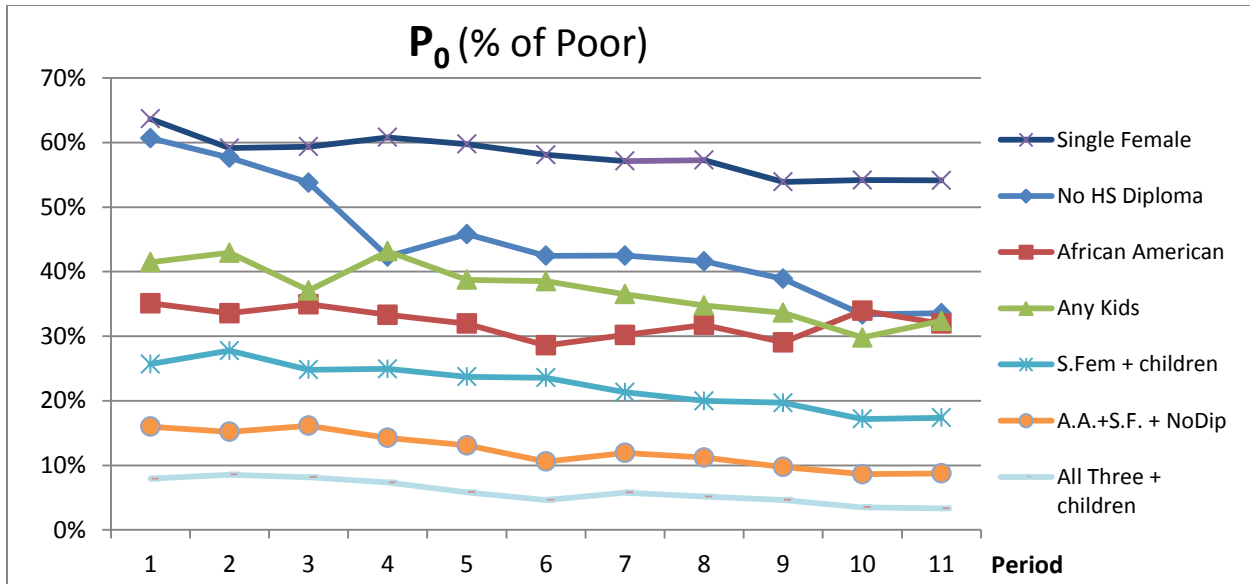
lower than Census Bureau estimates. This is not surprising, though, given the dissimilar ways each survey defines a family (marriage vs. cohabitating couples). The PSID has also historically accounted for more transfer income than the March CPS.

<i>Period</i>	1	2	3	4	5	6	7	8	9	10	11
Income Yr.	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
All $P_0$ (%)	12.2	12.5	11.5	11.8	10.3	8.5	9.5	9.8	10.7	10.7	11.5
All $P_1$ (%)	38.4	44.9	47.2	45.3	45.4	47.6	45.2	42.5	46.2	40.2	44.0
All $P_2$	22.7	29.5	33.0	31.7	44.0	50.6	35.3	29.6	32.0	25.4	30.4

**Table 1:**  $P_\alpha$  All in Poverty, by year

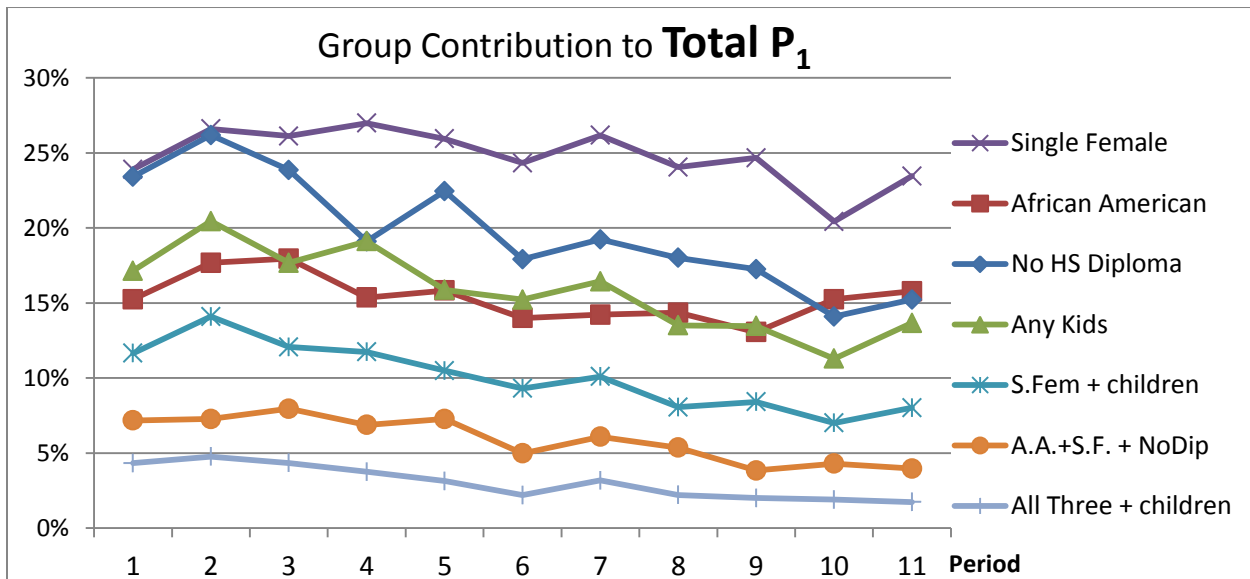
Cross sectional results show the average poor family's income falls 40%-45% below the poverty line. Severity, or  $P_2$ , is highest during period six, corresponding to income year 2000. This year is also the only instance when the overall  $P_2$  measure is greater than  $P_1$ , an abnormality resulting from outlier data. Some families exhibiting large *negative* net incomes bias overall scores upward but are retained for veracity.

Next, the subgroup contribution to overall poverty is calculated. Headcount ratios ( $P_0$ =rate) and average percentage shortfalls ( $P_1$ =gap) are calculated for the subgroups, illustrated in Figures 1 and 2. Together, the two figures depict decreasing trends for most subpopulations, especially unmarried females and heads without a diploma.  $P_0$  and  $P_1$  trends for African Americans remain fairly constant.



**Figure 1:** Percentage of poverty contributed from each subgroup, by year

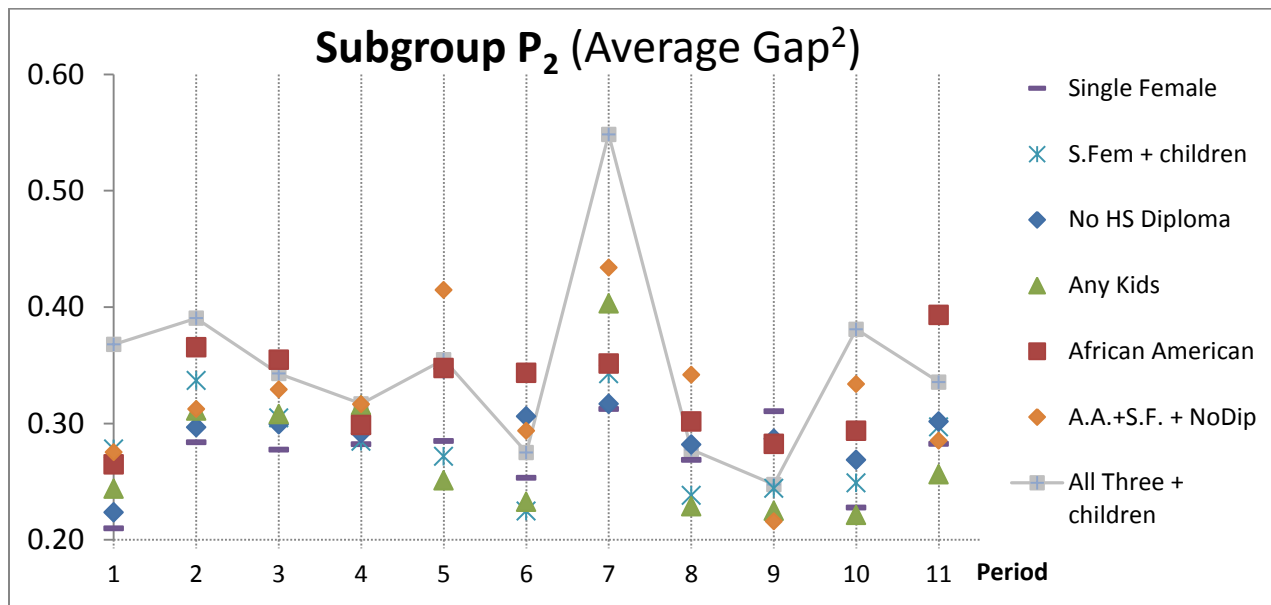
Single females consistently make up the largest portion of the average poverty gap.



**Figure 2:** Subgroup contribution (%) to average income gap of all poor, by year.

Figure 3 shows the gap<sup>2</sup>, or severity measure, for subgroups. Consistent with prediction, African American single mothers without a diploma have P<sub>2</sub> measures that are nearly always greater than the four subcategories separately, though this is not

always the case. Of the at-risk populations examined, the three subgroups containing black head of households tend to have the greatest  $P_2$  scores, though this is not always the rule. By contrast, households with any children and/or headed by single females (of any race) see some of the lowest severity scores—suggesting these units have higher average family incomes than their counterparts



**Figure 3:** Average gap-squared (severity) for each subgroup, by year

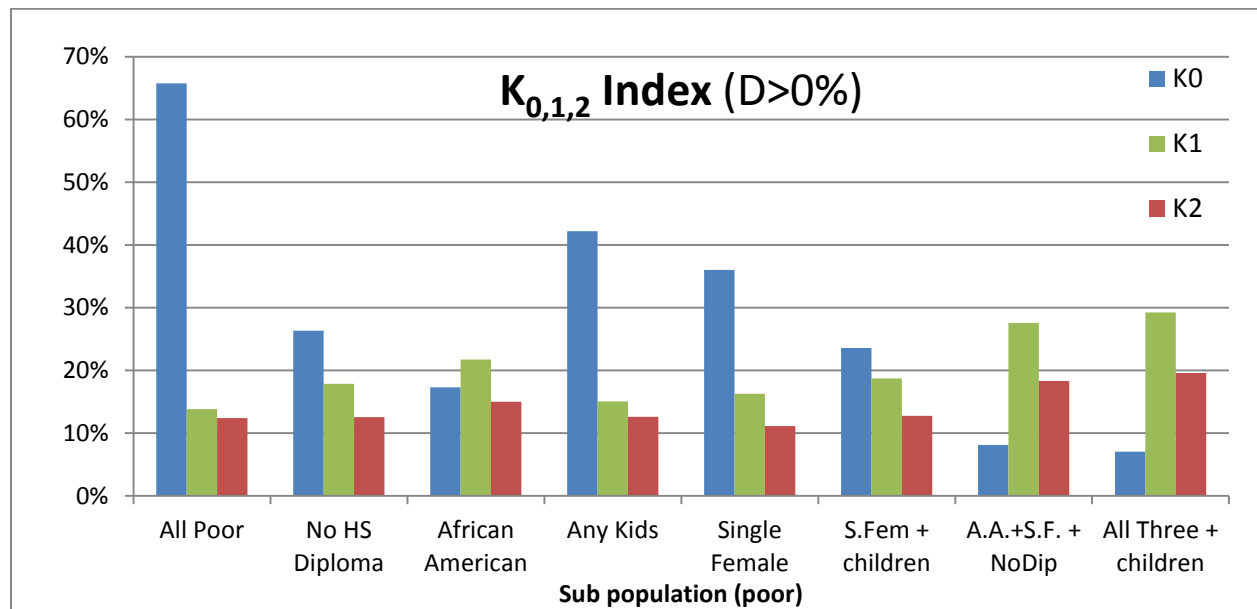
Comparatively,  $P_2$  trends are volatile. At times the scores are very close in value—periods three, four and nine—so it is difficult to draw strong conclusions from Figure 3.

### ***K<sub>0</sub>, K<sub>1</sub>, and K<sub>2</sub>***

To grasp a more complete picture of severity, the duration [ $D$ ] in poverty is considered. The interpretation of  $K_{\alpha,D}$  reads: of the total spells spent in poverty, the rate experiencing poverty at least  $D\%$  of time is  $K_0$ . Similarly,  $K_1$  (or  $K_2$ ) is the portion of poverty gap (or gap<sup>2</sup>) captured by [subgroup] if duration is at least  $D\%$  of time.  $K_\alpha$  values

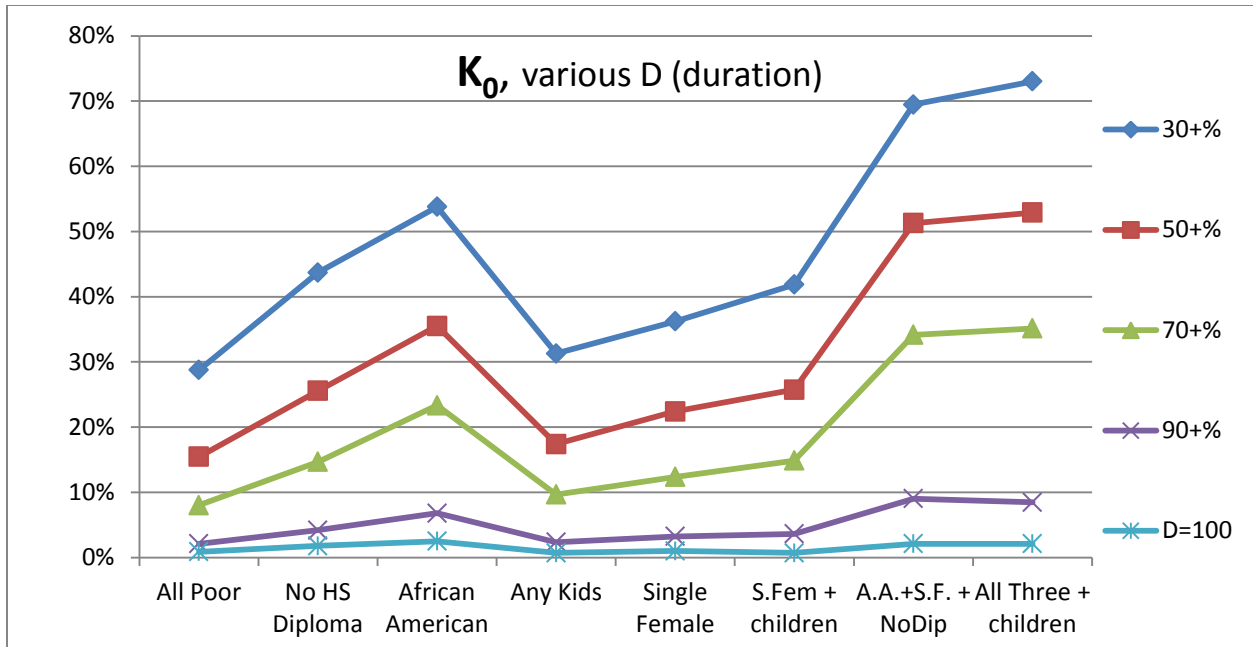
are presented in table format in *Appendix B*, while Figures 4 through 7 offer visual depiction, separated by subpopulation.

Figure 4 illustrates the  $K_{\alpha}$  rate for persons experiencing at least one spell of poverty. Two-thirds of the population encounters at least one poverty spell while the average income shortfall is around 14%. Households with children or who are unmarried females are particularly susceptible to poverty incidence. African American single females without a diploma (with or without children) have the largest average income shortfalls.

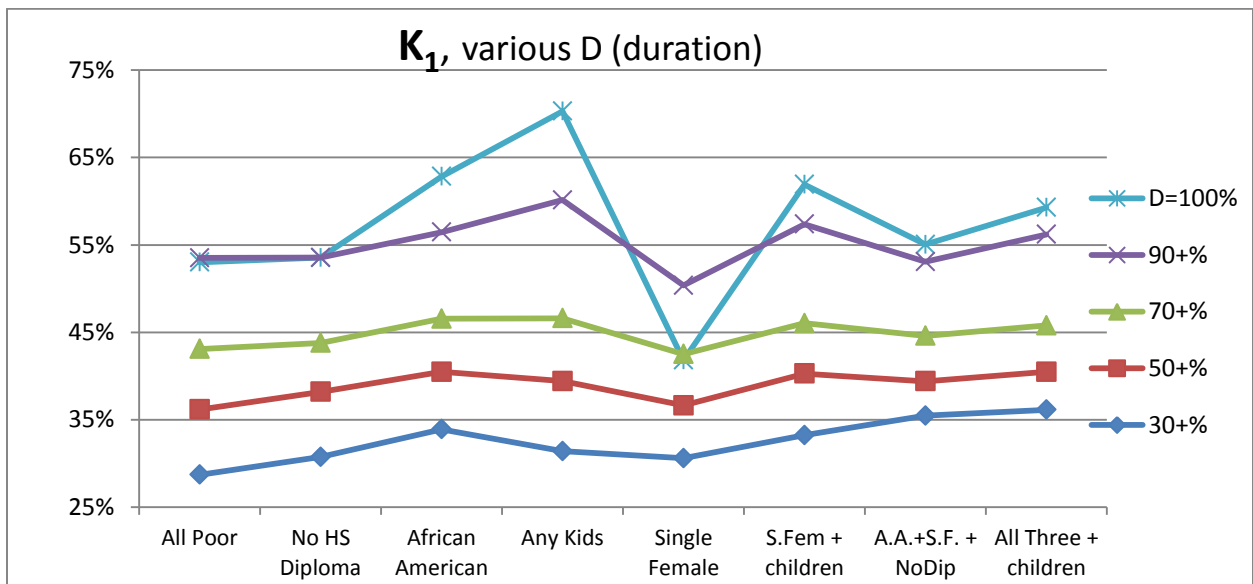


**Figure 4:** Overall  $K_{\alpha}$  scores (All poor) alongside subgroup contribution (%) to the duration-adjusted index, 1 or more poverty spells.

Figures 5, 6 and 7 illustrate  $K_{\alpha}$  rates when poverty duration is greater than 30%. Example conclusions drawn from Figure 5 read: 73.0% of African American single mothers without a diploma were in poverty 30+% of the time while 35.1% of this demographic was in poverty at least 70% of the time.  $K_0$  trends for male and female African American populations are consistently high for all durations.



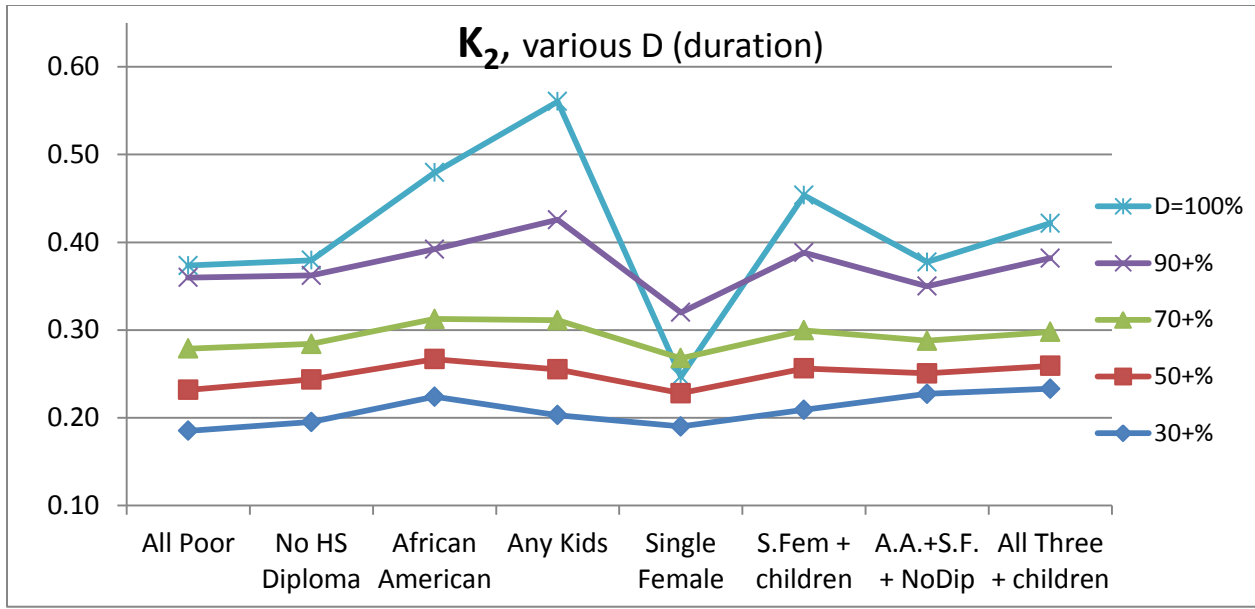
**Figure 5** : Duration-adjusted poverty rates ( $K_0$ ), overall and by subpopulation.



**Figure 6** : Duration-adjusted income gaps ( $K_1$ ), all poor and by subpopulation.

One interesting result is that even though families with children have some of the lowest  $K_0$  rates, they have deeper  $K_1$  and  $K_2$  poverty severity, especially for durations greater than 90%. Of the subgroups examined, having children corresponds to greater severity ( $K_2$ ) for the chronically poor, regardless of the head's race or gender.





**Figure 7:** Duration-adjusted severity measure ( $K_2$ ), by subpopulation.

Another finding not apparent in cross-sectional results, single females have lower duration adjusted percentage shortfalls (gap) and severity (gap<sup>2</sup>) than their counterparts. Single females are also the *only* category with 100% duration in better “standing” than those with duration greater than 70%, suggesting some of the worst off in this category did not live in poverty the entire time.

## Limitations

Limitations result from a number of assumptions made in calculating the poverty indices. First, geographic location is not considered in my analysis and the cost of living is assumed to be the same for all individuals. Small scale examination might prove useful to state or local authorities and reveal nuanced rural or urban poverty severity.

Second, measuring very liquid forms of income prevents noncash benefits or transfers—such as food stamps, in-kind subsidies, and tax credits—from being included in the results. Monetizing consumption and tax-based assistance partially fills the

income gap and may lift a family out of poverty in terms of disposable income. I chose the traditional way of measuring poverty mainly because supplemental data were not available before survey year 1999.

## **Recommendations**

The family income measured makes it difficult to ascertain dependency on public assistance, primarily due to most welfare programs taking the form of in-kind subsidies rather than cash transfers. Future study should incorporate additional, or different, dimensions for the resource measure  $y$ . Examining the *sources* of income might reveal yet a different portrait of poverty. Still, some implications arise from my results, mainly:

- The time spent in poverty should be considered when describing severity. Falling below a poverty threshold is a valid, commonly used cross-sectional measure but duration changes the analysis for certain populations.
- Unmarried females comprise a large portion of poor but African Americans have more persistent and chronic poverty. Given fairly acute trends, societal or structural dynamics related to income inequality should be considered further.
- Of the very chronically poor ( $D > 90\%$ ), families with children are “worst off,” regardless of race or gender. Large income disparities for these families indicate programs impacting children should continue to be funded.

Due to risk of discrimination, direct government intervention based on race, gender, or family status (having children)—is very unlikely. The Fourteenth Amendment to the U.S. Constitution permits *nongovernment* organizations the freedom to discriminate—or target programs based on certain demographics—but prohibit federal, state or local agencies from doing the same. Therefore, the private and nonprofit

industries have more leverage and ability to fill income shortfalls with intentional targeting, such as situational perks or skill building. An example of selective targeting could include working in collaboration with nongovernmental agencies and the private sector to create incentives to working with these at risk populations. While the federal government cannot directly target specific demographic further legislation could be promoted to include those populations who are most destitute.

## **Conclusion**

Upon reviewing the poverty rates, average percentage shortfalls, and average gap<sup>2</sup> calculations, many trends appear that were expected but some were also surprising. High poverty prevalence ( $P_0$  and  $K_0$ ) for single females and African Americans did not always indicate these populations were the “worst off.” In fact, when duration is considered, having children corresponds to the deepest, chronic poverty, followed by African American. Future study could incorporate cost of living adjustments, and/or explore the impact of different income sources on index estimations.

## Appendix A – Poverty Thresholds

Census (age-weighted average) Official poverty thresholds, in constant 2010 dollars

Index Ratio	Income Year	Individ 1	Fam 2	Fam 3	Fam 4	Fam 5	Fam 6	Fam 7	Fam 8	Fam 9+
1.668	1990	11098	14196	17383	22288	26347	29762	33769	37675	44792
1.554	1992	11102	14201	17385	22280	26347	29743	33562	37383	44676
1.471	1994	11104	14215	17393	22278	26337	29773	33728	37412	44582
1.390	1996	11111	14222	17394	22286	26339	29726	33727	37650	44433
1.338	1998	11125	14226	17395	22287	26327	29736	33788	37680	44600
1.266	2000	11132	14227	17399	22292	26358	29800	33873	37610	44510
1.212	2002	11131	14249	17391	22293	26356	29788	33940	37462	44923
1.154	2004	11135	14239	17391	22287	26354	29767	33745	37679	45091
1.082	2006	11134	14242	17391	22297	26372	29810	33752	37612	44886
1.013	2008	11132	14231	17382	22307	26382	29833	33958	37696	44913
1.0	2010	11137	14216	17373	22315	26442	29904	34019	37953	45224

## Appendix B – $K_{\alpha,D}$ Values

D = duration = % of observations spent in poverty

$K_0$	D >0%	D >30%	D >50%	D >70%	D >90%	D=100%
<b>All Poor</b>	65.8%	28.8%	15.5%	8.0%	2.1%	0.9%
No HS Diploma	26.3%	43.7%	25.6%	14.7%	4.2%	1.8%
African American	17.3%	53.8%	35.5%	23.3%	6.8%	2.5%
One or more kids	42.2%	31.3%	17.4%	9.7%	2.3%	0.7%
Single Female	36.0%	36.2%	22.4%	12.4%	3.2%	1.0%
S.Fem w. Kid(s)	23.6%	41.9%	25.7%	14.9%	3.6%	0.7%
AfAm S.F. w. NoDip	8.1%	69.5%	51.3%	34.1%	9.0%	2.1%
AfAm SF noDip + Kid(s)	7.0%	73.0%	52.9%	35.1%	8.5%	2.1%

$K_1$	D >0%	D >30%	D >50%	D >70%	D >90%	D=100%
<b>All Poor</b>	13.8%	28.7%	36.2%	43.1%	53.5%	53.0%
No HS Diploma	17.8%	30.7%	38.2%	43.8%	53.6%	53.6%
African American	21.7%	33.9%	40.5%	46.6%	56.5%	62.8%
One or more kids	15.0%	31.4%	39.4%	46.6%	60.1%	70.3%
Single Female	16.3%	30.6%	36.6%	42.5%	50.4%	41.8%
S.Fem w. Kid(s)	18.7%	33.2%	40.3%	46.0%	57.4%	61.9%
AfAm S.F. w. NoDip	27.5%	35.5%	39.4%	44.6%	53.1%	55.1%
AfAm SF noDip + Kid(s)	29.2%	36.1%	40.5%	45.8%	56.2%	59.3%

<b>K<sub>2</sub></b>	<b>D &gt;0%</b>	<b>D &gt;30%</b>	<b>D &gt;50%</b>	<b>D &gt;70%</b>	<b>D &gt;90%</b>	<b>D=100%</b>
<b>All Poor</b>	12.4	18.5	23.2	27.9	36.0	37.4
No HS Diploma	12.6	19.5	24.4	28.4	36.2	37.9
African American	15.0	22.4	26.7	31.3	39.2	47.9
One or more kids	12.6	20.3	25.5	31.1	42.6	56.0
Single Female	11.1	19.0	22.8	26.8	32.0	24.7
S.Fem w. Kid(s)	12.7	20.9	25.6	30.0	38.8	45.4
AfAm S.F. w. NoDip	18.3	22.7	25.1	28.8	35.0	37.8
AfAm SF noDip + Kid(s)	19.6	23.3	25.9	29.8	38.2	42.2

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