Title: The poverty balancing equation: Expressing poverty of place as a population process

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The measurement of poverty is essential for the development of effective poverty policy. Unfortunately, approaches using poverty rates to assess the causes and consequences of poverty do not fully capture the components of change in the poverty population. This is because changes in the conventional poverty rate can occur due to processes of natural increase, migration, or transitions in and out of poverty. This paper presents an accounting framework for changes in poverty within and between places. The framework, termed the poverty balancing equation, generates a series of summary statistics which can be used in place of the conventional poverty rate in future research. The approach is then demonstrated using the 2014 panel of the Survey of Income and Program Participation to generate state-level estimates of the poverty components of change for three states in the American South between January and December of 2013. Results show that even when poverty rates remain constant, there is significant dynamism within poor and non-poor populations. By applying this approach, either completely or in-part, researchers can provide more specific and actionable evidence for poverty alleviation policy.

Key words: Poverty; Migration; Mortality; Fertility; Poverty Balancing Equation; SIPP

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1. Introduction

The negative ramifications of poverty on people, both immediate and long-term, have been well documented by demographers and other social scientists. Experiencing poverty leads to lower physical and mental well-being (Burton et al., 2013; Desmond and Western, 2018; Dreyer, 2019; MacTavish, 2007; Rhubart and Engle, 2017) and decreased social mobility (Chetty et al., 2014; Desmond and Western, 2018), while also predisposing individuals to later bouts of poverty and cumulative negative impacts throughout the life course (Barrett et al., 2016; Larrimore et al., 2020; Musick and Mare, 2006; Rank and Hirschl, 2009). Although poverty occurs at the level of the individual, scholars frequently focus on poverty of place (e.g. the level of poverty in a region). The reason for this is two-fold. First, person-level data with detailed geographic information can be difficult to obtain, making aggregate studies a pragmatic approach when geography is of interest. Second, both empirical research and theory often intentionally focus on place-based policies, effects, outcomes, and causes. Research has consistently found that exposure to concentrated poverty, even absent of poverty at the individual level, can have a host of negative socioeconomic outcomes (Chetty et al., 2014, 2016; Sampson et al., 2002; Sampson, 2008). Further, many theories of the causes and consequences of poverty argue that social structure and place-based policies, not individual behaviors, are the ultimate drivers of poverty among populations (Brady, 2019; Tickamyer and Wornell, 2017).

Although the study of poverty of place is robust, with a vast body of literature beyond the scope of this paper, the *accounting* of the dynamics of poverty populations within and between places remains underdeveloped. Scholars have frequently argued about the correct way to determine if someone is poor, with some advocating absolute measures of poverty, others arguing for relative approaches, and some advocating for approaches which move beyond income and into the capabilities income provides (Brady, 2003; Hutto et al., 2011; Iceland, 2005, 2013; Sen, 2014). Although the importance of this ongoing conversation surrounding poverty determination cannot be overstated, all of the popular approaches generally produce a single threshold of poverty. Poverty of place research then uses one of these dichotomous measures at the individual level to produce an aggregate poverty rate. The poverty rate is a percentage of those classified as poor relative to the total population and is what is generally used as the variable of interest in place-based studies of

poverty. Depending on study goals, researchers assess the impact of changes in the poverty rate on outcomes, or changes in independent variables on the poverty rate. Unfortunately, this approach does not fully capture the population dynamics of poverty occurring across space.

The reason the conventional poverty rate is insufficient is because the poverty rate of a place can change through six different factors: births, deaths, in-migration, out-migration, transitions into poverty, and transitions out of poverty. Thus, using the conventional poverty rate as the dependent variable does not tell us *how* poverty is changing within a region. It only tells us that it *is* changing. This poses significant ramifications for both policy design and evaluation. If the goal of a policy is to transition people out of poverty, processes of migration and natural increase could very well mask the efficacy of said policy. Further, a region may have a stable poverty rate, while still having a considerable portion of the population transitioning into poverty. This is because transitions into poverty can be masked by a disproportionate in-migration of the non-poor. Thus, the conventional poverty rate can lead policy-makers to incorrectly believe poverty is not on the rise, or even on the decline, depending on the differential population processes occurring within the poor and non-poor populations.

In order to address these difficulties, the purpose of this paper is to present a framework, termed the population balancing equation, which allows researchers to assess these factors individually, and in doing so fully captures the way poverty is changing within and between places. This framework is a valuable and necessary step for advancing poverty scholarship. It provides a common language from which more precise poverty scholarship can proceed, while clearly articulating new summary statistics which can be calculated with both public and restricted data in future model-based and descriptive poverty alleviation efforts. Following the presentation of the framework, I then demonstrate the approach using the first wave of the 2014 Survey of Income and Program Participation (SIPP) to generate estimates of the components of change in the poverty population for three states with different poverty trajectories in the American South—a region known for its disproportionately high levels of poverty relative to the rest of the United States (Baker, 2019)—between January and December of 2013.

2. Prior Work on Poverty and Population Processes

Researchers have frequently assessed specific demographic processes among the poor. Although, to the authors knowledge, there is scant work focused on aggregate natural increase of the poor, the independent factors of mortality and fertility have received significant attention and are often selective on poverty. Elevated levels of poverty have been consistently related to higher rates of all-cause, cancer-related, child, and infant mortality (Cohen et al., 2003; Marcus et al., 2017; Moncayo et al., 2019; Pool et al., 2018; Pritchard and Keen, 2016; Sims et al., 2007; Smith and Waitzman, 1994; Taylor-Robinson et al., 2019; Toprani et al., 2016). Further, fertility among poor households has been found to be higher than fertility among the non-poor, with the risk of an infant being born into poverty increasing with each additional child (Thiede et al., 2018), and fertility declining faster among non-poor households than poor households over the past 50 years (Lichter, 1997).

Similar to mortality and fertility, there is a sizeable body of work on migration and poverty, both on the poverty of immigrants (Chapman and Bernstein, 2003; Bárcena-Martín and Pérez-Moreno, 2008; Crowley et al., 2006; Joo, 2013; Kazemipur and Halli, 2000; Lichter et al., 2005; Peri, 2011; Smith and Ley, 2008; Raphael and Smolensky, 2009; Thiede and Brooks, 2018; Van Hook et al., 2004), as well as the migration patterns of the poor (Allard and Danziger, 2000; Christiaensen et al., 2019; Cushing, 2005; Foulkes and Newbold, 2008; Foulkes and Schafft, 2010; Frey, 1995; Frey et al., 1996; Levine and Zimmerman, 1999). Unlike the consistent findings of higher fertility and mortality among those in poverty, research on the migration of the poor has been more varied in findings and focus. Research on the migration of the poor as it relates to welfare policy has focused on whether or not generous welfare policies act as ‘magnets’ for the poor (Allard and Danziger, 2000; Cushing, 2005; Frey et al., 1996; Levine and Zimmerman, 1999). Evidence suggests generous welfare policies have either modest (Cushing, 2005; Frey et al., 1996), or no effect on migration (Allard and Danziger, 2000; Levine and Zimmerman, 1999). Beyond welfare magnet research, work on North American poverty has found poverty is generally elevated among immigrant households and the children of immigrants (Crowley et al., 2006; Kazemipur and Halli, 2000; Lichter et al., 2005; Thiede and Brooks, 2018; Van Hook et al., 2004).

Beyond the bedrock population processes of mortality, fertility, and migration, the poverty rate can also change due to transitions in and out of poverty among those in the population. Although

the notion of poverty being a consistent status shared by those in an ‘underclass’ of society persists, this has never really been true and has only become less so in the modern era (Sandoval et al., 2009). Individual spells of poverty are often brief, with most spells of poverty only lasting one or two years (Rank and Hirschl, 2002). Further, the proportion of the population which will experience at least one bout of poverty in their lives is quite high, with the majority of Americans experience at least one bout of poverty by age 85 (Rank and Hirschl, 1999, 2001, 2015). As noted by Sandoval et al. (2009), this means that even if the aggregate poverty rate stays constant year to year, there can be considerable movement in and out of poverty within the population. Although work on transitions in and out of poverty—particularly the work done by Rank and Hirschl—has successfully demonstrated the dynamic and widespread nature of poverty, it ultimately maintains a focus on poverty of people, as opposed to poverty of place.

The work most methodologically aligned with the framework presented in this paper focuses on the role population composition plays in determining the level of poverty within regions (Chapman and Bernstein, 2003; Christiaensen et al., 2019; Foulkes and Schafft, 2010; Joo, 2013; Wright, 1996). This work targets the effect of migration on changes in aggregate poverty rates and empirically demonstrates how the poverty rate of a place can change due to processes besides changes in income. For example, relying on a conventional demographic decomposition techniques, which both Chapman and Bernstein (2003) and Wright (1996) refer to as a ‘shift-share’ technique, Chapman and Bernstein (2003) decomposed how much of a change in poverty rates was due to changes among migrants versus non-migrants in the United States; finding the increase in migrants was not a significant factor in the lack of poverty decline from 1989 to 1999.

Christiaensen et al. (2019) presented an analysis using a similar approach to assess changes in poverty rates due to migration in Tanzania and found that moves from urban to rural areas decreased aggregate poverty more than moves from rural to urban areas. From a different angle, Joo (2013) used a Oaxaca-Blinder decomposition to determine how much of the change in United States child poverty from 1993 to 2010 was due to the increase in children living in immigrant households versus other population factors. Joo (2013) found that the proportion of children in immigrant households did not play a significant role in the changes in poverty rates over the study period. Finally, Foulkes and Schafft (2010) used census migration data to assess the migration patterns of the poor, and determine how those migration patterns reinforced concentrated poverty.

Results showed that migration rates were higher among the poor than the non-poor, and that the poor moved in a pattern which increased the concentration of poverty within regions (Foulkes and Schafft, 2010).

The work of Foulkes and Schafft (2010), as well as the decomposition studies performed by Chapman and Bernstein (2003), Christiaensen et al. (2019), and Joo (2013), all address the core problem posed by the conventional poverty rate, while only providing partial solutions. The stated studies assessed only the effect of migration on the level of poverty within regions. This focus, while valuable, limits the ability for researchers to compare the various forces driving changes in the poverty level of a region (e.g. migration vs. natural increase vs. changes in resources). The reliance upon the decomposition of aggregated data limits the expansion of research questions on this topic, as the conventional poverty rate remains the ultimate dependent variable. Further, the decomposition methods used in these papers, while valuable for comparing migrants to non-migrants or the poor to the non-poor, break down when we attempt to account for all of the components of change in the poverty population at once.

In sum, although the demographic processes of the poor have received significant attention in the academic literature, there is a notable lack of work assessing the specific ways the poverty population is changing within and between places. The dearth of literature assessing the population dynamics of poverty of place, as well as the methodological limitations posed by the work that does exist, highlights the need for a more comprehensive approach for assessing changes in poverty. The goal of many poverty alleviation policies is lifting people out of poverty. But if we do not separate changes in aggregate poverty due to transitions in and out of poverty from changes due to migration or natural increase, then any estimates of policy impacts will be biased. In order to remedy this discrepancy in the literature, the framework outlined in the next section builds on the demographic balancing equation to provide a more comprehensive framework for assessing poverty dynamics.

3. Poverty as a Population Process

3.1. Components of Population Change in the Poverty Population

Before discussing the specifics of the poverty balancing equation and its relevant counterparts, an introduction of the components of change relevant to the case of poverty is necessary. As with

any population, the poverty population is only able to change due to a handful of mechanisms. There are only three processes by which the poverty population changes: natural increase,¹ net migration,² and net poverty transitions. These three processes are comprised of six factors: births, deaths, in-migration, out-migration, transitions into poverty, and transitions out of poverty.

When considering the size of the total population in a region, natural increase and net migration are the only processes we need to consider. However, when we move to the poverty population of a region there is one more important process, poverty transitions. This process, which I will refer to in formulas as $NPov$ and $NAff$,³ accounts for the entry and exit of individuals from the poor or non-poor populations through the changing ratio of household income to the poverty threshold among the constant population (i.e. those present in the region at the start and end of the period). The poverty balancing equation framework is agnostic to the measure of poverty used. All that is assumed is that the poor and non-poor are defined using a dichotomous criteria. Thus, relative measures or absolute measures using any version of income calculation can be applied.

Net poverty transition is presented in Equation 3 where F represents those who enter into the poverty population because their income fell below the poverty threshold and C represents those who exit the poverty population because their income has climbed above the poverty threshold. Equation 4 presents the inverse of this for net poverty transition among the non-poor population.⁴

¹Natural increase is simply the difference between births and deaths in the population and is presented in Equation 1 where B is births and D is deaths (Rowland et al., 2014). Natural increase tells us how much the population would have grown or shrunk if there was no migration or resource dynamic in the population.

$$NI = (B - D) \tag{1}$$

²Net migration accounts for population change due to the difference between in-migration and out-migration of a region (Rowland et al., 2014). Presented in Equation 2 where I represents immigrants and O represents outmigrants, net migration allows us to isolate the impact of migration on population change within a region.

$$NM = (I - O) \tag{2}$$

³Although affluent and non-poor are not synonymous, I use Aff to refer to the non-poor in the notation of this framework to ensure the notation can be quickly interpreted, thus Aff functions as a valuable trigger in the same way that Pov quickly provokes the idea of poverty.

⁴The term net poverty transition is adopted, as opposed to something like net income dynamic, because this process is measured by the ratio of income to the poverty threshold, not changes in personal income. As poverty thresholds adjust for family size, constant residents can enter the poor population by either losing income, or increasing the size of their family. For example, if a household of four was above the poverty threshold, but then had a birth which raised their poverty threshold and they did not generate more income, the whole family would now be considered

These three mutually exclusive processes, natural increase, net migration, and net resource dynamic, form the building blocks of the poverty balancing equation framework.

$$NPov = (F - C) \quad (3)$$

$$NAff = (C - F) \quad (4)$$

3.2. The Poverty Balancing Equation

The framework I present builds on the standard population balancing equation presented in Equation 5 where Pop_2 represents the population at time two, Pop_1 represents the population at time one, NI is natural increase in the time period, and NM is net migration in the area during the time period.

$$Pop_2 = Pop_1 + NI + NM \quad (5)$$

Although this formula is used to understand changes in the total population, with minor modifications we can adapt it to the population in poverty. For a given region, the population in poverty in that region can be expressed as the extension of Equation 5 presented in Equation 6. In this equation, Pov_2 represents the population in poverty at time two, Pov_1 represents the population in poverty at time one, NI_{pov} is the natural increase of the poverty population during the time period, NM_{pov} is the net migration of those in poverty to the region, and $NPov$ is the net poverty transition among those within the population at the start and end of the period.

poor. This would be counted at the end of the study period as one poor birth and four increases to the poverty population due to poverty transitions.

$$Pov_2 = Pov_1 + NI_{pov} + NM_{pov} + NPov \quad (6)$$

Although the formula in Equation 6 fully captures the unique ways an individual can move into or out of the poverty population in a region, it does not fully account for the other changes within a population. Take for example the in-migration of those in poverty captured by NM_{pov} . This in-migration does not have clear meaning unless we also account for the net migration of the non-poor population. We can express these dynamics of the non-poor in a similar manner to the way the population dynamics of those in poverty are expressed in Equation 6. This is done in Equation 7 where Aff_2 is the population of a region not in poverty at time two, Aff_1 is the non-poor population of a region at time one, NI_{aff} is the natural increase of the non-poor population, NM_{aff} is the net migration of the non-poor population, and $NAff$ is the net poverty transition of the non-poor population.

$$Aff_2 = Aff_1 + NI_{aff} + NM_{aff} + NAff \quad (7)$$

To understand all dynamics of the total population while accounting for the unique dynamics of $NPov$ and $NAff$, we can combine these equations. Equation 8 shows that the total population of a region at time two is simply the sum of the poor population and the non-poor population at time two. Substituting Equations 6 and 7 in Equation 8, Equation 9 shows that Pop_2 is the sum of two linked balancing equations.

$$Pop_2 = Pov_2 + Aff_2 \quad (8)$$

$$Pop_2 = Pov_1 + NI_{pov} + NM_{pov} + NPov + Aff_1 + NI_{aff} + NM_{aff} + NAff \quad (9)$$

Importantly, Equation 9 simply reduces to Equation 5. This is because the sum of $NPov$ and $NAff$ will always equal zero due to their calculation, and the other components sum to the components of change for the entire population. This collapsing nature highlights the full logic of the accounting exercise, while illustrating the fact that we can understand changes in the total population from the perspective of relative changes in the poor and non-poor population. Equations 10 and 11 show that the poor and non-poor components of change sum to the total population components of change and can be arranged to produce the share of each component due to the poor versus the non-poor. This is presented in terms of births, B , and share of births, $B\%_{pov}$, but can be calculated for deaths, immigrants, and outmigrants.⁵ It cannot be calculated with $NPov$ or $NAff$ due to their cancelling nature. The formulation presented in Equation 11 allows us to answer the question, “what percent of births in the overall population is made up of poor births?”

$$B_{pop} = B_{pov} + B_{aff} \quad (10)$$

$$B\%_{pov} = \frac{B_{pov}}{B_{pop}} * 100 \quad (11)$$

The linked nature of poverty transitions between the poor and non-poor populations highlights the difficulties the conventional poverty rate poses for a full accounting of the ways poverty of place can change, and thus the necessity of the approach detailed here. Equation 12 shows that the conventional poverty rate, PR , is a result of the ratio of the poverty population Pov_2 to the total population Pop_2 . As shown in Equation 8, Pop_2 is simply the sum of both Pov_2 and Aff_2 . Thus, when we substitute Equation 9 into Equation 12 we end up with Equation 13. This equation shows the difficulties of accounting for the population processes underlying changes in the conventional poverty rate. Changes in each component of change for the poverty population influence both the numerator and the denominator. Further, changes in the non-poor population influence the

⁵Although Equation 10 holds for the net components (e.g. natural increase), Equation 11 becomes uninterpretable when calculated using net components due to the opposing nature of constituent terms (e.g. births and deaths).

denominator, changing the interpretation of a change in the poverty population captured by the numerator. This changing denominator via linked populations makes traditional demographic decomposition of changes in poverty rates impossible while accounting for all poverty population dynamics. Thus, it is impossible to answer questions such as, "what portion of the change in overall poverty rate is due to the migration of the poor?" while also accounting for the coterminous population processes occurring among the non-poor segment of the population.

$$PR = \frac{Pov_2}{Pop_2} \quad (12)$$

$$PR = \frac{Pov_1 + NI_{pov} + NM_{pov} + NPov}{Pov_1 + NI_{pov} + NM_{pov} + Aff_1 + NI_{aff} + NM_{aff}} \quad (13)$$

Although the conventional poverty rate is limited in its ability to fully represent how poverty is changing in a place, by relating the poverty rate at the end of the interval to the share of each population component contributed by the poor during the interval (e.g. $B\%_{pov}$), we can understand the activity of the poor relative to their presence in the population. This approach is presented for births in Equation 14, where $B\%_{pov}$ is divided by the poverty rate at the end of the interval PR . This value can be calculated for all non-net population factors. If this value equals 1, then the poor in a region are contributing to the population factor (e.g. births) at a level representative to their prevalence in the population. If it is greater than 1 they are overrepresented, and if it is less than 1 then they are underrepresented.

$$B\%_{pov:PR} = \frac{B\%_{pov}}{PR} \quad (14)$$

The values generated by Equations 11 and 14 are valuable because they can not only tell us about a single region, but are comparable across regions. As currently presented, this is not true for the raw components of change. In order to facilitate this necessary comparison across regions, the

overall, poor, and non-poor balancing equations can be expressed as rates of change. This means that the initial population is subtracted from both sides of the equation and each term is divided by either the person years lived in the interval or the mid-year population.⁶ Equations 15 through 17 present each of the relevant balancing equation in this format, where the individual terms for one region are put in context of its specific total population or sub-population. This has the benefit of making each term for one region more comparable with another.

$$\frac{(Pov_2 - Pov_1)}{PY_{pop}} + \frac{(Aff_2 - Aff_1)}{PY_{pop}} = \frac{NI_{pov}}{PY_{pop}} + \frac{NM_{pov}}{PY_{pop}} + \frac{NI_{aff}}{PY_{pop}} + \frac{NM_{aff}}{PY_{pop}} + \frac{NPov}{PY_{pop}} + \frac{NAff}{PY_{pop}} \quad (15)$$

$$\frac{(Pov_2 - Pov_1)}{PY_{pov}} = \frac{NI_{pov}}{PY_{pov}} + \frac{NM_{pov}}{PY_{pov}} + \frac{NPov}{PY_{pov}} \quad (16)$$

$$\frac{(Aff_2 - Aff_1)}{PY_{aff}} = \frac{NI_{aff}}{PY_{aff}} + \frac{NM_{aff}}{PY_{aff}} + \frac{NAff}{PY_{aff}} \quad (17)$$

Building on Equation 15, we can produce one final important statistic for the cross-regional comparison of poverty population dynamics. This statistic, termed $RNPov$ and presented in Equation 18, is a special case of $NPov$ expressed in rate format for the total constant population, PY_{cpop} , and scaled by a constant k .⁷ As opposed to using the person-years lived or the mid-year population as the denominator, $RNPov$ uses the constant population, or the portion of a region's population present at the beginning and end of the time-interval. This means the value generated is a summary statistic of the poverty changes due to actual poverty transitions absent the impact of natural increase and net migration among either sub-population. This value, which more accurately reflects the goals of many poverty policies, allows to us ask, “at what rate did poverty within the population

⁶Although not shown explicitly in these equation, these rates will conventionally be scaled by a constant as is common for demographic rates (e.g. per 1000).

⁷I have chosen to refer to this in the formulation of $NPov$ due to the focus of the framework on the poor, one could easily represent the rate of net poverty transition as its inverse generated from $NAff$.

grow, shrink, or stay the same during the time interval due to transitions in and out of poverty?” For example, if $RNPov$ was scaled by a constant of 1000 and equal to 21, the statistic would tell us that for every 1000 people in the constant population, 21 more were in poverty at the end of the interval due to transitions in poverty status.

$$RNPov = \frac{NPov}{PY_{cpop}} * k \quad (18)$$

3.3. Summary and Value of the Approach

The formulas and summary statistics presented here comprise the poverty balancing equation framework for documenting the way poverty of place changes over time. All told, I have provided a variety of values which will likely be of interest to researchers and policy makers. These values are summarized in Table 1. The choice of which of these values to estimate and use as an independent or dependent variable will depend on the specific research questions being asked and policies being tested, it is not necessary to estimate all values presented to implement this framework. The large number of metrics presented here highlights the inherent complexity, and subsequent shortcomings, of using the conventional poverty rate as a variable of interest. Poverty rates can change or stay the same due to processes of natural increase, migration, or poverty transitions. Thus, an added level of specificity is needed if we are to accurately document the impact of economic shocks or poverty alleviation efforts. By applying this framework, demographers will be able to move beyond the conventional poverty rate, and into a more specific understanding of the components of change of the poverty population.

(Table 1 here)

It should be made clear that to fully implement this approach is data-intensive and currently not possible with many of the publicly available datasets demographers are used to using, which could limit its immediate uptake by demographers. Thus, a brief discussion of why this framework is valuable and warrants usage, in-light of current methodological difficulties, is warranted. First, the importance of the components of change identified here should not be overlooked simply due to the methodological difficulties imposed by current datasets. As it presently stands, policy evaluation

and demographic research relying on poverty rates as the dependent variable, whether the official US poverty rate, the supplemental poverty rate, or any other, is likely to draw inaccurate conclusions due to the complicated influence of the components of change outlined within this framework. As will be highlighted for the case of Florida below, it is quite possible to have dramatic movements among the poverty population and still see a stable poverty rate. Thus, the articulation of the framework I have presented represents a call to action for poverty scholars to begin pushing for both better data on poverty populations across space, while also encouraging creativity in how poverty scholars generate the statistics they use as their independent and dependent variables.

Second, although not without barriers, at time of writing the approach *can* be fully implemented via Federal Restricted Data Centers, as well as with creative usage of resources such as Survey of Income and Program Participation, which I will demonstrate in the next section. That said, even partially implementing this approach with datasets unable to facilitate a full application goes a long way for improving our understanding of poverty dynamics. It is each component of change which is valuable for scholars, not necessarily the construction of the entire poverty balancing equation. For example, calculating just *RNPov* requires only the poverty status of a constant, non-migratory population at two time periods. Ignoring net migration and natural increase, just calculating this value will allow poverty researchers to assess what is actually often of interest—the rate of people transitioning out of poverty in a place due to changes in resources. At the very least, this framework illustrates that any study using the conventional poverty rate should acknowledge that the use of such a measure is a significant limitation because we do not know which underlying process is responsible for any change observed, or not observed, at the aggregate level.

Third, although this approach has clear application for future nationwide model-based analyses of poverty dynamics, it also presents a framework for the applied demographer to characterize poverty dynamics occurring within their city, county, or state. By applying this framework to existing government data which applied demographers often have access to, researchers can present a clear picture to policy makers of what is, or is not, driving changes in material hardship within their geographic area. To demonstrate the value of the approach to our understanding of poverty population dynamics, I will apply the poverty balancing equation to three states in the American South from January and December of 2013 using the first wave of the 2014 Survey of Income and Program Participation (SIPP).

4. Empirical Demonstration for Three Southern States

4.1. Data and Methods

The data for this analysis comes from the 2014 panel of the SIPP. The SIPP is a recurring panel study of income dynamics in the United States civilian non-institutionalized population. Unlike prior panels, the 2014 panel was designed to be representative at the state level (U.S. Census Bureau, 2019). The first wave of the 2014 SIPP asked respondents to provide monthly information on income, residence, and household composition for the prior calendar year (i.e. 2013) (U.S. Census Bureau, 2019). I focus on this first wave and estimate changes in the poverty populations of each state in the United States, as well as Washington D.C., between January and December of 2013.⁸ The use of the SIPP introduces a unique characteristic to the population, you must be alive and in the sampled household at the time of the survey be included in the SIPP. As the survey occurred in April of 2014 and all 12 months of 2013 are documented, I am able to generate state-level estimates of in-migrants and out-migrants by comparing where all samples individuals lived at month one and twelve of the reference year. However, I am not able to generate precise estimates of international out-migration because I do not have data on areas outside the United States. If an individual out-migrated internationally in 2013 and returned to the U.S. by April of 2014 they are included, but otherwise international out-migration is absent. Thus, international migrants are captured in the overall in-migrant estimates but not fully captured in the out-migrant estimates. More seriously, as a result of this sampling approach there are no reported deaths. This unique characteristic makes it impossible to understand how much of the changes in the poor or non-poor populations were due to differentials in mortality between the poor and non-poor. Natural increase cannot be calculated. In its stead, I report the summary statistics for births alone. Given individuals in poverty generally experience higher rates of mortality (Marcus et al., 2017; Moncayo et al., 2019; Pool et al., 2018; Smith and Waitzman, 1994), future research should work to implement more robust data on vital statistics.

⁸I focus on just the first wave due to the difficulties posed by survey attrition in each additional wave. In the subsequent waves of the survey, households dissolved and individuals exited the panel. This introduces significant difficulties for this framework due to the inability to discern whether an exit was due to death, migration, institutionalization, or non-response. I also focus only on Type 1 individuals because Type 2 individuals—those who lived in the residence during the reference period but not at time of survey—do not have their own record in the data, making their inclusion infeasible.

The lack of deaths and international out-migrants in the sample means I am unable to separate the error due to generating point estimates from a weighted sample from the number of deaths and international outmigrants in the total population. I account for this by calculating an overall error term for the population between the two reference months. I do so by solving for the death portion of the overall, poor, and non-poor balancing equations using the point estimates of the other components.⁹ Importantly, this value should be viewed as a combination of the number of deaths, international out-migrants, and the error between the components of change in time one and time two due to weighting. I present this value alongside population estimates for the poor and non-poor sub-populations labeled as ‘error’ to avoid confusion.

I calculate the components of the poverty balancing equation framework presented in Table 1 at the state level for the reference months of January and December of 2013. To do so, I determine each individual’s monthly poverty status by comparing the total income of their household with their relevant poverty threshold as determined by the Official Poverty Measure of the United States. The official poverty measure is an absolute measure which sets a threshold of resources needed to meet material needs across the entire country for a given household size (Iceland, 2005)—although it should be noted the threshold it sets is regularly critiqued for not adequately capturing the needs of families and setting a ‘low-bar’ for poverty (Brady, 2003; Rodems and Shaefer, 2020). I determine an individual as poor if the ratio of their monthly household income to the poverty threshold was less than 1.0. As indicated above, the official poverty measure of the United States has received significant criticism, and a full discussion of these valid critiques is beyond the scope of this paper (see Iceland (2005) and Jensen and Ely (2017)). Given its status as the official poverty measure of the country under examination and its dominance in the literature, I rely on the official measure. However, it should be noted that the framework presented here can easily be calculated for any dichotomous poverty measure. All that is required is that the method of poverty classification groups individuals as poor and not-poor. Thus, fully relative measures such as share

⁹The formula for calculating deaths involves solving for deaths in the standard equation via algebra. Equation 19 demonstrates this for the poverty population.

$$Deaths_{pov} = Pov_1 + Births_{pov} + NM_{pov} + NPov - Pov_2 \quad (19)$$

of regional median income (Iceland, 2013), measures which are calculated using post-tax and post-transfer income (Brady, 2003), or quasi-relative measures such as the supplemental poverty measure (Warren et al., 2020), could easily be used for this approach.¹⁰

I generalize to the state-level using the provided monthly person weights from the SIPP. Due to the estimation of state subpopulations, I rely upon SIPP documentation to generate 95% confidence intervals around point estimates using the SIPP-provided formulas and universe-specific parameters (U.S. Census Bureau, 2017). I calculate confidence intervals for all point estimates except ratios of percentages. Although I was able to estimate all values for each state using the SIPP, I only present data on three states in the American South, Arkansas, Florida, and North Carolina, in the body of this manuscript.¹¹ I use this comparative approach to facilitate an in-depth illustration of the framework. To ensure an illustrative example, these three states were chosen due to their varying changes in aggregate poverty rates over the study period; Arkansas saw an decrease in the poverty rate, Florida had a generally constant poverty rate, and North Carolina experienced an increase in the poverty rate. To be clear, the goal of this exercise is not to discern the causal reasons for why we see differing poverty dynamics across these three states. Instead, the goal here is to demonstrate the utility of the poverty balancing equation framework for fully describing and accounting the complex ways poverty changes within places over time.

5. Results

Total population estimates along with the underlying sample sizes and poverty rates are presented in Table 2. In all results, population estimates are presented in thousands and all components of change are in rate format and presented per 1000. All rates were calculated using the mid-year population of the relevant group, calculated from the total population estimated by the SIPP for each state in the sixth month of the reference year (i.e. June of 2013). As can be seen in Table 2, although the sample for the SIPP is notably smaller than that of other sources such as the

¹⁰An important dimension of poverty of place beyond the scope of this paper is the way income needs vary across space (Pacas and Rothwell, 2020). Unfortunately, the official poverty measure does not adjust for cost of living in any way beyond family size. While I focus on the official poverty measure of the United States in this analysis due to the constraints of available data, it should be made clear that the most sophisticated version of this approach would be one which uses the parameters of the poverty balancing equation alongside a poverty measure which adjusts for changing costs of living across space (e.g. the supplemental poverty measure).

¹¹Results for all fifty states and D.C., as well as all code for replication, are available at the corresponding OSF project for this paper at DOI:[removed for blinding]

American Community Survey, the poverty rate estimates for 2013 via the SIPP are very similar to the poverty rates from the 2011-2015 American Community Survey estimates (Manson et al., 2020). The point estimates of poverty rates reflect what was stated above, with Arkansas seeing a decrease in the poverty rate, Florida seeing a constant level, and North Carolina experiencing a minor increase (Table 2, Figure 1).

(Table 2 here)

(Figure 1 here)

The poverty transition components of change during the study period are presented in both Table 2 and Figure 1. The left panel of Figure 1 illustrates the rate of poverty transitions among the poor ($NPov$), the non-poor ($NAff$), and the net rate of poverty transitions within the constant population ($RNPov$). As may be expected, the values of $NPov$ varied between the three states, with poverty transitions playing the largest role in Arkansas. In Arkansas, for every thousand poor people in the state, there were 206 fewer in poverty at the end of the study period due to poverty transitions alone. This was matched with an $NAff$ of 48.06, meaning that for every thousand non-poor people in the population, 48 were not-poor at the end of the study period. These correspond with a large negative value for net poverty transition ($RNPov$), where for every thousand people in the constant population, 40 fewer were in poverty at the end of the study period. Although we see significant poverty transitions in Arkansas, the other states saw less movement, with all poverty transition values hovering around zero. This suggests that any change in aggregate poverty rates in Florida and North Carolina over the study period did not occur due to poverty transitions among the constant population.

Table 3 and Figure 2 show the birth components of change for the three states of interest. In the left panel of Figure 2 we see the overall birth rate ($Bpop$), the birth rate of the poor in reference to the whole population ($Bpop : pov$), and the birth rate of the non-poor in reference to the whole population ($Bpop : aff$). It bears repeating that $Bpop : pov$ and $Bpop : aff$ sum to $Bpop$. In all three states, ($Bpop : pov$) was only slightly lower than ($Bpop : aff$). Given that the poor population represents a much smaller share of the population than the non-poor in all three states, this indicates that the birth rate was much higher among the poor than the non-poor. In fact, the percent of total births attributed to the poor was 41.7% in Arkansas, 28.0% in Florida,

and 37.9% in North Carolina (Table 3). This is further contextualized in the right panel of Figure 2, where $B\%pop : pr$ is the ratio of the percent of births which are poor relative to the population prevalence of the poor. In both Arkansas and North Carolina, the poor were over-represented in births relative to their population prevalence by a factor of greater than two, while in Florida this over-representation was slightly less at 1.7. These results highlight the fact that if we held net migration and poverty transitions constant, the portion of the population in poverty would have grown in all three states due to births alone.

(Table 3 here)

(Figure 2 here)

It is when we look at migration we see the most dynamism between the poor and non-poor populations (Table 4, Figure 3). Beginning on the right panel of Figure 3, we can see that both immigration and outmigration varied considerably between the three states. In Arkansas, where we saw the largest change in absolute poverty rate, we see that the poor are overrepresented in immigration ($I\%pov : pr$), but not outmigration ($O\%pov : pr$). This is in contrast to Florida, where the inverse is true. In Florida, we see that the poor are underrepresented in immigration, but overrepresented in outmigration, which results in the poor population contributing a negative value, or a net outmigration, to the overall net migration of Florida (Figure 3). Considering the overrepresented birth rate among the poor and modestly negative level of $NPov$ in Florida in 2013, it is likely this imbalance in migration is responsible for the generally steady level of aggregate poverty over the study period. We can also see significant dynamism in migration in North Carolina, where the poor are overrepresented in both immigration *and* outmigration. When looking at Figure 3, we can see the overrepresentation in immigration is greater than that of outmigration, with $I\%pov : pr$ being 2.25. This overrepresentation is echoed in the left panel of Figure 3, where we see the rate contribution to net migration among the poor and non-poor being almost equal in North Carolina despite the poor representing a much smaller share of the population. This greater overrepresentation of immigration than outmigration among the poor in North Carolina can likely explain the modest increase in the poverty rate we see in North Carolina over the study period.

(Figure 3 here)

5.1. Summary

These three examples, while illustrating the benefits of using the poverty balancing equation framework to understand the poverty components of change, also allow us to make some conclusions about how poverty changed, or did not change, within these states over the study period. First, in Arkansas it is clear that the majority of the decrease in the aggregate poverty rate can be attributed to actual transitions out of poverty among the constant population. We can conclude this due to the large negative rate of $RNPov$, the overrepresentation of the poor in immigration but not outmigration, and the overrepresentation of the poor in births. Second, although Florida had a generally stable poverty rate, this does not mean people did not become poor in Florida during the study period. The steady poverty rate in Florida appears an artifact of an overrepresentation of the poor in outmigration, and an underrepresentation of the poor in immigration, which were enough to offset any increase in poverty stemming from an overrepresentation in births. Third, the small growth in the aggregate poverty rate in North Carolina during the study period can be primarily attributed to immigration of the poor and overrepresentation of births among the poor. It does not appear poverty transitions among the constant population played a noticeable role in this increase.

These three examples highlight the unique and nuanced ways poverty of place changes over time, and how we need to look beneath the surface of changing aggregate poverty rates if we are to understand the actual dynamics of poverty. To take this further, some attention is necessary to highlight the benefits of this approach for poverty policy. First, these results show that those who are poor are more likely to have children in all three states. This highlights the need to make aid available to growing families while also ensuring reproductive autonomy among women, wherein birth control methods, if desired, are accessible and affordable (Senderowicz, 2020). Second, although some of the growth in poverty in North Carolina was clearly due to in-migration, the poor were more likely than the non-poor to both move in and out of the state. As moving is both expensive and disruptive to families, this suggests North Carolina may benefit from poverty policy targeted at helping those experiencing bouts of hardship stay put where they already live. Third, these results demonstrate that in Arkansas, the year of 2013 was marked by a considerable portion of the poor transitioning out of poverty. Although the cause of this is not clear, it shows that these changes were due to a very real increase in material well-being for Arkansas residents who

were previously in poverty. Finally, the results for Florida show that just because the poverty rate does not markedly change, there are still poverty population dynamics occurring which suggest specific ways Florida should attempt to reduce poverty. For example, the over-representation of the poor among out-migrants suggests that many experiencing spells of poverty are not able to escape poverty while remaining in the state—meaning Florida may benefit from targeted policies to help families escape bouts of poverty while still remaining where they live.

5.2. *Limitations*

The presented analysis has two limitations I must acknowledge. First, states, although valuable, are quite large for the application of this framework. Although I have been able to demonstrate significant dynamism in the poverty population, the vast majority of migration in the United States is not between states, but instead within and between counties (Molloy et al., 2011). Future work should use restricted data to apply this approach to smaller geographic units to better understand the migration of the poor versus the non-poor.

Second, due to data limitations there are no deaths in this sample and international out-migrants are only partly captured. Future work should apply this framework to data where deaths and international moves are fully captured. Mortality and migration among the poor is frequently higher than among the non-poor (Cohen et al., 2003; Foulkes and Newbold, 2008; Foulkes and Schafft, 2010; Marcus et al., 2017; Moncayo et al., 2019; Pool et al., 2018; Pritchard and Keen, 2016; Sims et al., 2007; Smith and Waitzman, 1994; Taylor-Robinson et al., 2019; Toprani et al., 2016). Thus, we cannot have a true accounting of poverty population dynamics until population processes are fully captured.

6. **Conclusion**

In this paper I have presented a framework for a full accounting of the ways poverty changes within and between places. The poverty balancing equation framework improves upon prior approaches by increasing the specificity available to those interested in generating either descriptive or causal statistics of changes in poverty of place. By identifying the key poverty components of change of natural increase, net migration, and net poverty transitions among the poor and non-poor, the main argument I have made is that the conventional poverty rate, however it is

determined, is an insufficient variable for understanding poverty dynamics. In line with this, this paper represents a call for future researchers to carefully decide whether the conventional poverty rate is the appropriate variable of analysis, and tailor research questions to the specific mechanism of poverty population change in question. If the interest of a study is assessing the efficacy of a policy for raising people out of poverty, then $RNPov$ is a more suitable outcome variable. Similarly, if researchers wish to understand how population churn due to migration is, or is not, influencing the persistence of poverty in a region, then metrics such as $I\%_{pov:pr}$ or $O\%_{pov:pr}$, which tell us how much the poor are over- or under-represented in the components of migration, will be more valuable.

This study presents a unique and novel approach to fully understanding how poverty does or does not change within and between places. The framework presented here is in many ways aspirational. Current scholars cannot immediately apply the full framework to many popular public datasets due to inherent limitations with the data. To be clear, this does not mean this framework is not valuable or should be ignored, instead, it means that demographers need to utilize the resources that do exist—such as Federal Restricted Data Centers—or be creative with what portions of the framework can be estimated with available public data. It also should be made clear that I am not the first to recognize this discrepancy in the usage of conventional poverty rates, the work of prior scholars shows otherwise (Chapman and Bernstein, 2003; Christiaensen et al., 2019; Foulkes and Schafft, 2010; Joo, 2013; Wright, 1996). However, what is presented here does push us beyond prior work by asking demographers to deeply consider what we mean when we discuss changing poverty within a place. The poverty balancing equation framework provides a common language for future theory and study design to proceed (Table 1). With the articulation provided here, we can begin to more completely chart changes in poverty beyond swings in conventional poverty rates. To do so, we should not only apply this framework to existing data, but should also ensure future data collection efforts are designed with this framework in mind.

The poverty balancing equation framework does not provide a single summary statistic for researchers to employ. That is by design. Poverty of place is a complicated problem with a series of specific underlying demographic processes. As I have illustrated in the summaries of Arkansas, Florida, and North Carolina, each place has its own unique puzzle of poverty in need of attention. A decrease in the poverty rate of one area does not correspond to the same decrease in another.

If the goal of research is an assessment of changes in how poverty changes across many places, then it is imperative that demographers and other social scientists use the most specific outcome variable possible. Further, if applied demographers are interested in understanding the state of poverty within their region, decomposing poverty into the components presented here is essential for appropriately documenting the problem and directing change. The solutions to poverty of place require us to ask specific questions and assess specific mechanisms. By employing the poverty balancing equation framework outlined here, future scholars can begin this necessary work.

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7. Figures

Figure 1: Figure Caption: NPov = rate of net poverty transitions among the poor population; NAff = rate of net poverty transitions among the non-poor; RNPov = rate of net poverty transitions among the constant populations; Poverty Start = poverty rate at start of interval relative to mid-year population; Poverty End = poverty rate at end of interval relative to mid-year population.

Figure 2: Figure Caption: Bpop = total birth rate; Bpop:pov = rate contribution to birth rate from the poor; Bpop:aff = rate contribution to birth rate of the non-poor; B%pov:pr = ratio of percent of births who are poor relative to population prevalence of the poor. CIs not calculated for ratios of percentages.

Figure 3: Figure Caption: NMpop = total net migration rate; NMpop:pov = rate contribution to net migration rate from the poor; NMpop:aff = rate contribution to net migration rate from the non-poor; I%pop:pr = ratio of percent of immigrants who are poor relative to population prevalence of the poor. O%pop:pr = ratio of percent of outmigrants who are poor relative to population prevalence of the poor. CIs not calculated for ratios of percentages.

8. Tables

Table 1: Poverty balancing equation framework formulas

Statistic	Formula	Description
Vital Statistic Components		
$NI_{pop:pov}$	$\frac{(B_{pov}-D_{pov})}{PY_{pop}}$	Rate of natural increase in the total population due to the poor population
$NI_{pop:aff}$	$\frac{(B_{aff}-D_{aff})}{PY_{pop}}$	Rate of natural increase in the total population due to the non-poor population
NI_{pov}	$\frac{(B_{pov}-D_{pov})}{PY_{pov}}$	Rate of natural increase in the poor population
NI_{aff}	$\frac{(B_{aff}-D_{aff})}{PY_{aff}}$	Rate of natural increase in the non-poor population
$B\%_{pop}$	$\frac{B_{pov}}{B_{pop}} * 100$	Percent of total births due to the poor population
$D\%_{pop}$	$\frac{D_{pov}}{D_{pop}} * 100$	Percent of total deaths due to the poor population
$B\%_{pop:PR}$	$\frac{B\%_{pov}}{PR} * 100$	Share of births among the poor relative to population prevalence of the poor
$D\%_{pop:PR}$	$\frac{D\%_{pov}}{PR} * 100$	Share of deaths among the poor relative to population prevalence of the poor
Migration Components		
$NM_{pop:pov}$	$\frac{(I_{pov}-O_{pov})}{PY_{pop}}$	Rate of net migration in the total population due to the poor population
$NM_{pop:aff}$	$\frac{(I_{aff}-O_{aff})}{PY_{pop}}$	Rate of net migration in the total population due to the non-poor population
NM_{pov}	$\frac{(I_{pov}-O_{pov})}{PY_{pov}}$	Rate of net migration of poor population
NM_{aff}	$\frac{(I_{aff}-O_{aff})}{PY_{aff}}$	Rate of net migration of non-poor population
$I\%_{pov}$	$\frac{I_{pov}}{I_{pop}} * 100$	Percent of total immigration due to the poor population
$O\%_{pov}$	$\frac{O_{pov}}{O_{pop}} * 100$	Percent of total outmigration due to the poor population
$I\%_{pov:PR}$	$\frac{I\%_{pov}}{PR} * 100$	Share of immigration among the poor relative to population prevalence of the poor
$O\%_{pov:PR}$	$\frac{O\%_{pov}}{PR} * 100$	Share of outmigration among the poor relative to population prevalence of the poor
Poverty Transition Components		
$NPov$	$\frac{(F-C)}{PY_{pov}}$	Rate of net poverty transition in the poor population
$NAff$	$\frac{(C-F)}{PY_{aff}}$	Rate of net poverty transition in the non-poor population
$RNPov$	$\frac{(F-C)}{PY_{pop}}$	Rate of net poverty transition in the constant population

B = Births, D = Deaths, I = Immigration, O = Outmigration, F = Entrants into poverty, C = Exits out of poverty

Table 2: Population and poverty components

Statistic	Arkansas			Florida			North Carolina		
	Est.	Lower	Upper	Est.	Lower	Upper	Est.	Lower	Upper
Population Characteristics									
Poverty Rate Start	20.39	17.01	23.77	16.68	15.46	17.90	16.30	14.60	18.00
Poverty Rate End	17.04	13.89	20.19	16.46	15.25	17.67	17.45	15.71	19.20
Poverty Rate via five-year ACS	19.27	.	.	16.54	.	.	17.38	.	.
Population Start	2,901.23	2,658.97	3,143.48	19,119.78	18,514.42	19,725.13	9,581.08	9,145.63	10,016.54
Population Mid	2,904.28	2,661.90	3,146.66	19,208.36	18,601.69	19,815.02	9,618.50	9,182.22	10,054.77
Population End	2,911.55	2,668.88	3,154.24	19,329.59	18,721.14	19,938.05	9,666.62	9,229.29	10,103.95
Error	74.70	35.65	113.75	272.33	197.80	346.87	209.87	144.43	275.31
Sample Size Start	2,292.00	.	.	2,926.00	.	.	2,489.00	.	.
Sample Size Mid	2,313.00	.	.	2,926.00	.	.	2,503.00	.	.
Same Size End	2,370.00	.	.	2,987.00	.	.	2,570.00	.	.
Poverty Components of Change									
<i>NPov</i>	-206.57	-284.70	-128.44	-9.03	-16.12	-1.94	6.09	-3.02	15.20
<i>NAff</i>	48.06	28.15	67.98	2.11	0.45	3.77	-1.12	-2.79	0.56
<i>RNPov</i>	-40.50	-57.34	-23.65	-1.77	-3.16	-0.37	0.98	-0.49	2.46

Est. = Point estimate; Lower = 95% CI lower bound; Upper = 95% CI upper bound.

Rates reported per 1000. Confidence intervals not calculated for ratios of percentages. Population estimates reported in thousands.

Table 3: Birth components of change

Statistic	Arkansas			Florida			North Carolina		
	Est.	Lower	Upper	Est.	Lower	Upper	Est.	Lower	Upper
B_{pop}	10.41	1.90	18.91	8.16	5.23	11.09	9.79	5.26	14.33
$B_{pop:pov}$	4.33	-1.17	9.84	2.28	0.73	3.84	3.71	0.91	6.51
$B_{pop:aff}$	6.07	-0.44	12.58	5.88	3.38	8.37	6.08	2.50	9.67
B_{pov}	22.96	-5.94	51.87	12.07	3.89	20.26	23.94	6.05	41.83
B_{aff}	7.48	-0.54	15.51	7.25	4.18	10.32	7.20	2.96	11.44
$B_{pov}^{\%}$	41.66	.	.	28.00	.	.	37.88	.	.
$B_{pov:pr}^{\%}$	2.44	.	.	1.70	.	.	2.17	.	.

Est. = Point estimate; Lower = 95% CI lower bound; Upper = 95% CI upper bound.

Rates reported per 1000. Confidence intervals not calculated for ratios of percentages.

Table 4: Migration components of change

Statistic	Arkansas			Florida			North Carolina		
	Est.	Lower	Upper	Est.	Lower	Upper	Est.	Lower	Upper
Inmigration									
I_{pop}	29.26	15.13	43.39	32.51	26.73	38.29	35.46	26.94	43.98
$I_{pop:pov}$	6.36	-0.31	13.03	3.40	1.50	5.29	13.91	8.52	19.31
$I_{pop:aff}$	22.90	10.36	35.44	29.11	23.63	34.60	21.55	14.86	28.24
I_{pov}	33.70	-1.13	68.52	17.96	8.00	27.91	89.77	56.32	123.22
I_{aff}	28.23	12.81	43.65	35.91	29.17	42.64	25.50	17.60	33.40
$I\%_{pov}$	21.74	.	.	10.45	.	.	39.24	.	.
$I\%_{pov:pr}$	1.28	.	.	0.64	.	.	2.25	.	.
Outmigration									
O_{pop}	10.39	1.89	18.89	15.57	11.53	19.61	14.54	9.03	20.06
$O_{pop:pov}$	0.56	-1.43	2.56	4.57	2.37	6.77	4.68	1.53	7.82
$O_{pop:aff}$	9.83	1.56	18.10	11.00	7.60	14.40	9.86	5.31	14.42
O_{pov}	2.99	-7.55	13.53	24.17	12.66	35.68	30.19	10.16	50.21
O_{aff}	12.11	1.93	22.30	13.56	9.38	17.75	11.67	6.29	17.05
$O\%_{pov}$	5.43	.	.	29.36	.	.	32.18	.	.
$O\%_{pov:pr}$	0.32	.	.	1.78	.	.	1.84	.	.
Net Migration									
NM_{pop}	18.87	7.41	30.33	16.94	12.73	21.15	20.92	14.30	27.53
$NM_{pop:pov}$	5.80	-0.57	12.16	-1.18	-2.29	-0.06	9.23	4.83	13.64
$NM_{pop:aff}$	13.07	3.55	22.60	18.12	13.77	22.46	11.68	6.73	16.63
NM_{pov}	30.71	-2.59	64.00	-6.21	-12.10	-0.32	59.58	31.88	87.28
NM_{aff}	16.12	4.39	27.84	22.34	16.99	27.69	13.83	7.97	19.68

Est. = Point estimate; Lower = 95% CI lower bound; Upper = 95% CI upper bound.

Rates reported per 1000. Confidence intervals not calculated for ratios of percentages.