Insurance benefits from progressive taxes and transfers

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1. Introduction

State and local governments' role in redistribution during the last few decades has changed in ways that are unexpected given both previous experience and the existing academic research. Standard fiscal federalism models (see early work by Wallace Oates and David Bradford) predict that redistribution should be provided by the federal government. The argument is that the provision of redistribution policies by state and local governments is undermined by the mobility of potential residents. Redistribution at the local level attracts net beneficiaries and leads net payers to move elsewhere.

In recent decades, however, states have increased their involvement in redistribution policies. State income taxes have increased substantially as well as state expenditures on the lower-income population. On the transfer side, the gains in state expenditures have primarily taken place in the area of health care—with increases in expenditures on Medicaid and SCHIP.

These facts and theoretical backdrop provide the motivation for this paper. We comprehensively explore the nature of state redistribution policies, and examine reasons for their changes over time. We start by presenting a framework for calculating the insurance value of redistribution. In so doing, we decompose the observed transfers that households receive into a redistributional component and an insurance component. The redistributional component is due to predictable changes in income (and household circumstances) while the insurance component is due to unpredictable changes in income. Our approach is a forward-looking one, where we examine income and transfers over a 10-year period. Within this approach, we can examine the possibility that these programs do not so much redistribute across people with different levels of expected income as provide insurance against unexpected income shocks within groups of people that have the same expected income. In other words, the insurance component ex-post redistributes (among a group of individuals who ex-ante had the same expected income) from those with high income realizations to those with low income realizations. Such insurance benefits are inherent in unemployment insurance, but are also present in public health insurance programs, welfare programs and the personal income tax.

We examine changes over time in the redistributive and insurance value and decompose those changes into: (i) the component that is due to changes in income and family composition mobility, (ii) the component that is due to changes in residential mobility, and (iii) the component that is due to changes in the rules of the state tax and transfer programs.

In this preliminary draft of the paper, we lay out the methodology for measuring the redistributive and insurance value of transfers and our approach for implementing the decomposition. We describe the data, tax, and transfer programs and some details on our empirical implementation. Finally, we provide some initial descriptive figures from our procedures.

2. Literature Review

To be added.

3. Methodology

Overview

In this methodology section, we present a framework that allows us to measure how rational, risk-averse individuals value the tax and transfer system of the state in which they reside. We first define the concepts of insurance value and redistributive value of a tax and transfer system in very general terms. Next, we show how we implement these concepts to measure the insurance and redistributive value of state tax and transfer programs. We assume that individuals have a simple CRRA utility function and fully consume their annual net income.

Our framework generates three, increasingly inclusive, measures of the value to individuals of the tax and transfer system in their state of residence. We plot each of these three measures as a function of current income to depict the degree to which state tax and transfer programs redistribute.

First, we calculate the "naïve" annual value of the state tax and transfer program, which is the individual's net state benefit (=state transfer net of state taxes minus) in the current year minus the mean net state benefit in the individual's state of residence in that year. This naïve annual measure misses two components of the value of the state tax and transfer system, namely the redistribution value over longer horizons and the insurance value.

Second, we calculate the total redistributive value (including both current and future years) taking a weighted average of the individual's future and current net state benefits minus the mean weighted average of the future and current net state benefits in the individual's state of residence, where future benefits are weighted by the discount factor and the probability that the individual still resides in that state in the future.

Third, we calculate the total value of the state tax and transfer program by adding the insurance value of the program to the redistributive value calculated above. A state tax and transfer program offers insurance value if future incomes are uncertain, individuals are risk averse, and the net benefits fall with income.

For an individual of a given current income level, the differences across states in the total value of the state tax and transfer program determine the individual's incentive to relocate. Hence, in order to explain why states' tax and transfer programs haven't substantially declined in size, we would need to find that the gradient of total value of the state tax and transfer program is relatively flat with respect to current income.

After presenting the basic framework, we show how the redistributive and insurance value can be decomposed into components that are attributable to different tax and transfer programs or to different sources of mobility. These decompositions are formed by running counterfactual scenarios through the basic framework.

Throughout we assume that individuals have rational expectations and take their income as given. In other words, we do not incorporate income responses to incentives from the tax and transfer system into our framework.

Insurance versus Redistribution in a Static Framework

Before describing our methodology in more detail, it is useful to define the value of redistribution and the value of insurance in conceptual terms. We will subsequently translate these conceptual constructs into formulae that we can implement. Consider individuals that derive utility U from after-tax income. After-tax income consists of pre-tax income Y and a benefit net of taxes $B(Y)$ that is a function of pre-tax income. We refer to $B(.)$ as the net benefit schedule. Pre-tax income is a stochastic variable. While in this static framework Y is technically simply a scalar, conceptually it corresponds to any stochastic determinants of benefits. In our implementation framework, we will replace Y by the variables for the future trajectories of income, family composition, and state of residence.

The value of the net benefit schedule, as measured by its equivalent variation, is the premium over the average net benefit that the government would need to pay to each person to keep average utility constant if the government replaced the actual net benefit schedule by the average net benefit. Thus, Z, the value of the net benefit schedule, is the solution to the equation:

$$E_Y[U(Y+B(Y))] = E_Y[U(Y+E_Y[B(Y)]+Z)], \quad (1)$$

where the expectation is taken over the distribution of Y. Note that $E_Y[B(Y)]$ is simply the average net benefit, which would be zero if the government did not have to raise any revenue. If U is affine (so individuals are risk neutral), Z equals zero since in that case the expectation operator can be moved outside the utility function. This also makes intuitive sense because tax and transfer systems have no value if the marginal utility is the same for all individuals.

The value Z includes both the insurance value and the redistribution value of the tax and transfer system. Thus, we can write $Z = Z^I + Z^R$, where Z^I is the insurance value and Z^R is the redistribution value. To separate these two components, we must define the information set X that individuals use to form their *conditional* distribution of income Y. Net transfers that were expected given the conditional distribution of Y have redistributive value, while variation in net transfers around their conditional expectation have insurance value. Formally, we decompose equation (1) as:

$$E_Y[U(Y+B(Y))] = E_X[E_{Y|X}[U(Y+E_{Y|X}[B(Y)] + Z^I)]] \quad (2a)$$
$$E_X[E_{Y|X}[U(Y+E_{Y|X}[B(Y)] + Z^I)]] = E_Y[U(Y+E_Y[B(Y)]+ Z^I + Z^R)]. \quad (2b)$$

Equation (2a) defines the insurance value of the tax and transfer system as the premium that the government would need to pay individuals to keep average utility constant if it were to pay each person his expected net benefit rather than his actual net benefit. Equation (2b) defines the redistributive value of the tax and transfer system as the premium that the government would need to pay individuals to keep average utility constant if it were to pay each person the average net benefit rather than his expected net benefit.

As equations (2a) and (2b) make clear, the decomposition between insurance value and redistributive value depends crucially on the conditional expectation of income Y given the value of the conditioning variables X. On the one extreme, if X perfectly predicted Y, then $E_{Y|X}[B(Y)]$ would equal $B(Y)$, and the insurance value would be zero. On the other extreme, if X had absolutely no predictive power for Y, $E_{Y|X}[B(Y)]$ would equal $E_Y[B(Y)]$, and the redistributive value would be zero.[1] In other words, the predictable component of net transfers is counted as redistribution and the unpredictable component of net transfers is considered to be insurance. Thus, the distinction between the insurance and redistribution rest completely on the predictability of net transfers.

To clarify the role of the predictable component, it may be useful to explain how an analogous decomposition can be made in the health insurance context. Now think of *B* as health expenditures and of *Y* as health status. Individuals differ in their future health expenditures that are predictable from observable characteristics *X*. A private insurance market would charge each person her expected future health expenditures (assuming actuarially fair pricing and no adverse selection). So the difference between the actual realized health expenditure and the insurance premium, $B(Y) - E_{Y|X}[B(Y)]$, is the insurance component (note that this difference drives equation 2a). If the government provided everyone with health "insurance" for a premium equal to the average health expenditure, $E_Y[B(Y)]$, then in fact this government program can be thought of as first redistributing the difference between the individual-specific premium and the average premium, $E_{Y|X}[B(Y)] - E_Y[B(Y)]$ (note that this difference drives equation 2b). This redistribution is referred to as risk-adjustment in the health context. Next, the difference between the realized health expenditure and the predictable health expenditure, $B(Y) - E_{Y|X}[B(Y)]$, is the true insurance component of the health insurance program. In the extreme, if everyone's health expenditure were perfectly predictable, this program would only redistribute because there is no uncertainty to insure. In the other extreme, if health expenditures are completely unpredictable, everyone could have just as well bought insurance at a premium equal to the average expenditure in a private insurance market. Hence, in that case, the government program would be a pure insurance program.

The framework described above can also be used to calculate the insurance value and redistributive value of the tax and transfer system to specific individuals. These individual-specific valuations are important when trying to assess individual reactions to the tax and transfer system, such as whether the individual would vote at the ballot box or with her feet for a particular tax and transfer system. For an individual with characteristics *X*, the total value of the

[1] This later situation corresponds to the notion of individuals valuing the tax and transfer schedule behind the veil of ignorance, where the total value of the tax and transfer system is the insurance value.

tax and transfer system $B(.)$ is given by $Z^I(X) + Z^R(X)$, which are defined by the individual-level analogues of equations (2a) and (2b):

$$E_{Y|X}[U(Y+B(Y))] = E_{Y|X}[U(Y+E_{Y|X}[B(Y)] + Z^I(X))] \quad (3a)$$

$$E_{Y|X}[U(Y+E_{Y|X}[B(Y)] + Z^I(X))] = E_{Y|X}[U(Y+E_Y[B(Y)]+ Z^I(X) + Z^R(X))]. \quad (3b)$$

Note that equation (3b) can be explicitly solved for $Z^R(X)$:

$$Z^R(X) = E_{Y|X}[B(Y)] - E_Y[B(Y)]. \quad (3c)$$

As can be seen from equation (3c), the redistributive value averages out across individuals: $E_X[Z^R(X)] = E_X[E_{Y|X}[B(Y)] - E_Y[B(Y)]] = E_Y[B(Y)] - E_Y[B(Y)] = 0$. Hence, the redistributive value will be negative for those individuals with X characteristics that are associated with high incomes and positive for those with X characteristics that are associated with low incomes. Under our standard assumptions of (i) risk-averse individuals, (ii) uncertainty in income conditional on X, and (iii) a redistributive net benefit system (so $dB/dY<0$), the insurance value $Z^I(X)$ is positive for all values of X.

Extension to a Dynamic Framework

Tax and transfer systems are persistent over time. Hence, when individuals assess the value to them of the tax and transfer system, they need to take into account not only the net benefit they receive in the current year but also the value of future net benefits. The framework laid out in the previous section can easily be extended to incorporate the intertemporal component of tax and transfer systems. To do so, we interpret X as income in the current year and Y as income in a future year. Thus, $Z^I(X)$ and $Z^R(X)$ represent the insurance value and redistributive value, respectively of the tax and transfer system for a future year for someone with income X in the current year. To find the total value of the tax and transfer system, we would then construct the weighted average (weighted by discount factors) of $Z^I(X)$ and $Z^R(X)$ in the current year and in all future years.

A “naïve” annual measure of the value of the tax and transfer system would be to compare the individual’s net benefit in the current year to the average benefit in the current year:

$$Z^{Naïve}(X) = B(X) – E_X[B(X)]. \tag{4}$$

This naïve annual measure deviates from the true value for two reasons, a “horizon effect” and an “insurance effect.”

First, incomes fluctuate over time. If incomes are mean reverting, individuals with low incomes in the current year can expect to have higher incomes, and therefore lower benefits, in future years. Similarly, those with high incomes in the current year can expect higher benefits in future years. Thus, if incomes are mean reverting, the net benefits averaged over a longer time horizon fall less sharply with current income than current net benefits do. Thus, there is less redistribution across people if we average the net benefits received over several years. Moreover, if expected future incomes are a concave (convex) function of current income, the fraction of individuals with expected incomes below the median is lower (higher) than the fraction of individuals with current incomes below the median. This observation is central in the paper of Bénabou and Ok (2001), who show that expected future income being a concave function of current income can cause a majority of individuals to vote against a persistent income redistribution program even if a majority of individuals would benefit from that program in the current period. The difference between the naïve annual measure and the true redistributive value of the tax and transfer system in a future year is given by:

$$\textit{Horizon Effect}\ (X) = Z^R(X) - Z^{Naïve}(X) = E_{Y|X}[B(Y)] - B(X) – (E_X[B(X)]-E_Y[B(Y)]). \tag{5}$$

Note that the horizon effect only depends on the expected conditional benefit and the current benefit, but does not depend on risk aversion or the correlation between income and benefits. If benefits are constant over time, the term between parenthesis, $(E_X[B(X)]-E_Y[B(Y)])$, is zero. So, the difference between the expected future benefit (conditional on current income) and current benefits, $E_{Y|X}[B(Y)] - B(X)$, is the component of the horizon effect that is of conceptual interest.

Second, the naïve annual measure does not capture the insurance value of the tax and transfer system. The insurance value is $Z^I(X)$, which is calculated by solving equation (3a). The insurance value is positive for all individuals if the net benefit and income covary negatively (which is the case if $dB/dY<0$). The insurance increases in the variance of the conditional income distributions (as in unexpected income fluctuations) and it increases in the degree of risk aversion. The insurance value will therefore move everyone's preference in the direction of a more redistributive tax and transfer system.

Implementation for State Tax and Transfer Systems

We now describe how we implement this conceptual framework to measure the redistributive and insurance value of state tax and transfer systems.

We assume that individuals derive utility exclusively from consumption:

$$U(C_{ist}) = \frac{C_{ist}^{1-\rho}}{1-\rho}, \tag{6}$$

where *i* indexes individuals, *t* indexes years, *s* indexes state of residence, ρ is the coefficient of relative risk aversion, and C_{it} denotes real household consumption adjusted for household size using an equivalence scale. Thus, we implicitly assume that resources are shared within households and there are economies of scale for larger households. Henceforth, all individual-level consumption, income, tax, and transfer variables are real and adjusted for household size using an equivalence scale.

We assume that individuals fully consume their disposable income in each year. In other words, we assume that individuals do not save or borrow to smooth consumption against shocks. Clearly, this is a very strong assumption. We make this assumption for two reasons. First, we do not have long panel data with comprehensive consumption measures, so we cannot measure realized consumption dynamics. Second, modeling optimal consumption choices, while not impossible, is relatively complex and not the focus of this paper. Rather than explicitly modeling saving behavior, we implicitly allow for it by our choice of the coefficient of relative risk aversion; to the extent that individuals can smooth actual consumption over time by saving or borrowing they are less averse to fluctuations in disposable income, which is our measure of consumption. As a conservative lower bound of the insurance value, we will also calculate the insurance value assuming that individuals were able to perfectly smooth their consumption (so assuming they only derive utility of the total future benefit, but not from the time path of that benefit).

Disposable income consists of pre-tax income (Y_{it}), the federal transfer net of federal taxes (F_{it}), and the state transfer net of state taxes (B_{ist}):

$$C_{ist} = Y_{it} + F_{it} + B_{ist}. \tag{7}$$

F_{it} and B_{it} are implicit functions of pre-tax income, the state of residence, the federal and state tax system in year t, and certain household characteristics (e.g., the presence of dependent children). Later, for certain implementations of the insurance value and when we perform decompositions, we will explicitly model F_{it} and B_{it}, but unless otherwise noted we simply measure their values in the data. We assume that individuals have a real discount rate of r.

Naïve Annual Value

For each individual, we calculate the naïve annual value of his state's tax and transfer system as:

$$Z_{ist}^{Naïve} = B_{ist} - \overline{B}_{st} , \tag{8}$$

where $\overline{B}_{st}$ denotes the mean net transfer in state s in year t. To measure the degree to which state tax and transfer programs redistribute according to the naïve annual measure, we plot averages of $Z_{ist}^{Naïve}$ by percentiles of Y_{it}.

Redistributive Value

The redistributive value differs from the naïve annual value by taking expected future net state benefits into account. Net benefits in year $t+k$ are discounted by the discount factor $(1+r)^{-k}$ times the probability the individual still resides in the same state in year $t+k$. Let $R_{it}(t+k)$ denote an indicator function that equals one if individual i resides in period $t+k$ in the same state as this individual inhabited in period t. We need the indicator since we only measure the redistributive value of the tax and transfer system of the individual's current state of residence.

The realized redistributive value for individual i is given by:

$$Z_{ist}^{R,realized} = \sum_{k=0}^{K-1} \left(B_{i,s,t+k} - \overline{B}_{s,t+k} \right) R_{it}(t+k)(1+r)^{-k} \Big/ \sum_{k=0}^{K-1} R_{it}(t+k)(1+r)^{-k} , \tag{9}$$

where K denotes the individual's planning horizon. In practice, we set K to 10 years because of data limitations. In equation (3c), we defined the redistributive value, $Z^R(X)$, as the *expected* future net benefit rather than as the realization of that benefit. However, since equation (9) is linear in $B_{i,s,t+k}$, we can find the redistributive value by income percentile by averaging the realized future net benefit across all individuals in the same income percentile as individual i. In other words, since we are going to average redistributive values by percentiles of income in year t anyway, calculating the realized redistributive value yields the same final result as calculating the expected redistributive value.[2]

Combined Redistributive and Insurance Value

$Z(X)$, the sum of the redistributive and insurance value for someone with characteristics X, is conceptually given by solving the following equation (which combines equations 3a and 3b):

$$E_{Y|X}[U(Y+B(Y))] = E_{Y|X}[U(Y+E_Y[B(Y)]+ Z(X))]. \qquad (10)$$

Define $\mathcal{X}(i,t)$ as the set of individuals who have the same conditioning variables as individual i in year t. The conditioning variables are variables on which the future income distribution and benefit eligibility are conditioned. These variables will typically include state, income bracket, education, age bracket, and family composition. If the set $\mathcal{X}(i,t)$ contains sufficient observations for each individual such that the income and benefit paths of individuals in $\mathcal{X}(i,t)$ accurately depict the uncertainty that individual i faces at time t, then we could proceed by finding the sum

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[2] To make the same point using math notation, $B_{i,s,t+k}$ in equation (9) is the analogue of $B(Y)$ in equation (3c), and $\overline{B}_{s,t+k}$ is the analogue of $E_Y[B(Y)]$. The complete set of conditioning variables, X, includes current income percentile but also other variables (such as state of residence, family structure). Denote current income percentile by $X1$, which is an element of X. Ultimately, we are going to plot $Z(X) = E_{Y|X}[B(Y)] - E_Y[B(Y)]$ as a function of $X1$, so take averages of $Z(X)$ by current income percentile. Whether we now calculate $Z(X)$, which depends an expectation conditional on X, or whether we calculate $Z^{realized} = B(Y)-E_Y[B(Y)]$, we will get the same result in the next step, when we take the average by current income percentile. Averaging by current income percentile yields the expectation with respect to $X1$, and this calculation results in the same outcome for $Z^{realized}$ as for $Z(X)$:

$E_{Y|X1}[Z^{realized}] = E_{Y|X1}[B(Y)-E_Y[B(Y)]] = E_{Y|X1}[B(Y)]-E_Y[B(Y)]$

$E_{Y|X1}[Z(X)] = E_{Y|X1}[E_{Y|X}[B(Y)] - E_Y[B(Y)]] = E_{Y|X1}[B(Y)]-E_Y[B(Y)]$

of the insurance and redistributive value for individual *i* from the perspective of year *t* as the solution for Z_{ist} to the following equation:

$$\sum_{j \in X\ (i,t)} \sum_{k=0}^{K-1} \Big(U(Y_{j,t+k} + B_{j,s,t+k} + F_{j,t+k}) - U(Y_{j,t+k} + \overline{B}_{s,t+k} + F_{j,t+k} + Z_{ist}) \Big) R_{jt}(t+k)\big(1+r\big)^{-k} = 0\,. \quad (11)$$

Thus, the insurance value (Z_{ist}) is the same for all the individuals in set $\mathcal{X}(i,t)$ because these individuals have the same conditioning variables. Next, we would calculate the average value of the Z_{ist} by income percentile (so averaging over the other conditioning variables) to find the average redistributive and insurance benefit of the state tax and transfer system by income percentile. Note that this calculation is *not* equivalent to solving equation (11) by $\mathcal{X}(i,t)$ that are solely defined by income percentile since *U*(.) is a non-linear function.

The framework assumes that individuals don't save or borrow. Hence, utility in a year is completely determined by disposable income in that year. This implies that part of the measured insurance benefit stems from the fact that the tax and transfer systems helps smooth the disposable income flow over time *within an individual*. This benefit would completely disappear if the individual could smooth consumption through other means (or would only derive utility from lifetime income). To take out the component associated with *within-individual* insurance, we can recalculate equation (11), but replace all time-indexed variables by the average value over time of that variable for a given individual (using a discounted weighted average for the years that the individual resides in the same state).

In practice, however, the sets $\mathcal{X}(i,t)$ will likely contain only one or just a couple of observations if, as would be appropriate, they are conditioned on state, income bracket, education, age bracket, and family composition. This means that solving equation (11) is not feasible by just using realizations of similar individuals to model conditional uncertainty because in practice there are none, or very few, similar individuals in each set of conditioning variables. The reason that these sets are so small is that the conditional variables have many dimensions. There are two basic potential "solutions" to this dimensionality problem.

First, we could assume that expectations of future income and net benefits are only conditioned on current income bracket. This is a highly restrictive assumption since, in fact, benefits depend significantly on family composition (married/singe, number of dependent children) and the state of residence. Moreover, income trends depend on age and education.

Second, we could explicitly model alternative future income realizations for individual *i* from the perspective of year *t*. We then would draw time paths for income, family composition, and state of residence from this parametric model and add them to the set $\mathcal{X}(i,t)$ to ensure the set $\mathcal{X}(i,t)$ contains sufficient observations. An additional challenge is that when we draw paths of income, family composition, and state of residence that did not actually occur, we will also need to predict the associated state and federal net benefit trajectories for those paths. The drawback of creating a model is that it imposes a parametric structure on the paths of income, family composition, and state of residence that may not match the true time-series properties of these variables and interdependencies between these variables. Creating a parametric model of income mobility is challenging because distribution of the income paths is highly dimensional. These paths are characterized by an expected trend (that may vary by initial income, education, state, occupation, age, family composition), the variance of shocks around the trend (that again might vary with all these factors), and the pattern of serial correlation in these shocks (not necessarily just 1st order serial correlation). Similarly, the path of family composition is characterized by many dimensions: marital status and number and ages of children (including the birth of additional children). The path of family composition needs to be modeled carefully because AFDC/TANF, Medicaid/SCHIP, and the EITC depend on this. Finally, the income path and the family composition path are not independent, but subject to correlated shocks.

Hybrid Solution

We propose to solve the dimensionality problem by doing a combination of the two basic solutions outlined above. We use a relatively coarse set of conditioning variables for the possible time-paths of income and family composition (i.e., relying on the first proposed solution). We use a model for residential mobility (i.e., relying on the second proposed solution). We assume that the residential mobility process is independent of the income and family composition process.

We propose that the conditioning set $\mathcal{X}(i,t)$ consists of the observations in the same income decile and in the same "effective-benefit" quintile (to be defined shortly). Since the

PSID has about 5000 observations, this would mean that each set $\mathcal{X}(i,t)$ consists of about 100 observations, which should suffice for estimating a conditional variance. We will assume counterfactually that all of the observations in $\mathcal{X}(i,t)$ reside in person *i*'s state of residence in year *t*. We will therefore replace the actual state benefits of the individuals *j* in set $\mathcal{X}(i,t)$ by the net benefits they would have received had they resided in person *i*'s state of residence in year *t*. This yields $B_{j,s,t+k}$ for equation (11). We assume that the federal net benefits (and their income and family composition path) of individuals *j* are the same as the actual realization that occurred in a different state of residence, so we use the measured values of $Y_{j,t+k}$ and $F_{j,t+k}$ in equation (11). We define the effective benefit quintile from the distribution of net state benefits in year *t* among all individuals in person *i*'s income decide under the assumption that the benefits of these people are determined according to the rules of the state of residence of person *i* in year *t*. By conditioning on the effective benefit quintile, we hope to capture much of the information that would otherwise be captured by family composition, education, industry etc. In other words, we hope that the effective benefit quintile can serve as a rough summary statistic for many of variables that ideally would be part of the conditioning set, but that we omitted because of the dimensionality problem.

To model residential mobility, we estimate a hazard model of leaving one's state of residence. This hazard model will contain a full set of state dummies, year dummies, and various demographic characteristics (age, education, family composition, income bracket). We will apply this model to predict the hazard for each individual in the set $\mathcal{X}(i,t)$ of leaving person *i*'s state of residence. When calculating the predicted hazard rates, we assume counterfactually that all the individuals in set $\mathcal{X}(i,t)$ live in year *t* in person *i*'s state of residence. From these hazard rates, we calculate $\hat{R}_{jt}(t+k)$, which is the predicted cumulative probability that person *j* (who is part of set $\mathcal{X}(i,t)$ in year *t*) still resides in year *t+k* in the same state as person *i* inhabited in year *t*. We replace $R_{jt}(t+k)$ in equation (11) by $\hat{R}_{jt}(t+k)$. We model mobility parametrically because mobility is state-specific and there are too few observations in some states and some years from which to draw realized mobility paths. This problem becomes especially severe if we, in addition, want to condition mobility on any other personal characteristics such as education or income decile.

In this hybrid approach, expectations are conditioned on (i) income decile, (ii) state of residence, and (iii) effective state net benefit quintile. To avoid having 10×50×5=2500 conditioning sets (with an average of 2 observations given that the PSID has 5000 observations), we made two important assumptions. First, we assumed that conditional on income decile and effective state net benefit quintile, income and federal benefits paths are independent of state of residence. Second, we assumed that mobility in state of residence is adequately captured by a hazard model. With these assumptions, the can reduce the number of conditioning sets to 50 (10 income deciles × 5 effective benefit quintiles), so that each conditioning set has roughly 100 observations.

By using a relatively coarse set of conditioning variables we ensure that the sets $\mathcal{X}(i,t)$ contain sufficient observations. The benefit is that the observation in $\mathcal{X}(i,t)$ are real observations (rather than coming from a model with many structural assumptions), but the drawback is that, in fact, individuals' expectations were probably conditioned on more factors than we assume. It is not possible to determine the direction of bias associated with having the conditioning sets being too coarse; it depends on whether the additional conditioning variables would increase or reduce the absolute value of the conditional covariance between Y and $B(Y)$. Conditioning variables that help predict Y for a given family composition would reduce the absolute value of conditional covariance and therefore reduce the estimated insurance value. Thus, their omission would lead to an upward bias in the estimated insurance value. However, other conditioning variables could increase the absolute value of the conditional covariance. For example, variables that predict family size (which might both increase Y and $B(Y)$), could increase the absolute value of the conditional covariance, and their omission would lead to a downward bias in the estimated insurance value.

The Insurance Value Against Common Shocks

As outlined above, the framework classifies the average net benefit received in a future year conditional on current year's income decile and current year's effective benefit quintile as a predicted transfer, which is therefore counted as redistribution. In other words, shocks in a future year that are common to individuals that share income decile and benefit quintile in the current year are not counted in the insurance value. In reality, such shocks are probably largely unpredictable, and therefore should be included when we calculate the insurance value. To avoid treating these common year-specific shocks as predictable, we propose drawing counterfactual income paths from all individuals (with the same income decile and effective net benefit quintile) not only from the current year but also from the three preceding years and the three subsequent years. Thus, counterfactual income paths would be drawn from a seven-year window around the individual in question. A common shock that hits the individual four years in the future, would hit the individuals from which the counterfactual income paths are drawn anywhere between 1 and 7 years in the future. Hence, it terms of expectations this common shock would be smoothed out.

To implement the correction for common shocks, we add to the original PSID sample six "time-shifted" replications of the PSID sample (corresponding to time shifts of -3, -2, -1, 1, 2, and 3 years). We refer to the resulting sample as the "expanded" sample. To create a time-shifted replication of *m* years, we take an original observation and shift the time index of each variable (real income, real net federal benefits, family composition) forward by *m* years.[3] For person *i* in year *t* from the *original* sample, we create the set $\mathcal{X}(i,t)$ by taking all observations in the same income decile and in the same "effective-benefit" quintile from the expanded sample. Thus, we will calculate the insurance and redistribution value *only* for people from the original sample, but use observations from the expanded sample to create a set of possible paths for the joint time paths of income, family composition, and state of residence. We will assume counterfactually that all of the observations in $\mathcal{X}(i,t)$ reside in person *i*'s state of residence in year *t*. We will therefore calculate for all individuals in the expanded sample the net state benefits they would have received had they resided in person *i*'s state of residence in year *t*. This yields $B_{j,s,t+k}$ for equation (11) for all the individuals *j* in set $\mathcal{X}(i,t)$. We define the effective benefit quintile from the distribution of net state benefits in year *t* among all individuals in the expanded sample that share person *i*'s income decile under the assumption that the benefits of these people are determined according to the rules of the state of residence of person *i* in year *t*.

Decompositions

The framework described above can be used to investigate what are the major drivers of the insurance and redistributive value curves, which plot both insurance and redistributive value by income percentile. We are planning to do the following investigations:

a. By time period

Calculate the redistributive and insurance value curves for different time periods ("decades")

b. Decomposition of changes over time

Changes over time in the redistributive and insurance value curves are decomposed into:

(i) the component that is due to changes in income and family composition mobility,

(ii) the component that is due to changes in residential mobility

(iii) the component that is due to changes in the rules of the state tax and transfer programs

Each of these components is found by calculating the redistributive and insurance value curves but replacing one of the actual determinants by a counterfactual determinant. For example, to calculate component (iii) we would apply draws from the income and family composition mobility from *all* time periods and use residential mobility from *all* time periods, but calculate net state benefits according to the rules of the actual time period.

c. By program

Decompose the redistributive and insurance value curves into components that are attributable to specific government programs (such as UI or TANF/AFDC). This would yield the marginal value of each program.

d. By state

We would plot the redistributive and insurance value curves for each state.

e. By demographics

We can calculate the average redistributive and insurance values by demographic groups (rather than by income percentile), so see which groups especially gain insurance and

[3] We do not recalculate the net federal benefits, so the federal benefits of the time-shifted observation are based on federal tax and benefit rules that where in effect *m* years ago. We will recalculate all the state benefits to reflect the

redistributive benefits. It is not clear that the insurance benefits, when calculated as an average for a demographic group, are meaningful when these demographic characteristics were not part of the set of conditioning variables.

4. Data and Empirical Implementation

The primary data for this project comes from the Panel Study of Income Dynamics (PSID), a panel data set that began in 1968 with a sample of about 5,000 households. All members (and descendants) of these original survey families were re-interviewed annually through 1997 and since 1997 the survey has become bi-annual. We currently have data through survey year 2005 (survey year 2007 data will soon be released). The original 1968 sample consists of two subsamples: a nationally representative subsample of 3,000 households and a subsample of 1,900 households selected from an existing sample of low income and minority populations. To adjust for this nonrandom composition, the PSID includes weights designed to eliminate biases attributable to the oversampling of low income groups and to attrition. All results use the weights provided by the PSID.

The PSID includes data on annual income from earnings, assets, and public and private transfers. The income data refer to the calendar year prior to the survey year, so the "income years" for the PSID span 1967-2004. These income amounts are collected for the head, wife, and other family members. These can be aggregated to total family income amounts.[4] In addition to the income variables, the PSID includes measures of family structure and family size, demographics, and state of residence.

The unit of observation in our analysis is the individual and we include an observation in the sample only if we observe it for the next K years (so we can construct the forward looking measures of redistribution and insurance value as shown in (9) and (11)). In practice, we choose a 10-year horizon (K=10). Further, we use a 3 percent discount rate (r=.03). We choose to look at individuals rather than households or families because of the significant changes to families that occur over time, over the life cycle (leaving home, marriage, divorce, children, etc). We treat utility as an individual-level concept but one that depends on household-level income. So,

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rules in the time-shifted year rather than the rules in the year when the original observation took place.

[4] In some years, less detail is provided on the recipient of the income. For example, sometimes the head and wife are asked separately and sometimes they are aggregated into one variable.

implicitly we assume resources are shared equally within households (and thus construct income and benefit measures using household definitions). However, to account for differences in family size and composition, we adjust all income and transfer amounts using the OECD modified equivalence scale.[5]

Our baseline sample consists of individuals age 25-52 in survey years 1968-1996. We stop the sample in 1996 since we require 10 years for the look-forward period (through 2005). The rationale for excluding those over age 52 is to ensure that by the end of the 10-year window all individuals will be younger than the early retirement age for Social Security (62). Once individuals retire, they face relatively little earnings risk and the programs aimed at them are by and large federal anyways.

We use the PSID to construct our key variables: total family income (*Y*), state transfers net of state taxes (*B*), and federal transfers net of federal taxes (*F*). Table 1 lists the components of each of these variables. Total family income consists of earnings, assets, and private transfers. *F* includes federal transfers (Social Security, SSI, and Food Stamps) less federal taxes (personal income taxes and payroll/FICA taxes). We use realized (PSID measured) federal transfer payments and use TAXSIM to calculate personal income and FICA taxes. *B* includes state transfers (UI, AFDC/TANF, Worker's Comp, General Assistance, value of Medicaid and SCHIP) less state taxes (personal income taxes, sales taxes).[6]

To construct annual measures of income and transfers, we linearly interpolate between sample observations when the survey becomes bi-annual beginning in 1997.[7] We linearly interpolate realized values for income, taxes, and benefits for the missing years. Note, that we interpolate realized value of *B* rather than calculate *B* for the interpolated realized value of *Y*. This creates a discrepancy if *B* is a *nonlinear* function of *Y*. On the other hand, *B* also depends on household composition and other factors that we cannot model well. We therefore feel that this discrepancy is minor relative to the estimation error involved in calculating *B* for the interpolated value of *Y*.

For all realized measures of transfers, we start with the observed PSID amounts for the transfer variables. For the tax measures and state public health insurance, we do not have any

[5] This scale assigns a value of 1 to the household head, of 0.5 to each additional adult member and of 0.3 to each child. See http://www.oecd.org/LongAbstract/0,3425,en_2649_33933_35411112_1_1_1_1,00.html for details.
[6] This covers the major state redistributive transfer programs with the exception of housing benefits.

observed values to use in the PSID. Instead we make use of tax and transfer calculators to assign these values. We use TAXSIM to measure state and federal income taxes and FICA taxes.[8] We plan to use a Medicaid/SCHIP calculator to assign the value of public health insurance for those who are eligible (more on this below). We also plan to use a crude state sales tax calculator. In Table 1, we present in bold each of the tax and transfer programs that we plan to model as part of this project.

To construct the redistributive and insurance value of state transfers net of taxes, and to perform our decomposition exercises, we need to calculate *B* under different assumptions for income, family structure, and so on. To do that, we will use transfer calculators for AFDC/TANF and UI. So in total, our project will be using three tax calculators (TAXSIM, Bakaji, Sales tax calculator TBA) and three transfer calculators (AFDC/TANF, UI, and Medicaid/SCHIP). The UI calculator is originally from Jon Gruber, updated by Raj Chetty. The Medicaid/SCHIP calculator was originally constructed by Janet Currie and Jon Gruber and updated by Doug Miller and Peter Huckfeldt. We have our own AFDC/TANF calculator. We do not plan on modeling worker's compensation or general assistance.

Remaining implementation details

Take-up: Not all eligible families receive public transfers. Indeed, take-up rates range widely across programs (Currie, 2003). This is not an issue to the extent we use realized values of components of *B*. For calculated components, which we use if there are no measures of realized components (e.g. Medicaid) or when we do decompositions, we need to make an assumption about take-up. In those cases, we will use the average take-up rates from the literature. This is particularly relevant for Medicaid and for TANF (post-welfare reform). We also would have to make an assumption about how to deal with lifetime time limits with TANF.

Public health insurance: The rising cost of health care and increasing state spending on public health insurance are hugely important contributors to the changes in state spending on redistribution. While modeling state health insurance raises challenges, it seems essential to

[7] There are also a small number of observations that are missing from the survey one year and then return. We apply the same method to those missing values.

[8] TAXSIM currently includes state income taxes back to 1977. For our current calculations we apply the 1977 TAXSIM calculator for state taxes also to the years 1968-1976 (we first convert earlier years of income into 1977 dollars before running them through the 1977 TAXSIM calculator and we take into account that TAXSIM returns

include it in our project. Public health insurance matters in determining the insurance value of transfers in direct and indirect ways. First, expansion of state public health insurance provides an increase in the safety net and directly affects our calculations of the insurance value of transfers. Second, increases in health costs and/or reductions in employer provided health insurance can lead to increases in the costs of a negative earnings shock. This increases the insurance value of public health insurance (even without any expansion in the program).

We plan to model state public health insurance in several steps. First, we use the Medicaid/SCHIP calculator to determine whether the family (or children in the family) are eligible for either program given income and characteristics. Second, if eligible we add the Medicaid value times the average take-up rate to *B* for this observation. We propose to measure the Medicaid value using average realized Medicaid/SCHIP expenditure per recipient in the state and year. We think we can obtain these amounts from Medicaid administrative reports.[9] Finally, we deduct from *B* (or *Y*?) predicted out of pocket medical expenses for this individual. The out-of-pocket medical expenses would vary by earnings decile and year (and possibly public health insurance status). We are looking into the best data to make this calculation (CEX, MEPS, PSID).

5. Preliminary Calculations

Here we provide some preliminary calculations using our PSID sample. All of the transfer amounts are realized values (i.e., as reported in the PSID) and includes all items in the first two panels of Table 1. We also have calculations of state and federal taxes using TAXSIM. Each observation is assigned the income (or tax or benefits) of the household in which they live. Unless otherwise stated, the household income/benefits are adjusted to per person amounts using the equivalence scale. Values are in 2005$ and all means are weighted using the PSID sample weights.

We begin by providing a few descriptive figures on our key variable *B* and, for comparison, *F*. Figure 1 plots average state transfers over the sample period. The state transfer is decomposed into the tax component (negative) and transfer component (positive). The total state transfer is the sum of the two and is also shown. For these calculations we include all individuals

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state taxes in 1977 dollars). Eventually, we will use Jon Bakaji's state tax calculator that covers our entire sample period.

ages 22-62 and income years 19XX-2004. The state benefits here are averages of the total household values and are not adjusted for family size. Figure 1 shows that state transfers are highly cyclical with peaks in the recession years of 1982 and 1992. State taxes are increasing significantly over this time period. Finally, average state net of tax transfers are negative (taxes>transfers). In Figure 2, we provide similar trends for the federal tax and transfers. Federal taxes include both personal income tax and FICA. The figure shows that federal transfers are very small compared to taxes and, like state taxes, federal taxes are increasing over time.

In Figure 3, we present means of the naïve annual value ($Z^{Naïve}$) defined in equation (8). We calculate means by percentile of the distribution of family income Y. In particular, we take means by 5-percentile bins. In this and the remaining calculations, both Y and Z are adjusted for family size using equivalence scales. There are three lines in Figure 3, one for state taxes, one for state transfers and one for the total. Recall from (8) that the naïve annual value Z is equal to the individual's benefit less the mean for that state-year cell. The figure shows that there is significant redistribution in the state tax and transfer programs. As expected, transfers largely accrue to the bottom of the distribution while at the top of the income distribution pays high net taxes. Figure 4 shows the mean of the naïve annual value (net of tax and transfer) across four time periods: 1967-76, 1977-86, 1987-96, and 1997-04. This demonstrates that indeed the amount of redistribution is increasing over time.

Finally, Figures 5-7 compare naïve annual value ($Z^{Naïve}$ defined in equation 8) to the realized redistributive value ($Z^{R,realized}$ defined in equation 9). The realized redistributive value uses the 10-year look forward and calculates annualized benefits over this period for all years the individual resides in the state. For these figures, we limit the sample to those 22-52 in years 1967-1996 (as described above in the data section). As expected, the forward-looking realized benefit is less redistributive than the single period measure, however, they do not differ substantially. We will explore further why this is the case. Figures 6 and 7 show the same calculations, where we separate out state taxes and transfers. The differences between current period realized benefits and 10-year realized benefits are more substantial for transfers and there is little difference for the measures using taxes.

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[9] Note that Medicaid covers not only low income families and children (as is the focus of this project) but also the elderly and disabled. We think it is possible to obtain the cost data by type of eligibility allowing for us to use only the expenditures (and caseloads) for (the much lower cost group of) families and children.

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Table 1
Components of Family Income, Federal & State Tax and Transfers

	Total Family Income (Y)	Federal Tax and Transfer Payments (F)	State Tax and Transfer payments (B)
Measured in the PSID	Labor Earnings Child Support & Alimony Income from Assets Lumpsum Payments from insurance or inheritance Private transfers from relatives Other private transfers	Social Security Supplemental Security Income Food Stamps	**AFDC/TANF** **Unemployment Insurance** General Assistance & Other Worker's Compensation
Calculated using tax and transfer calculators		**(−) Federal Tax Liability** **(−) FICA Liability**	**(−) State Tax Liability**
Not yet modeled	**(−) Out of pocket health expenses**		**(−) State Sales Tax** **Medicaid (value of)** **SCHIP (value of)**
No plans to measure			Housing benefits

Figure 1

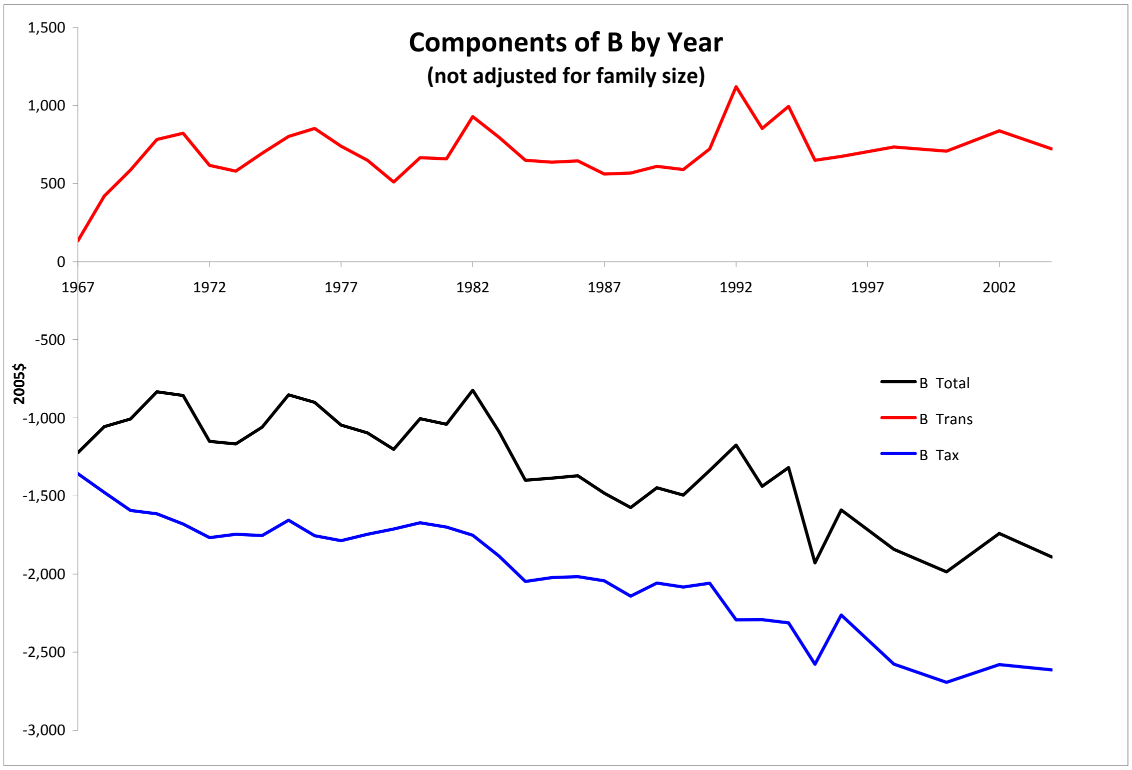

Figure 2

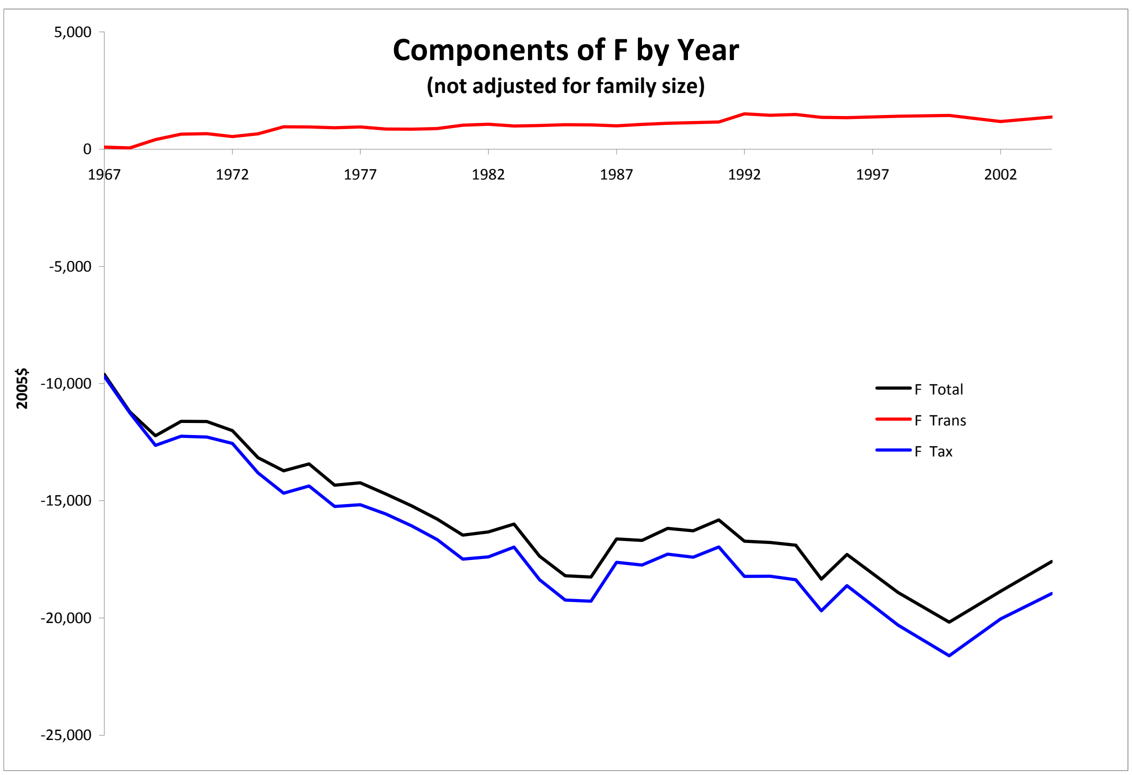

Figure 3

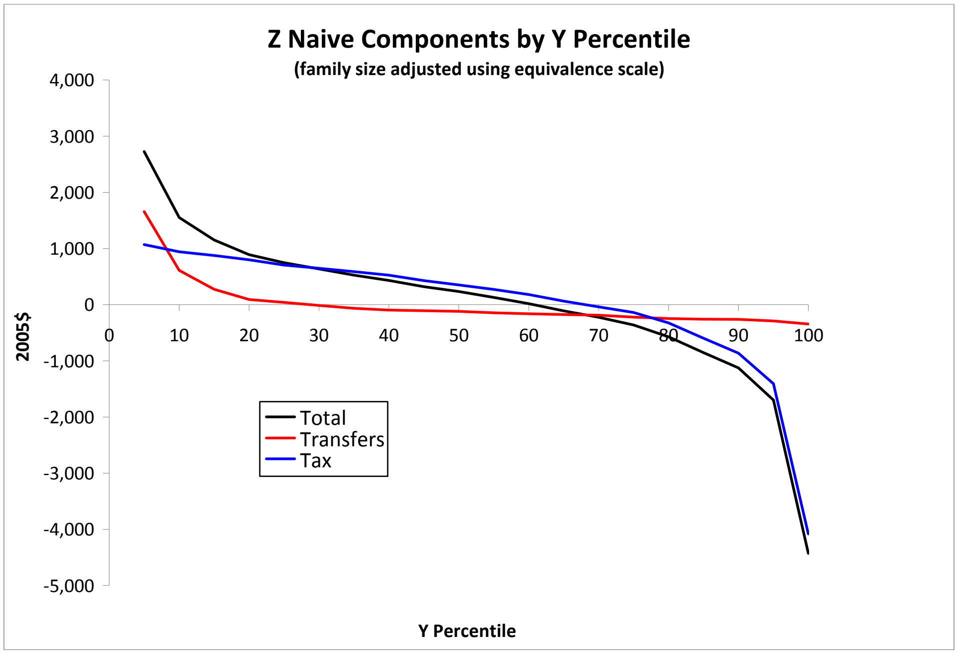

Figure 4

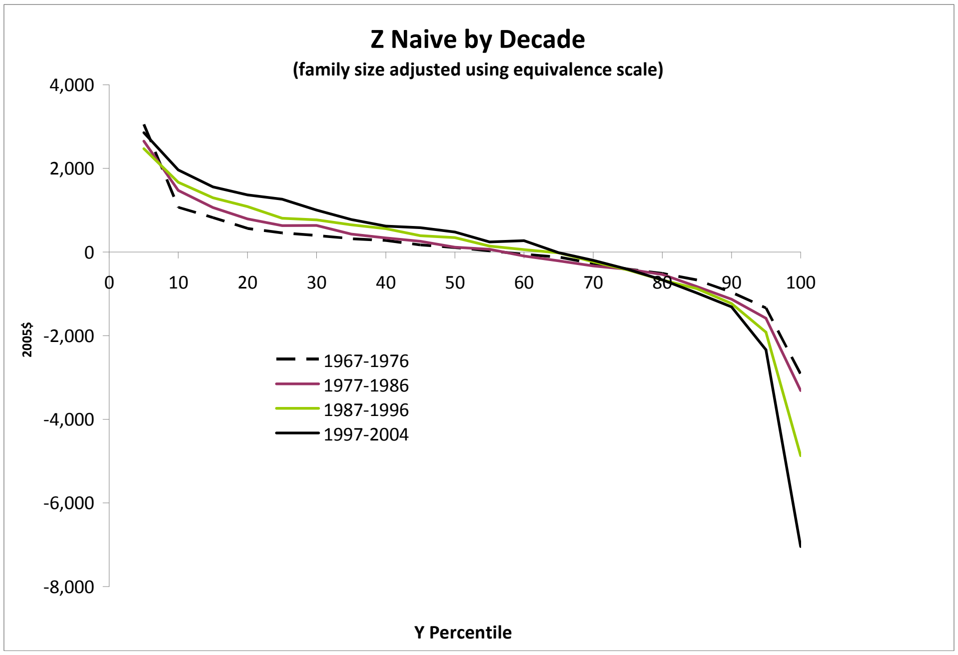

Figure 5

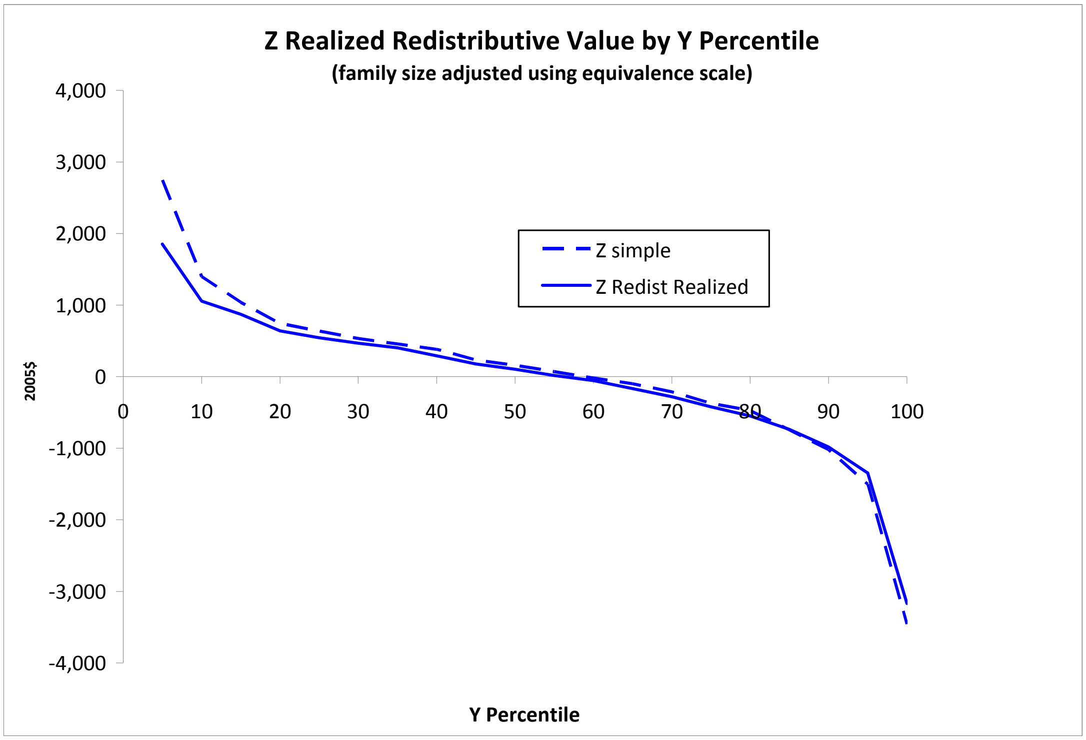
Z Realized Redistributive Value by Y Percentile
(family size adjusted using equivalence scale)
4,000
3,000
2,000
1,000
0
-1,000
-2,000
-3,000
-4,000
2005$
0
10
20
30
40
50
60
70
80
90
100
Z simple
Z Redist Realized
Y Percentile

Figure 6

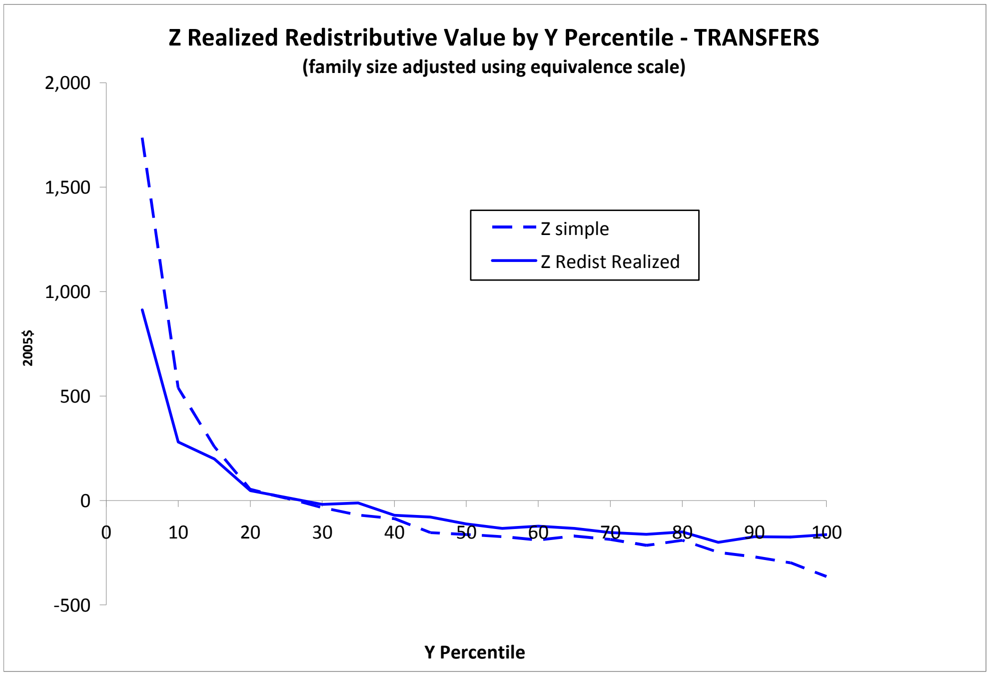

Figure 7