The Insurance Value of State Tax-and-Transfer Programs[*]

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Abstract

This paper estimates the effective total value that individuals derive from their state's tax-and-transfer program, and shows how this value varies by income. The paper decomposes this total value into two components: redistributive value, which is due to predictable changes in income (and family circumstances), and insurance value, which occurs when taxes and transfers compensate for unexpected income shocks. Our approach is a forward-looking one, where we examine income and transfers net of taxes over a 10-year period. We model state taxes (personal income taxes, the EITC, and sales taxes) and state means-tested transfers (AFDC/TANF and Medicaid/SCHIP). The calculations are made using the Panel Study of Income Dynamics and allow for analysis of the determinants of changes in the value of state net benefits over a more than 30 year period. We find that the redistributive value of state tax-and-transfer programs sharply declines with income, but that the insurance value of transfers is increasing in income. The resulting effective total value is positive across the income distribution and is relatively flat across income groups. This latter finding may explain why mobility does not "undo" state redistributive spending.

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 Oates 1972 and Musgrave 1959 and the recent survey by Boadway and Tremblay 2010) 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 (Baicker et al. 2010, Moffitt 2003). State income taxes have increased substantially as well as state expenditures on the lower-income population, including state Earned Income Tax Credits (Levitis and Koolish 2008). On the transfer side, the increases in state expenditures have primarily taken place in the area of health care—with tremendous expansions in public health insurance coverage and expenditures on Medicaid and SCHIP. This is interesting in light of the fact that mobility costs have declined over time (Rhode and Strumpf 2008) and, at least among highly educated, mobility has increased over time (Baicker et al. 2010).

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 employ the framework developed in Hoynes and Luttmer (2010) for calculating the effective total value (i.e., the equivalent variation) that an individual receives from a tax-and-transfer system, and implement it for state tax-and-transfer systems. The framework allows us to decompose this total value into a redistributive component and an insurance component. The redistributive component is due to predictable changes in income (and family 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 social insurance programs such

as unemployment and disability insurance, but are also present in public health insurance programs, welfare programs, and the personal income tax.

Our empirical implementation uses the Panel Study of Income Dynamics. The PSID is ideally suited for this analysis as it provides longitudinal data on a sample of individuals. Further, by spanning more than three decades (1968-2004) we are able to richly explore the determinants of changes in the insurance and redistributive value of state net benefits over time.

We use the PSID and several tax-and-transfer calculators to evaluate individuals' net state benefits – the difference between benefits (transfers) and contributions (taxes). This is derived from Buchanan's (1950) notion of "net fiscal residuum" or what is commonly called "net fiscal benefit." Our method requires calculating the conditional covariance between net state benefits and future income. We form this conditional distribution by using income and family composition paths and their corresponding net state benefits from observations that are similar to the observation in question (i.e., "nearest neighbors" using nonparametric matching methods). We model state taxes (personal income taxes, the EITC, and sales taxes) and state means-tested transfers (AFDC/TANF and Medicaid/SCHIP) to calculate net state benefit paths for these nearest neighbors.

We find that the insurance value of state tax-and-transfer systems increases with income, and that the redistributive value of state tax-and-transfer systems falls with income. The sum of these two components, "effective total value," is positive for all income levels and declines only moderately with income. Thus, we find that insurance value is an important source of value from state tax-and-transfer systems, and this may help to explain why residential mobility has not seriously undermined state tax-and-transfer systems. In fact, we find that between 1972 and 1992 the effective total value has significantly increased at each income level, with somewhat stronger increases for higher income levels. We decompose this change over time into: (i) the component that is due to changes in income and family composition mobility, (ii) the component that is due to changes in across-state residential mobility, and (iii) the component that is due to changes in state tax-and-transfer programs. We find that changes in income and family composition mobility account for about 50% of the increase in effective total value, changes in residential mobility account for virtually none of the increase, while changes in state tax-and-transfer programs account for about 20% of the increase. The remainder is explained by the interaction of these three components.

The remainder of the paper is as follows. In Section 2, we describe the prior literature

and, in Section 3, we lay out the methodology for measuring the redistributive and insurance value of transfers and our approach for implementing the decomposition. In Section 4, we describe the data, tax-and-transfer programs, and our empirical implementation. We present the results in Section 5, and Section 6 concludes.

2. Literature Review

Our work has origins in several different areas. Seminal work by Varian (1980) extends the canonical optimal tax problem to allow for an insurance component to redistributive policies. He shows that if evolutions to income involve a random component, and if there are incomplete markets to insure this risk, then redistributive taxation helps to insure against individual risk. Thus, the efficiency consequences of taxation need to be balanced against not only the equity of redistribution but also against the insurance value of redistribution.

A related literature focuses on voting models for redistribution policies. The basic question posed in this literature is why the (relatively) poor majority does not vote for redistributive policies, thereby expropriating funds for their group. Buchanan (1976) originally incorporated insurance versus redistribution in tax-and-transfer systems into voting models. He modeled political support for redistribution policies in a setting where future incomes are uncertain, thus identifying an insurance component to redistribution. Bénabou and Ok (2001) developed this idea further by exploring to what extent the *prospect of upward mobility* can affect the optimizing choices of forward-looking voters. They find empirical support for their model although the results become weaker when risk aversion is added (and thus an insurance component is introduced). Their work examines the redistributive and insurance components of *central* government policies. Further, the focus is on voting models and understanding the determinants of support for redistribution policies, rather than the empirical measurement and decomposition of the kind we implement here.

In our work, we extend this literature to examine *state* tax-and-transfer policies. Of course, the major change in moving from a centralized government setting to the state (and local) level is the potential mobility of individuals. From an individual's perspective, the state policies are only relevant in the future to the extent that the individual remains in the state. Feldstein and Wrobel (1998) show that with costless mobility and full information about opportunities outside the state, inter-state mobility of workers and the consequent adjustment of pre-tax earnings across states undoes states' redistribution policies. The extent of full adjustment of pre-tax

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earnings depends, of course, on the costs of mobility and so on. Feldstein and Wrobel present empirical results that show that increases in marginal tax rates in the state lead to substantial reductions in pre-tax earnings.

Ideas about identifying the insurance versus redistribution components are not unique to government tax policies. They have been investigated and applied in other areas such as health insurance (Cochrane 1995), employment protection and labor market institutions (Agell 2007), private annuities (Brown 2003), and bankruptcy (White 2007).

Finally, our work is guided by several empirical literatures. There is a parallel to the vast literature on the incidence of taxes, introduced by Pechman (1985) and expanded in many dimensions including (i) moving from a partial to general equilibrium setting, (ii) moving from static to lifetime incidence (Fullerton and Lim Rogers 1993), and (iii) expanding the range of taxes and government activities considered. This approach has also been applied to estimate the lifetime incidence of (or rate of return in) the Social Security program (Brown et al. 2009, Coronado et al. 2000, Gustman and Steinmeier 2001) and long-run participation in means-tested transfer programs (Bane and Ellwood 1994, Blank and Ruggles 1996). The similarity to our work comes from the extension to a multi-period setting; however there is no attempt to identify the insurance versus redistributive components of these programs. That is, this literature examines the degree of progressivity of income taxes taking into account realized income paths.

The literature on the consumption smoothing effects of transfer programs (Gruber 1997, 2000) is also motivated by an interest in evaluating the degree of insurance in government transfer programs. Gruber uses variation in generosity of state transfer programs to estimate insurance against job loss (provided by unemployment insurance) and divorce (provided by AFDC/TANF) as measured by the impact on household consumption. However, as with the above literature, it relies fully on realized earnings paths and thus cannot distinguish between the insurance and redistributive aspects of policies.

Our work makes several contributions. First, our methodology provides a more complete decomposition and identification of the insurance and redistributive elements of government policies. Second, we focus on state tax-and-transfer policies. Third, our emphasis is on estimating the value of the state tax-and-transfer programs and decomposing their sources of change. Fourth, we comprehensively measure state redistribution policies including taxes (income taxes, state Earned Income Tax Credit, sales taxes) and means-tested transfers (AFDC/TANF, Medicaid and SCHIP).

3. Methodology

3.1 Overview

We start by giving a brief overview of the general methodology as developed in Hoynes and Luttmer (2010) for calculating redistributive and insurance value. In the next subsection, we explain how we implement this methodology for state tax-and-transfer systems.

The starting point of our methodology is the "total value" that an individual receives from a tax-and-transfer system. This total value is defined as the equivalent variation of the tax-and-transfer system relative to a baseline of having no tax-and-transfer system, i.e., in the baseline, each individual pays the same lump-sum tax to finance government consumption, which is held constant.[1] The equivalent variation is forward-looking and it is defined on an annual basis. In particular, the equivalent variation is the amount such that the individual is indifferent between (i) the baseline and receiving the equivalent variation each year and (ii) the existing tax-and-transfer system. Because of data limitations, we will look forward 10 years, rather than forever, when calculating the total value.

To determine between which bundles individuals are indifferent, we assume that individuals have CRRA utility functions, have rational expectations, and only derive utility from consumption. We further assume that individuals consume in each year their income plus the benefits they receive minus the taxes they pay. Henceforth, we will refer to benefits received minus taxes paid as "net benefits." We also assume that wages and prices do not adjust in response to the taxes and transfers, so that the incidence of taxes and transfers lies fully on the individuals who pay the taxes or receive the transfers.[2] Finally, we assume that individuals take their income and net benefits as exogenous. In other words, we do not incorporate into our framework any labor supply or savings responses to the tax-and-transfer system.[3]

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[1] By defining the value of the tax-and-transfer system in terms of a thought experiment that keeps government consumption constant, we avoid the having to make very strong assumptions about how to allocate the benefits of government consumption along the income distribution. Empirically, we limit our analysis to the core redistributive state tax and transfer programs and ignore state benefits deriving from public goods and other state expenditures.

[2] We follow Gordon and Cullen (2010) in assuming that relative wages do not respond to state tax-and-transfer policies. Even if workers are not perfectly mobile or workers of different skill levels are not perfect substitutes, this assumption remains valid as long as the conditions of the Heckscher-Ohlin model are satisfied within the U.S. (as appears plausible). Note, however, that the empirical findings in Feldstein and Wrobel (1998) indicate that some of the incidence of state redistribution programs may nevertheless fall on firms.

[3] Our focus is somewhat different from the widely used spatial general equilibrium models of Rosen (1979) and Roback (1982).

We decompose the total value into an insurance and redistributive component. The redistributive value of a tax-and-transfer system is the equivalent variation of receiving one's *expected* net benefit in each future year relative to the baseline of receiving the population average net benefit in each future year. The redistributive value thus captures the expected benefit of the tax-and-transfer system. The insurance value is the equivalent variation of receiving one's *actual* net benefit in each future year relative to the baseline of receiving one's *expected* net benefit in each future year. In other words, the insurance value captures the value of taxes and transfers in deviation from what the individual is expected to receive. The decomposition between insurance value and redistributive value depends crucially on the expectation of future net benefits given the characteristics of the individual. On the one extreme, if future net benefits were perfectly predictable given current information, the insurance value would be zero. On the other extreme, if future net benefits do not depend at all on current information, the redistributive value would be zero because everyone's expected future net benefit would be the same.[4] 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 rests completely on the predictability of net transfers.

Because our framework is dynamic, we can distinguish two channels by which the tax-and-transfer system provides value. First, the tax-and-transfer system provides redistribution and insurance *across* people: it redistributes from people with high expected incomes to those with low expected incomes, and it channels insurance payments from people with unexpectedly good income realizations to those with unexpectedly poor income realizations. Second, the tax-and-transfer system provides redistribution and insurance *within* people: it redistributes from a person in periods when that person is expected to have high income to the same person in periods when that person is expected to have low income, and it channels insurance payments from a person in periods with unexpected high income realizations to that same person in periods with unexpectedly low income realizations. Thus, we calculate four components of value from the tax-and-transfer system: across-person redistributive value, across-person insurance value, within-person redistributive value, and within-person insurance value.

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[4] 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.

While it is clear that the across-person components provide value, the within-person components may not always provide value. To an individual with access to perfect capital markets, the time-profile of expected net benefits is irrelevant because this individual can borrow or save to achieve the desired expected consumption profile. Hence, such an individual derives no value at all from the within-person redistributive component. Individuals facing liquidity constraints or individuals facing interest rates that are not equal to their discount rates, however, can derive value from the within-person redistributive component. Nevertheless, in light of the generally well-functioning capital markets in the U.S., we believe that the most credible estimate of the total value of the tax-and-transfer system is formed by excluding the within-person redistributive component. We refer to the total value minus the within-person redistributive component as the "effective total value." Thus, the effective total value consists of three components: the across-person redistributive component, the across-person insurance component, and the within-person insurance component.

Even individuals with access to perfect capital markets generally derive value from the within-person insurance component. To see this, consider a person who in the first period receives an unexpectedly good income realization and in the second period receives an unexpectedly poor income realization of the same magnitude. Hence, the insurance component for this individual is exclusively within person. If the person knew in period 1 that next period's shock would exactly offset the current period's shock, the person could perfectly smooth consumption by saving 100% of the current period's shock. However, by the definition of a shock, individuals do not know whether a current period's shock will be offset or compounded by a future shock. Not knowing this, an individual would optimally save only part of the shock, thus not perfectly smoothing consumption. Hence, "buffer stock" saving and borrowing will reduce the value of the within-person insurance component but not eliminate it. Given the unpredictability of future shocks (conditional on current ones) we believe that the most credible estimate of the effective total value of the tax-and-transfer system is formed by including the within-person insurance component.

In principle, a more precise estimate of the within-person insurance value could be obtained by explicitly modeling buffer-stock savings behavior, but we do not build such a model for two reasons. First, our data do not have comprehensive consumption measures (or savings behavior), 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 buffer-stock 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.

We isolate the across-person value of the tax-and-transfer system by calculating the value of the tax-and-transfer system under the assumption that individuals are (somehow) able to perfectly smooth consumption. We calculate the total value of the tax-and-transfer system under the assumption that individuals do not at all smooth consumption. Finally, the within-person value is found by subtracting the across-person value from the total value.

Implementing this framework for state tax-and-transfer systems generates three, increasingly inclusive, measures of the value to individuals of the tax-and-transfer system in their state of residence. In our empirical results, 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 and provide insurance value. By only counting the value of the state tax-and-transfer system of the state of residence, we exclude the option value of tax-and-transfer systems in other states to which the individual could move in response to income shocks.[5] While there is undoubtedly some option value of moving to a different state in response to a shock, mobility costs are higher when the timing of a move is exogenously imposed by the timing of a shock rather than endogenously determined by the individual. We therefore suspect this option value is limited in practice.

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) 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 across-person redistributive value (including both current and future years) taking a weighted average of the individual's current and expected future net state benefits minus the population mean of the 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 effective 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 effective 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 showing the basic results, 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.

3.2 Implementation for State Tax-and-Transfer Systems

We assume that individuals derive utility from own consumption according to a CRRA utility function:

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

where i indexes individuals, t indexes years, s indexes state of residence, ρ is the coefficient of relative risk aversion. C_{ist} denotes real family consumption adjusted for family size using an equivalence scale. Thus, we implicitly assume that resources are shared within families and there are economies of scale for larger families. Henceforth, all individual-level consumption, income, tax, and transfer variables are real and adjusted for family size using an equivalence scale. When calculating the total insurance and redistributive value, we assume that individuals fully consume their disposable income in each year.

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}):

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[5] In our empirical implementation, we do allow moving probabilities to depend on realizations of income and

$$C_{ist} = Y_{it} + F_{it} + B_{ist}.$$ (2)

F_{it} and B_{it} are implicit functions of pre-tax income, the state of residence, the federal and state tax-and-transfer system in year t, and family characteristics (e.g., marital status, family size, number of dependent children). We assume that individuals have a real discount rate of r.

3.3 Combined Redistributive and Insurance Value

The total value Z_{ist}^{Total} of a state's tax-and-transfer system depends on the person's conditioning characteristics X_{ist}, because these characteristics are used to form the conditional expectation of the person's future income and net benefits as well as their conditional variance and covariance. We form conditional expectations for future income and benefits by first defining $\mathcal{X}(i,t)$ as the set of individuals who have the same (or very similar) values of the conditioning variables as individual i in year t. The conditioning variables are variables on which the future income distribution and benefit eligibility depend. Candidates for inclusion in $\mathcal{X}(i,t)$ are state of residence, 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 can proceed by finding the sum of the insurance and redistributive value for individual i from the perspective of year t as the solution for Z_{ist}^{Total} to the following equation:

$$\sum_{j \in \mathcal{X}(i,t)} \sum_{k=0}^{K-1} \left(U(Y_{j,t+k} + B_{j,s,t+k} + F_{j,t+k}) - U(Y_{j,t+k} + \bar{B}_{s,t+k} + F_{j,t+k} + Z_{ist}^{Total}) \right) R_{jt}(t+k)(1+r)^{-k} = 0, \quad (3)$$

where $\bar{B}_{st}$ denotes the mean net transfer in state s in year t. K denotes the individual's planning horizon, which in practice we set to 10 years. 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

income changes, but we do not calculate the option value of such moves.

$t+k.$[6] Let $R_{jt}(t+k)$ denote an indicator function that equals one if individual j 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. Next, we calculate the average value of the Z_{ist}^{Total} by income percentile to explore how the redistributive and insurance benefits of the state tax-and-transfer system vary by income percentile. Note that this calculation is *not* equivalent to solving equation (3) by $\mathcal{X}(i,t)$ that are solely defined by income percentile since $U(.)$ is a non-linear function.

We decompose equation (3) into its four components (across-person redistributive, within-person redistributive, across-person insurance, within-person insurance). To perform this decomposition, we first need to calculate the expected benefits for each future year for person i conditional on the information set $\mathcal{X}(i,t)$ and conditional on remaining in the current state:

$$\mathrm{E}_{\mathcal{X}(i,t)}[B_{i,s,t+k} \mid R_{it}(t+k)=1] = \sum_{j \in \mathcal{X}(i,t)} \left(B_{j,s,t+k}\, R_{jt}(t+k) \right) \Big/ \sum_{j \in \mathcal{X}(i,t)} R_{jt}(t+k). \tag{4}$$

The total insurance value Z_{ist}^{I} is found by solving:

$$\sum_{j \in \mathcal{X}(i,t)} \sum_{k=0}^{K-1} \Big(U(Y_{j,t+k} + B_{j,s,t+k} + F_{j,t+k}) - U(Y_{j,t+k} + \mathrm{E}_{\mathcal{X}(i,t)}[B_{s,t+k}] + F_{j,t+k} + Z_{ist}^{I}) \Big) \times$$
$$R_{jt}(t+k)\left(1+r\right)^{-k} = 0. \tag{5}$$

Equation (5) shows that the insurance value is the equivalent variation of the actual tax-and-transfer program relative to a baseline in which the individual receives his or her expected net benefit. We do not model all state expenditures, so empirically the expected net benefit is negative, i.e. an expected net tax, for many individuals. Thus, in the baseline, many individuals face a risk of having to pay a net tax even if their income and federal net transfers fall below the amount of this net tax. Because utility goes to minus infinity as consumption approaches zero, these individuals greatly value insurance against being required to pay under all circumstances a net tax (equal to minus their expected net benefits). While this valuation of insurance is valid in

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[6] We use a real discount rate of 3%, so we set $r = 0.03$.

the context of the thought experiment that defines our measure of insurance value, it is likely that in reality nobody's consumption would in fact become negative because alternative forms of catastrophic insurance would emerge (the government might not enforce collecting the net tax, or friends, family, and charities might help out). To test the sensitivity of our results to such forms of catastrophic insurance, we will also calculate the insurance value for utility functions where utility has a lower bound that corresponds to a minimal level of consumption.

We decompose the total insurance value into across-person insurance value and within-person insurance value. The across-person insurance value measures the insurance value of shocks that are not offset by shocks (in some other period) in the opposite direction. It is therefore most responsive to permanent shocks. To obtain the across-person insurance value, we recalculate equation (5), 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). This time-averaging removes any shocks that are offset by future shocks to the same individual in the opposite direction. Let a tilde denote this discounted average, so for any variable $W_{j,t}$ for individual j from the perspective of year t:

$$\tilde{W}_{j,t} \equiv \sum_{k=0}^{K-1} \tilde{W}_{j,t+k} R_{jt}(t+k)\left(1+r\right)^{-k} \bigg/ \sum_{k=0}^{K-1} R_{jt}(t+k)\left(1+r\right)^{-k} \tag{6}$$

The across-person insurance value $Z_{ist}^{I,Across}$ is found by solving:

$$\sum_{j \in \mathcal{X}(i,t)} \sum_{k=0}^{K-1} \left(U(\tilde{Y}_{j,t} + \tilde{B}_{j,s,t} + \tilde{F}_{j,t}) - U(\tilde{Y}_{j,t} + \mathrm{E}_{\mathcal{X}(i,t)}[\tilde{B}_{s,t}] + \tilde{F}_{j,t} + Z_{ist}^{I,Across}) \right) \times$$
$$R_{jt}(t+k)\left(1+r\right)^{-k} = 0, \tag{7}$$

and the within-person insurance value is found as:

$$Z_{ist}^{I,Within} = Z_{ist}^{I} - Z_{ist}^{I,Across}. \tag{8}$$

The within-person insurance value measures the insurance value of shocks that, ultimately, are offset by future shocks (though the individual could not foresee this). It is therefore most responsive to transitory shocks.

The total redistributive value Z_{ist}^{R} is found by solving:

$$\sum_{j\in\mathcal{X}'(i,t)}\sum_{k=0}^{K-1}\Big(U(Y_{j,t+k}+\mathrm{E}_{\mathcal{X}'(i,t)}[B_{s,t+k}]+F_{j,t+k}+Z_{ist}^{I})-$$

$$U(Y_{j,t+k}+\overline{B}_{s,t+k}+F_{j,t+k}+Z_{ist}^{I}+Z_{ist}^{R})\Big)R_{jt}(t+k)(1+r)^{-k}=0. \tag{9}$$

The total redistributive value is based on the assumption 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 total redistributive value stems from the fact that the tax-and-transfer system helps smooth the disposable income flow over time *within an individual*. This component of the value 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 redistribution, we recalculate equation (9), but replace all time-indexed variables by the average value (denoted by a tilde):

$$\sum_{j\in\mathcal{X}'(i,t)}\sum_{k=0}^{K-1}\Big(U(\tilde{Y}_{j,t}+\mathrm{E}_{\mathcal{X}'(i,t)}[\tilde{B}_{s,t}]+\tilde{F}_{j,t}+Z_{ist}^{I})-U(\tilde{Y}_{j,t}+\tilde{\overline{B}}_{s,t}+\tilde{F}_{j,t}+Z_{ist}^{I}+Z_{ist}^{R,Across})\Big)\times$$

$$R_{jt}(t+k)(1+r)^{-k}=0. \tag{10}$$

Because both $\mathrm{E}_{\mathcal{X}'(i,t)}[\tilde{B}_{s,t}]$ and $\tilde{\overline{B}}_{s,t}$ are constant for all j in $\mathcal{X}(i,t)$, we can solve (10) explicitly:

$$Z_{ist}^{R,Across}=\mathrm{E}_{\mathcal{X}'(i,t)}[\tilde{B}_{s,t}]-\tilde{\overline{B}}_{s,t}. \tag{11}$$

Equation (11) shows that the across-person redistributive component does not depend on the curvature of the utility function (i.e., is independent of ρ). This is not surprising because the across-person redistributive component for an individual is equal to the expected present discounted value of the net benefit for that individual from the state tax-and-transfer system in the state of residence of that individual minus the present discounted value of population average net state benefits in that state.

We find the within-person redistributive component as the difference between the total redistributive value and the across-person redistributive component:

$$Z_{ist}^{R,Within}=Z_{ist}^{R}-Z_{ist}^{R,Across}. \tag{12}$$

3.4 Gradients with Respect to Current Income

In the results section, we plot three measures of the value of the state tax-and-transfer system as a function of base-period real income Y_{it}. First, for each individual, we plot the "Naïve Annual Value," $Z_{ist}^{Na\text{ï}ve}$, the naïve annual value of his state's tax-and-transfer system:

$$Z_{ist}^{Na\text{ï}ve} = B_{ist} - \bar{B}_{st} , \tag{13}$$

The naïve value only measures the redistributive value in the current year. It therefore ignores the value that stems from net state benefits in future years or from the insurance value of the state tax-and-transfer system.

Second, we plot the across-person redistributive value, $Z_{ist}^{R,Across}$, by current income. The difference between the plot of $Z_{ist}^{Na\text{ï}ve}$ and the plot of $Z_{ist}^{R,Across}$ shows the importance of expected income mobility. If individuals are expected to retain their position in the income distribution, the plots of $Z_{ist}^{Na\text{ï}ve}$ and $Z_{ist}^{R,Across}$ will be very close, whereas the plot of $Z_{ist}^{R,Across}$ would have a much weaker gradient with respect to current income than the plot of $Z_{ist}^{Na\text{ï}ve}$ if those with current low income expect higher income (and thus lower net benefits) in the future and those with current high income can expect higher (or less negative) net benefits in the future.

Third, we plot the effective total value,

$$Z_{ist}^{EffectiveTotal} \equiv Z_{ist}^{R,Across} + Z_{ist}^{I,Across} + Z_{ist}^{I,Within} , \tag{14}$$

which is the total value minus the within-person redistributive component. The difference between the plot of $Z_{ist}^{EffectiveTotal}$ and the plot of $Z_{ist}^{R,Across}$ shows the insurance value of the state tax-and-transfer system. As long as insurance value is positive (which it is for risk averse individuals if net benefits negatively covary with income shocks), the plot of $Z_{ist}^{EffectiveTotal}$ must lie weakly above the plot of $Z_{ist}^{R,Across}$. The gradient of $Z_{ist}^{EffectiveTotal}$ with respect to income will be less strong than the gradient of $Z_{ist}^{R,Across}$ if higher income individuals derive more insurance value from the state tax-and-transfer system.

3.5 Calculating Conditional Expectations

An important part of our approach lies in how we construct the information set $\mathcal{X}(i,t)$, because $\mathcal{X}(i,t)$ determines the conditional variances and covariances that drive our estimate of the effective total value and the conditional expectations that drive the decomposition into insurance and redistributive value. In practice, the sets $\mathcal{X}(i,t)$ will likely contain only one or just a couple of observations if, as would be appropriate, they are multidimensional and conditioned on, say, state of residence, current income, education, age, and family composition. This means that solving the above equations and modeling conditional uncertainty is not feasible using realizations of similar individuals in the information set. We see two basic potential "solutions" to this dimensionality problem.

First, we could simply reduce the dimensionality of the information set and assume that variances and expectations of future income and net benefits are only conditioned on one variable, say current income bracket. This is a highly restrictive assumption since, in fact, benefits depend significantly on family composition (married/single, 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 (and realizations for family structure, state and so on) for individual i from the perspective of year t. We then would draw time paths for income, family composition, and state of residence from these parametric models and add them to the set $\mathcal{X}(i,t)$ to ensure the set $\mathcal{X}(i,t)$ contains sufficient observations. 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 the distribution of the income paths is highly complex. 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 first-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). In addition, the path of family composition needs to be modeled carefully because most state tax and transfer policies explicitly depend on

15

them. Finally, the income path and the family composition paths are not independent, but subject to correlated shocks.[7]

We solve the dimensionality problem by adopting a hybrid solution that uses a combination of the two basic solutions outlined above. First, 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). In particular, variances and expectations are conditioned on (i) current income, (ii) effective state net benefit percentile, defined below, and (iii) age. We then construct the conditioning set $\mathcal{X}(i,t)$ by choosing observations that are "close to" the current observation in terms of real income in year t, the effective-benefit percentile in year t, and the age of the individual. We implement this using a kernel distance measure, described below. Because of thinness in the cells, we do not condition on state of residence but instead assume counterfactually that all of the observations in $\mathcal{X}(i,t)$ reside in person i's state of residence in year t. We therefore replace the actual state benefits of the individuals j in set $\mathcal{X}(i,t)$ by the net benefits they would receive had they resided in person i's state of residence in year t (that is, we use the income, family structure, etc. of observations j put through our tax-and-transfer calculator for i's state of residence). This yields $B_{j,s,t+k}$ for equation (3). 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 (3). We define the effective benefit percentile from the distribution of net state benefits in year t among all individuals in person i's current income group 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.[8] By requiring observations in the information set to be similar in terms of effective benefit percentile, we hope to capture much of the information that would otherwise be captured by family composition, education, industry, etc. In other words, we intend the effective benefit percentile to serve as a sufficient statistic for many of variables that ideally would be part of the conditioning set, but that we omit because of the dimensionality problem.

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[7] An additional challenge is that when we draw paths of income, family composition, and state of residence that did not actually occur (e.g., predicted from the parametric models), we will also need to predict the associated state and federal net benefit trajectories for those paths. Our approach relies completely on realized federal benefits so does not require transfer calculators for these programs.

[8] A person's income group is defined as all individuals with a current annual adjusted household income within 10 percentile points of the person's income.

Second, we use a parametric model for residential mobility (i.e., relying on the second proposed solution). We choose to model mobility parametrically because mobility likely varies substantially across states and there are too few observations in some states and some years from which to draw realized mobility paths.[9] We estimate residential mobility as a probit model (described more fully below) that depends on state, year, current income, changes in income, and demographic characteristics. Notably, the model depends on realizations and dynamics in income. We apply this model to predict the probability for each individual in the set $\mathcal{X}(i,t)$ of leaving person i's state of residence in each of the years $t+1$ through $t+K$. When calculating the predicted moving probabilities, we assume counterfactually that all the individuals in set $\mathcal{X}(i,t)$ live in year t in person i's state of residence and have exactly the same demographic characteristics a person i, but we continue to use person j's actual income realization (which we consider a potential income path for person i). For each person j (who is part of set $\mathcal{X}(i,t)$ in year t), we then generate 10 draws of the sequence $R_{ji}(t+k)$ for $k=0…10$ from that person's predicted mobility rate.[10]

In sum, in our hybrid approach, expectations are conditioned on (i) current income, (ii) state of residence, (iii) effective state net benefit percentile, and (iv) age. To avoid creating conditioning sets that have too few observations, we made two important assumptions. First, we assume that if we condition on narrow ranges of current income, effective state net benefit percentile, and age, then income and federal benefits paths are independent of state of residence. Second, we assume that mobility out of the state of residence is adequately captured by a parametric model.

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 elements 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

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[9] This problem becomes especially severe if we, in addition, want to condition mobility on any other personal characteristics such as education or income decile.

[10] We need to use draws from the probability of leaving the state rather than the actual probability because equations (7) and (11) are nonlinear functions of R: R enters both directly and through the variables with a tilde. To see why this matters, suppose the probability of leaving the state is 30%. The solution to these equations when we set $R=0.30$ will be different than when we solve the equation with $R=1$ for 30% of observations and $R=0$ for 70% of observations.

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 increase both 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.

3.6 The Insurance Value Against Common Macroeconomic Shocks

As outlined above, our framework classifies the average net benefit received in a future year by individuals in the person's information set as an *expected transfer*, which is therefore counted as redistribution. However, a downside of this approach is that macroeconomic shocks in a future year that are common to persons in the same information set are counted as "expected" and thus redistribution rather than insurance value. In reality, such shocks are largely unpredictable, and therefore should be included when we calculate the insurance value. To avoid treating these common year-specific shocks as predictable, we draw counterfactual income paths from all individuals in the information set (defined over current income, effective benefit percentile, and age) 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 centered around the individual in question. A macroeconomic 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 macroeconomic shock would be smoothed out.

To implement the correction for common shocks, we add to the original PSID sample (described below) 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.[11] For person *i* in year *t* from the *original* sample, we create the set $\mathcal{X}(i,t)$ by taking all observations from the expanded sample that fall within the information set defined over current income, effective benefit percentile, and age. Thus, we 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 assume counterfactually that all of the observations in $\mathcal{X}(i,t)$ reside in person *i*'s state of residence in year *t*. We 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 (3) for all the individuals *j* in set $\mathcal{X}(i,t)$. We define the effective benefit percentile from the distribution of net state benefits in year *t* among all individuals in the expanded sample that are in person *i*'s income group 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*.

3.7 Implementing the Conditioning Sets as Kernel Estimators

We implement the conditioning sets in the spirit of kernel estimation. In particular, we define the set $\mathcal{X}(i,t)$ such that it consists of observations that are "centered" around observation *i*. We define the distance of observation *j* to observation *i* along three dimensions: percentile in the income distribution, percentile in the effective benefit distribution, and age. We define the distance as:

$$d(i,j) = \sqrt{\left(\frac{p_i^{income} - p_j^{income}}{h^{income}/2}\right)^2 + \left(\frac{p_i^{benefit} - p_j^{benefit}}{h^{benefit}/2}\right)^2 + \left(\frac{age_i - age_j}{h^{age}/2}\right)^2}, \tag{15}$$

where p_i^{income} denotes individual *i*'s percentile in the income distribution, $p_i^{benefit}$ denotes individual *i*'s percentile in the effective state net benefit distribution, age_i denotes individual *i*'s age in years, and h^W denotes the bandwidth for variable *W*. We select the following bandwidths:

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[11] 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 do recalculate all the state benefits to reflect the

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h^{income} =10 percentiles, $h^{benefit}$ =20 percentiles, and h^{age} =10 years.[12] The set $\mathcal{X}(i,t)$ is then defined

to include all observations j in period t (including "time-shifted" observations) such that $d(i, j) \leq$

1. Moreover, when calculating expectations or conditional expectations, we weight the

observation j in set $\mathcal{X}(i,t)$ using the Epanechnikov kernel:

$$weight_{j,\mathcal{X}(i,t)} = \max\left\{0, \frac{3}{4}\left(1 - d(i, j)^2\right)\right\}. \tag{16}$$

4. Data and Empirical Implementation

4.1 PSID Data and Sample

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 families. All members

(and descendants) of these original survey families were re-interviewed annually through 1997

and bi-annually beginning in 1997. Our data extends to survey year 2005. The original 1968

sample consists of two subsamples: a nationally representative subsample of 3,000 families and a

subsample of 1,900 low income and minority families. 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. Because of some inconsistencies in the income definitions

in the first survey year, we drop the 1968 survey year data and thus our sample spans 1968-2004.

Income amounts are collected separately for the head, wife, and (for some years and some types

of income) other family members. These can be aggregated to measure total family income. We

have worked to construct a comprehensive and consistent income measure, which is challenged

by the inevitable changes in the reporting of income over time.[13] In addition to the income

variables, the PSID includes measures of family structure, family size, demographics, and state

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

[12] We choose a tighter band on income because we found it to be the most important predictor of future income.

[13] Examples of changes over time include some income sources not being available in the early years of the survey (child support, alimony and social security income begin in 1970). In addition, in some years income information is

of residence.

The unit of observation in our analysis is the individual. We look at individuals—rather than families—because of the significant changes to families that occur over time and over the life cycle (leaving home, marriage, divorce, children, etc). We recognize, however, that many (most) of the tax-and-transfer programs depend on *family* income and *family* characteristics. In recognition of this, our sample consists of longitudinal data on individuals but in each year we assign to them the income and family composition (e.g., number of children) of their family unit. We therefore treat utility as an individual-level concept but one that depends on family-level income. So, implicitly we assume resources are shared equally within families (and thus construct income and benefit measures using family definitions). However, to account for differences in family size and composition, we adjust all consumption, income, and transfer amounts using the OECD modified equivalence scale.[14]

Our baseline sample consists of individuals ages 25-52. Further, we include an observation in the sample for a given year *only* if we observe them for the next K-1 years (so we can construct the forward-looking measures of redistribution and insurance value as shown in (5) and (10)). In practice, we choose a 10-year horizon (K-1=9). 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. Finally, we start the sample at age 25 so as to start the process after individuals have completed their schooling and are in the labor force.

We limit further our baseline sample to include observations from income years 1972, 1982, and 1992. Recall that in order to minimize the influence of common shocks our information set for an observation in year t includes individuals from years three years prior to t and three years after t. Therefore, given the 9-year look-forward and the 3-year time shifting to smooth the common shocks, the sample from 1992 will use data through 2004, the last year in the data.[15] By using these three years (1972, 1982, 1992), we are able to apply our methodology to the full PSID period and examine how the insurance and redistributive values have changed

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provided separately for the head and wife and sometimes they are aggregated into one variable. Meyer, Mok and Sullivan (2009) provide useful reference on this issue.

[14] 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.

over time. We refer the samples based on these three base years as our decade-1, decade-2, and decade-3 samples. In our results, decade-3 is our *baseline sample* and, unless otherwise stated, results refer to this sample.

4.2 Measurement of Income and Consumption

We use information from the PSID to construct or calculate our key variables: total family (pre-tax and transfer) income (Y), state transfers net of state taxes (B), and federal transfers net of federal taxes (F). Specifically, B includes state transfers (AFDC/TANF, and Medicaid/SCHIP) less state taxes (personal income taxes including state EITCs and sales taxes). For all graphs and results in the paper, the elements of B are calculated using the tax and transfer calculators described below. Using the available realized values in the PSID is insufficient because of the need to measure B under counterfactual situations. F includes federal transfers (Social Security, Supplemental Security Income, and Food Stamps) less federal taxes (personal income taxes including federal EITC and payroll/FICA taxes). Our methodology does not require making counterfactual calculations for federal benefits so the elements of F are realized values. (The tax elements of F are not observed in the PSID so they still have to be calculated.)

Finally, Y includes total family pre-tax-and-transfer income plus all state transfers that we do not model in B. Because of dependence on prior earnings and circumstances associated with job leaving, we do not model state unemployment insurance.[16] Because of their complexity (rationing of benefits) we do not model housing benefits and because of their relatively minor role, we do not model general assistance or worker's compensation. These income, tax, and transfer variables are summarized in Table 1.

To construct annual measures of income and transfers, we linearly interpolate between sample observations when the survey becomes bi-annual beginning in 1997.[17] We linearly interpolate realized values for income, taxes, and benefits for the missing years. Note, that we interpolate the B (and F) rather than calculate B for the interpolated values of Y. This creates a discrepancy if B is a *nonlinear* function of Y (which in general it is). On the other hand, B also

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[15] The 1972 sample uses data back to 1969. If we had used a 1971 base sample, we could have extended the sample back to the first year of the survey. We choose 1972 so our samples were consistently separated by 10 years.
[16] In a prior version of this paper we included UI in the transfer calculator. As a social insurance program, UI requires tracking prior earnings and measuring unemployment spells in order to assign UI benefits. In the face of these complications, we decided to focus the analysis on the major state means-tested programs.
[17] 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.

depends on family 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.[18]

We measure each person's consumption as $Y+F+B$. However, because of measurement error in the PSID values or imprecision in the calculated components of F and B, our measured values for consumption are sometimes implausibly low. Given that consumption must logically be positive and that the calculation of the redistributive and insurance value is sensitive to observations with very low consumption values (since utility goes to minus infinity as consumption approaches zero), we bottom code adjusted consumption to $1000 per year (in real 2005 dollars). We implement this bottom coding by increasing Y until equivalent (family-size adjusted) consumption equals at least $1000 per year.

Figure 1 shows the evolution of the means of the resulting Y, F, and B over time. The variables are in real 2005 dollars and the means are weighted using the PSID sample weights. Federal net benefits are substantially larger than state net benefits but both are increasing fairly substantially over this period. Figure 2 plots average net state benefits over the sample period. The state net benefit 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. The figure 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 are quite a bit larger, on average, than state transfers. Finally, average state net benefits are negative (taxes>transfers).

Table 2 shows basic descriptive statistics for our sample. The first column shows the descriptive statistics of the individuals in our sample in 1972, the base year for decade 1. The second and third column, show the same statistics for the base years of decades 2 and 3. The table highlights that a relatively small share of families receive state benefits (AFDC/TANF and Medicaid/SCHIP) but this share is rising over time. Residential mobility rates are nontrivial (10 percent or more move out of the state within 10 years) and are rising only slightly over time.

4.3 Tax-and-Transfer Calculators

Our analysis makes use of realized and calculated tax-and-transfer benefits. First, for all calculations and decompositions, we use *realized* values for federal transfers (Social Security,

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[18] One implication of this interpolation is that it mechanically leads to a reduction in the within-person insurance

SSI, and Food Stamps) but need to use calculated values for federal taxes because federal taxes paid are not in the PSID. We use the NBER TAXSIM tax model to calculate personal income and FICA taxes (Feenberg and Coutts 1993). Because the aim of the paper is to measure the insurance, redistributive, and total value of *state* tax-and-transfer programs, the framework outlined above does not require any counterfactual calculations for federal net benefits (F).[19] Hence, we rely on realized values for components of F measured in the PSID (along with calculated F for taxes), and we include F only to fully capture the family's total post-tax and transfer income.

For state tax-and-transfer variables, we need to calculate the net benefits B under many counterfactual scenarios. For example, to calculate the baseline insurance and redistributive values, we make use of the information set defined as observations that are "similar" to the given observation based on income percentile, effective benefit percentile, and age (equation 3). To implement this approach requires calculating net benefits for each member of the information set under the rules in the state-year of the given observation. Specifically, we model two state transfer programs (AFDC/TANF, Medicaid/SCHIP), state personal income taxes, and state sales taxes.

The modeling of Medicaid and SCHIP raises challenges—for example the need to empirically measure the income-equivalent value of the benefits—but it is important to include it in our project. Public health insurance matters in determining the insurance value of transfers in direct and indirect ways. First, the 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).

Table 1 summarizes the income components and the federal and state tax-and-transfer benefits that we include in the analysis. The top panel lists the elements that are reported in the PSID (and therefore we can measure realized values) and the middle panel lists the tax and transfers that we model using our calculators. The bottom panel provides the final definitions for

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value. This will only affect the decade-3 calculations.
[19] See Hoynes and Luttmer (2010) for an analysis of the insurance and redistributive value of *federal* tax-and-transfer programs.

Y, *F*, and B used in our empirical analysis of the insurance and redistributive value of state net benefits.

The state tax-and-transfer calculators are described more fully in the appendix. But here we discuss each briefly:

- AFDC/TANF: Prior to welfare reform in the 1990s, we assign AFDC eligibility and benefits using maximum benefits by state, year and family size and (non state varying) benefit reduction rates. We limit benefits to female-headed households. Welfare reform (beginning with welfare waivers and ultimately with conversion to TANF) led to many changes in state aid; our eligibility and benefits are calculated to account for the income disregard rules in each state-year.

- Medicaid/SCHIP: We account for eligibility for state public health insurance as part of categorical eligibility (if eligible for AFDC/TANF then eligible for Medicaid), as well as the expansions in coverage for pregnant women and children beginning in the late 1980s. Thus using family income, family size, children's age, and presence of an infant child in the next year (proxy for pregnant woman), we assign eligibility using the rules in place in each state-year. Conditional on eligibility, we assign the income-equivalent benefit using average Medicaid/SCHIP expenditure per recipient in the state-year.[20]

- State Personal Income Taxes: We use the NBER TAXSIM model to calculate state personal income taxes beginning in 1977. For years prior to 1977, we use the state tax calculator developed by Jon Bakija (Bakija 2009).

- State Sales Taxes: Sales taxes are calculated by applying state-year varying sales tax rates to estimated family taxable expenditures. Family taxable expenditures are estimated by multiplying family income by the ratio of taxable expenditure to income, calculated by year and income quintile using the CEX.

Not all eligible families receive public transfers. Indeed, take-up rates range widely across programs (Currie, 2006). This is not an issue to the extent we use realized values of *F*. For calculated state transfers and the state and federal EITC, however, we apply take-up rates from the literature. We simply multiply imputed benefits by the relevant take-up rates. For more information on this adjustment, see the appendix.

4.4 Estimating Moving Probabilities

As describe above, to calculate conditional expectations and variances, we adopt a hybrid approach where we use realized income paths for individuals within the same information set combined with a parametric geographic mobility model. We need estimates of $R_{jt}(t+k)$ which

equals one if individual *j* resides in period *t+k* in the same state as this individual inhabited in period *t*.

To do so, we estimate a probit model on our pooled three-decade sample described above. There are nine observations for each observation in our baseline sample (individuals 25-52 in income years 1972, 1982, or 1992). The nine observations correspond to the 9-year forward-looking period (which combined with the base period creates a 10-year window). We allow the moving probabilities to depend on variables as of the base period (variables for which changes are not predictable or that don't change such as demographics) as well as the path of future incomes (allowing moving probabilities to depend on income realizations).[21] Base period explanatory variables include: dummies for state, race, gender × marital status, gender × spousal educational attainment, and gender × marital status × linear years since base year *t*. Explanatory variables that vary by year include dummies for calendar year, gender × own educational attainment, family size, number of children (0,1,2+ in each of the following three age ranges: 0-5, 6-12, 13-18), a cubic in adjusted income percentile, a cubic in the change in adjusted income percentile (between *t* and *t+k*), and a quadratic in age. In addition, we allow the impact of income (the cubic polynomials in the level and change in income percentile) to vary by state.[22]

When calculating the predicted geographic mobility hazard rates, we assume counterfactually that all the individuals in information set $\mathcal{X}(i,t)$ live in year *t* in person *i*'s state of residence and have exactly the same demographic characteristics a person *i*, but we continue to use person *j*'s actual income realization (which we consider a potential income path for person *i*). For each person *j* (who is part of set $\mathcal{X}(i,t)$ in year *t*), we then generate 10 draws of the sequence $R_{jt}(t+k)$ for *k*=0,..9 from that person's predicted hazard rates.

5. Results

5.1 Baseline Results

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[20] The Medicaid/SCHIP calculator was originally constructed by Currie and Gruber (1996, 1997) and updated by Huckfeldt and Miller (2009).

[21] Once a person has moved, we remove the person from the sample for the remainder of the look-forward period, so the probit probabilities are hazard rates of moving (i.e. probability of moving given that the person hasn't moved yet).

[22] Specifically, for each state we regress net benefits *B* on income percentile and year fixed effects. The coefficient on income percentile β_s captures the scope for tax-and-transfer benefits in state *s*. In the mobility probit, we interact the cubics in the level and change in income by the β_s, thereby allowing for state-variation in the impact of income on mobility.

For our main results, we report individual's valuations of the tax-and-transfer program in their state by real adjusted family income. Family income, however, is very right skewed. To reduce the skewness, we transform real income by reporting real income in percentiles of the distribution of real income in 1992. In other words, these "percentiles" are only percentiles of income in 1992; for other base years, they should be interpreted as a measure of real income that is comparable across years. For our baseline specification, we select a coefficient of relative risk aversion of three (ρ=3), report results for decade 3, and do not impose a lowerbound on utility.

Figure 3 reports the naïve annual value, the across-person redistributive value, and the effective total value by real adjusted family income in the base year of decade 3. The naïve annual value (defined in equation 13) simply measures an individual's valuation of his or her state's tax-and-transfer system as the net benefit received in the current year minus the population average of the net benefit in that state in the current year. The dashed red line shows that by the naïve measure state tax-and-transfer systems are strongly redistributive, with those in the bottom 5 percentiles of the real income distribution valuing it at $4300 and those in the top 5 percentiles placing a value of -$6500 on the tax-and-transfer system. The naïve measure, however, does not take into account that expected future net benefits may differ from net benefits in the current year. The across-person redistributive value (defined in equations 10 and 11) further takes into account expected net benefits for the next ten years. The across-person redistributive value is an annualized measure in which expected future benefits are discounted by a 3 percent real discount rate and by the person-specific estimated probability of leaving the state. The solid blue line with square markers shows that the across-person redistributive value is very close to the naïve measure, except near the top and the bottom of the income distribution. Those at the bottom of the income distribution have higher expected future incomes and lower expected future net benefits, and their across-person redistributive value therefore lies below their naïve value. The opposite is the case at the top of the income distribution. Except near the top and bottom of the income distribution, however, annualized expected future benefits are very close to current benefits, and the naïve measure is a good approximation of redistributive value across individuals.

Neither the naïve nor the across-person redistributive value takes into account that state tax-and-transfer systems can also provide insurance value. The solid blue line shows the effective total value (defined in equation 14), which equals the across-person redistributive value

plus the insurance value. The effective total value is positive throughout the income distribution, declining somewhat in the first 10 percentiles of real income, but roughly constant for the rest of the income distribution. Thus, for our baseline specification, even the top five percentiles of the income distribution prefer the current state tax-and-transfer system over the alternative of having to pay the population-average state tax net of state benefits in each year irrespective of own future income. Below, we will explain the intuition of this result and explore its robustness to alternative assumptions about risk aversion and to the introduction of a lower bound on utility.

Figure 4 shows the effective total value by state in decade 3 for those in the bottom quartile of the 1992 real income distribution, while Figure 5 shows the effective total value for those in the top quartile.[23] Note that we measure the effective total value of a state's tax-and-transfer system holding state consumption (=non-transfer spending) fixed because we define the equivalent variation of the tax-and-transfer system relative to baseline where everyone pays a lump-sum tax to finance the existing level of state consumption. Thus, differences in effective total value across states are only a valid measure of the incentives for an individual to migrate across states if, for that individual, the valuation of the difference in state consumption levels is equal to the difference in state consumption expenditure. The states with the largest effective total values include California, Minnesota, New York, Massachusetts and Maryland (for the lowest income quartile) and these same states joined by Michigan, Wisconsin, Ohio, Georgia, and Utah for the highest income quartile. Generally, those states that provide a high effective total value to their lowest income quartile also offer a high effective total value to their highest income quartile. In fact, the correlation between the effective total value at the bottom and top quartile is 85%. Thus, states that offer more redistributive value to the bottom of the income distribution tend to compensate individuals in the top quartile for the greater amount of redistribution by providing them with more insurance value.

Figure 6 explores the sensitivity of the relationship between real income and the effective total value of the state tax-and-transfer system to assumptions about the coefficient of relative risk aversion (ρ). While there is no consensus about the exact value of the coefficient of relative risk aversion, values between 1 and 5 are typically used in the literature. The figure shows that the effective total value remains positive throughout the income distribution for this range of plausible values of risk aversion. Hence, even for low values of risk aversion, high-income

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individuals still obtain sufficient insurance value for their effective total value to remain positive. As we noted in Section 3.3, the across-person redistributive value does not depend on risk aversion, so all the variation in effective total value by risk aversion is driven by the insurance component. As expected, effective total value increases monotonically with the coefficient of relative risk aversion, increasing from an average of about $1900 for a coefficient of relative risk aversion of 1 to an average of about $2600 for relative risk aversion of 5. In other words, effective total value is relatively insensitive to assumptions about risk aversion.

As explained in Section 4.3, we adjust all calculated benefits for average take-up rates. In practice, however, those with larger benefits are more likely to take up their benefit than those with smaller benefits because the fixed costs of applying for benefits are more likely to exceed the value of the benefits for those with small benefits. Because the inclusion or exclusion of small benefits hardly affects our estimates, the effective total value under the assumption of 100% take-up is very similar to the effective total value if only those with the largest benefits take them up, but the former is computationally much less demanding. In results not shown here, the relationship between real income and effective total value is very similar whether we assume partial or full take-up of benefits.

One might expect that the effective total value of the tax-and-transfer system strongly varies over the life cycle because younger individuals tend to face more income uncertainty and tend to be more mobile, and because programs such as AFDC/TANF, Medicaid/SCHIP, and the EITC are linked to the presence and ages of children. Figure 7 shows the effective total value by real income in decade 3 for three (base-year-defined) age groups: 25-33, 34-43, and 44-52. The figure shows, however, that the effective total value is quite close for these three age groups, although the lowest income percentiles show lower value for older persons. The same is the case for the insurance value and the redistributive value separately (figures not shown).

5.2 Decomposition into Insurance and Redistributive Components

In Figure 8, we decompose the effective total value into its insurance component and its redistributive component. As we saw in Figure 3, the across-person redistributive component shows that state tax-and-transfer systems redistribute from high-income individuals to low-income individuals. The redistributive value is positive (around $3,000) for the bottom 5 percentiles of the income distribution and declines to become negative (around -$6,000) for the top 5 percentiles. The insurance value, in contrast, is positive throughout the income distribution

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and increases with real income. It is not surprising that the insurance value increases with income if, as seems plausible, income uncertainty is roughly proportional to income and individuals exhibit constant relative risk aversion. The increase in insurance value with income almost offsets the decline of redistributive value with income so that the effective total value only declines slightly with real income. Figure 9 shows the same data, except that we now scale the values by average consumption in each income percentile. Figure 9 confirms that insurance value is roughly constant around 10 percent of consumption for all but the bottom decile of real incomes. In contrast, redistributive value falls sharply as a percentage of consumption, from positive 46% for the bottom 5 percentiles of real income to negative 6% for the top 5 percentiles.

A central element in our methodology is that we model the uncertainty that individuals face with information sets that non-parametrically describe the conditional distribution of alternative income, net benefit, and family composition paths for the individual. We augment these information sets with draws from a parametric residential mobility model. In all likelihood, the individual faces less uncertainty about the future than is described in the augmented information set because (i) we used a relatively coarse set of conditioning variables and (ii) the individual has information that is not available in our dataset. How would the likely overestimate of uncertainty implicit in our information sets bias the results? The across-person redistributive value, when presented as an average by income bin, is not affected by misspecification of the information set as long as the information set contains income.[24] The likely overestimate of the conditional variance of income in the information set would lead the estimate of the insurance value to be biased up if, as seems plausible, it leads to an overestimate of the conditional covariance between income and state net benefits. This would also cause an upward bias in the effective total value. Moreover, since the insurance value generally increases with income, this upward bias likely increases with income. Thus, we suspect that in truth the effective total value declines more with income than our estimates show.

Figure 10 decomposes the insurance value into a within-person component and an across-person component. The figure shows that the within-person component accounts for about two thirds of the insurance value. As we argued in Section 3.3, we believe that the within-person

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[24] To understand why, note that we obtain the average redistributive value by income bin by taking the expectation of equation 11 with respect to income bin. By the law of iterated expectations, the outcome of expectation by income bin of the equation 11 does not depend on the information set as long as the information set contains income bins. The information set contains income, but in slightly larger bins (10 percentiles) than the bins used to create the

insurance component belongs in the effective total value because, by the definition of a shock, individuals cannot foresee future shocks and fully absorb them by adjusting their savings. However, some of these shocks might be foreseen by the individual but not foreseen by us because our information set is not as precise as the individual's information set and, as a result, we may overestimate the within-person insurance value. Figure 11 does a similar decomposition as Figure 10, but now for the redistributive value. Recall that we only include the across-person redistributive component in effective total value because, as we argued in Section 3.3, individuals with access to capital markets can perfectly smooth foreseen movements in income. Figure 11 shows that within-person redistributive value is miniscule anyways, so that effective total value will barely be affected by whether or not the within-person redistributive value is included. The fact that the within-person redistributive value is so much smaller than the within-person insurance component indicates that the vast majority of income changes (as least as modeled by our specification of the information sets) are unforeseen.

As noted earlier, our concept of total effective value compares the state's actual tax-and-transfer system with a system where state consumption expenditure is financed through a lump-sum tax. The important benefit of this underlying thought experiment is that we can hold state consumption constant and do not need to get into the very tricky issue of how to allocate the benefits of state consumption spending across the income distribution. The drawback of our formulation, however, is that the lump-sum tax in the alternative system acts like a consumption commitment, which increases insurance value (Chetty and Szeidl, 2007). In particular, in our setup, any state of the world in which an individual would have less disposable income ($Y+F+Z^{Insure}$) than the lump-sum tax would result in negative consumption and infinitely negative utility. As a result, individuals would need to receive a sufficiently high compensation (Z^{Insure}) that consumption would not go negative for any state of the world (as modeled by observations in the information set). Though the determination of Z^{Insure} through this mechanism is perfectly consistent with our thought experiment, one may nevertheless be concerned that it yields artificially high values of Z^{Insure} because, in practice, consumption would not go negative and utility would not become infinitely negative, even in a world with lump-sum taxes.

In recognition that utility would not become infinitely negative, we reran our baseline specification but with a lower bound on the utility function. In Figure 12, the lower bound of

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figures (5 percentiles). Thus, as a first approximation, redistributive value by income bin is not biased by

utility is equal to the utility that one would receive from food stamps.[25] The exact level of this utility floor is admittedly somewhat arbitrary, but we thought that food stamps would be a reasonable approximation of a very minimal level of subsistence. In Figure 13, the lower bound of utility is equal to the utility that one receives from consuming 10% of one's net worth per year.[26] Again, this floor is admittedly somewhat arbitrary, but consuming 10% of one's net worth per year struck us as a conservative floor because assets are depleted only very slowly at this rate. We chose not to use a utility floor in our baseline specification for three reasons. First, the selection of the level of the floor is quite arbitrary. Second, the utility floor causes the utility function to become locally convex around the consumption level where the utility floor becomes binding. This convexity causes (locally) risk-loving behavior and can generate negative insurance values. Third, our framework does not allow us to account for the cost (provision of food stamps; depletion of assets) that is implicit in the provision of a utility floor.

Figures 12 and 13 show that the introduction of a utility floor substantially reduces the insurance value. The average and median insurance value with the 10%-of-net-worth utility floor are only about half of their values in the baseline, while the food-stamp utility floor reduces average and median insurance value to about a third of their baseline values. (We include the baseline effective total value, the red line with circle markers, for ease of comparison.) The reductions at the top of the income distribution are even larger; for the top five percentiles of the income distribution the utility floors reduce insurance value by a factor of three to four. As a result, the effective total value now becomes negative at the top end of the income distribution, though the effective total value remains positive or very close to zero for over 90% percent of the income distribution. Thus, the vast majority of individuals still receive positive value from their state's tax-and-transfer system, even if they are assured a utility floor.

5.3   *Decomposition By Program*

In this subsection, we examine the contributions of the different state tax-and-transfer programs to the effective total value. We measure each program's *marginal* contribution by calculating by how much the value would change if the program in question were replaced by a lump-sum tax equal to minus the population average net benefit of that program while all the

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misspecification of the information sets.

[25] Specifically, we assign each person the maximum food-stamp benefit, which varies by family size and year.

other tax-and-transfer programs are left in place. Because we measure marginal values of each program, the sum of the marginal values need not add up to the total value of all the tax-and-transfer programs combined.

Figure 14 shows the effective total value by each component of the state tax-and-transfer system that we consider. The effective total value of state income taxes is positive for all income groups, averaging about $1700. Notably, the effective total value of state income taxes is remarkably constant across income groups (except for the top 5%, where effective total value rises sharply). The figure shows a similar pattern for state sales taxes, except that the average effective total value for sales taxes is about a third the size of that for state income taxes. This is consistent with the fact that state income taxes are generally substantially larger than state sales taxes.

As one would expect, the patterns across the income distribution are quite different for the means-tested transfer programs. The effective total value of AFDC/TANF is large for the bottom two deciles of the income distribution and relatively small elsewhere. For about 90 percent of the income distribution, the effective total value of AFDC/TANF is negative, which perhaps helps explain why popular support for AFDC/TANF is relatively low (assuming voting in self interest). In contrast, the effective total value for Medicaid/SCHIP extends in an economically meaningful way through the first three deciles and is positive for most of the income distribution. This reflects the higher income eligibility thresholds in Medicaid (compared to AFDC/TANF) and resulting reach of the program into middle income levels.

5.4. Decomposition Over Time

We now examine how the effective total value and its components evolve over time, and which mechanisms account for the changes over time. We continue to graph outcomes as a function of real income in the base year (1972, 1982, or 1992), where real income is transformed into percentiles in the 1992 income distribution. Figure 15, shows how incomes in our sample are distributed in each of the three decades. The distribution for 1992 would have been completely flat if our sample selection criteria (in particular, observing data for all years in our 10-year window) had been equally stringent at each income level. However, this criterion was slightly more stringent at lower income levels, causing these observations to be somewhat

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[26] Net worth is defined as liquid assets minus debt plus home equity and is assigned for the base year for each

underrepresented in our estimation sample. The distributions for 1972 and 1982 are centered to the left of the 1992 distribution, reflecting the general increase in real income over this period. The distributions for 1972 and 1982 are also more concentrated, indicating a rise in income inequality.

Figure 16 shows that at each level of real income, the effective total value of state tax-and-transfer programs has risen both from 1972 (square markers) to 1992 (solid line). The effective total value in 1982 (dashed line) lies between the lines for 1972 and 1992. The magnitude of the increase in the effective total value is economically meaningful — the effective total value approximately doubled from 1972 to 1992. Figure 17 decomposes the change in effective total value from 1972 to 1992 (solid line) into its insurance and redistributive components, both of which have increased over time at all income levels. About 40 percent of the increase in effective total value is accounted for by the increase in redistributive value. Redistributive value increased because the rise in real incomes caused each given level of real income to fall in the overall income distribution, and hence receive more redistributive value. The remainder of the increase in effective total value is due to the increase in insurance value. Because the increase in insurance value is especially pronounced for higher income levels, the effective total value increased more at higher income levels than at lower income levels; in other words, the gradient of effective total value with respect to income was more negative in 1972 than in 1992.

To examine what explains the increase in effective total value over time, we calculate effective total value for three counterfactual scenarios. First, we calculate effective total value using income and family composition data and the across-state mobility estimates from decade 3, but calculating net state benefits using the state tax-and-transfer rules from decade 1.[27] This counterfactual scenario is plotted (dashed line) in Figure 18. As the figure shows, the line of this counterfactual scenario lies closer to the 1992 line than the 1972 line indicating that it can only account for a fraction (about 20%) of the increase in effective total value over this period. Second, we calculate effective total value using the tax-and-transfer rules and the across-state mobility estimates from decade 3, but using income- and family composition data from decade 1. This line (round markers) lies roughly in the middle of the 1992 line and the 1972 line, which

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observation *i*.

[27] Of course, we inflation-adjust the decade-3 dollar amounts to their decade-1 levels before applying the decade-1 tax-and-transfer policies.

means that changes in income- and family composition (and their dynamics) can explain roughly 50% of the increase in effective total value between 1972 and 1992. The third counterfactual scenario uses the across-state mobility estimates from decade 1, but uses all other data and estimates from decade 3. The resulting counterfactual effective total value (not shown) is virtually identical to effective total value in 1992, which means that changes in across-state mobility play no rule in the change over time in the total effective value. In short, we conclude that the changes in income- and family composition and dynamics by themselves explain about 50% of the rise in effective total value and the changes in state tax-and-transfer programs by themselves account for about 20% of this rise, with the remainder explained by the interaction of both effects.

Figures 19 and 20 show the first two counterfactual scenarios described above for the insurance value and redistributive values, respectively. Figure 19 shows that changes in tax-and-transfers programs by themselves can only explain a small fraction (about 10%) of the rise in the insurance value. Changes in income- and family composition and dynamics can explain just under half of the increase, while the interaction between these two factors presumably account for the remaining half of the increase.

Figure 19 shows that the insurance value of the tax-and-transfer system is negative for the lowest income group in 1972. This is surprising as we would expect the insurance value to be non-negative. Additional investigation (not shown) reveals that the negative insurance values are due to the coarseness in our matching with the information set. The net benefit levels and the income levels of the observations in the information set would be equal to the values of B and Y of individual i in the base year if we could set the bandwidths arbitrarily small. Because we cannot set these bandwidths arbitrarily small in practice, all of the variation in B and Y across individuals in the information set *in the base year* and some the variation in B and Y in subsequent years does not reflect true uncertainty for individual i but rather our inability to condition on exact initial income and benefits using the information-set approach. This leads to negative insurance in some cases, and typically at the bottom of the distribution. This is a limitation of the modest samples sizes in the PSID.[28]

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[28] To eliminate this artificial source of uncertainty, we added an adjustment that is constant over time in real terms to the income of each individual in the information set such that each observation in the information set has exactly the same Y, B, and F as observation i in the base year. In other words, we take the changes in income and net benefits from the individuals in the information set, but use the initial level of these variables from individual i. This removed the negative insurance values at the bottom of the distribution. However, this additive adjustment leads to a

Figure 20 shows that changes in income- and family composition and dynamics by themselves can account for virtually the entire increase in the redistributive value from 1972 to 1992. However, changes in state tax-and-transfer programs can also by themselves account for about a third of the increase, which means that the interaction of these two factors must be responsible for the fact that the two factors by themselves account for more than 100 percent of the change.

6. Conclusions

In this paper, we develop a methodology to measure the insurance and redistributive value of state tax-and-transfer programs and derive empirical estimates using data from the PSID. One of the major innovations in the paper is the use of nonparametric matching methods to predict the conditional distribution of future income and family composition for each individual in our sample. This is necessary to calculate the effective total value of taxes and transfers and to decompose it into the redistributive (predicted) and insurance (unpredicted) components. In our application, we model state taxes (personal income taxes, the EITC, and sales taxes) and the major state means-tested transfers (AFDC/TANF and Medicaid/SCHIP).

We have three major findings. First, the effective total value of state taxes and transfers is relatively flat across real incomes. This, however, masks substantial variation in the components—the insurance value increases with income and the redistributive value decreases with income. Second, perhaps surprisingly given the focus on the redistributive features of state tax-and-transfer programs, the insurance component is sizable. In fact, among middle-income families, the insurance value accounts for between 60-100% of the effective total value of state tax-and-transfer programs. Third, reflecting the expansion in state spending, the value of state tax-and-transfer programs has increased in the 30-year period that we examine. Our analysis concludes that changes in income- and family composition (and their dynamics) account for at least half of this increase while changes in the tax-and-transfer policies account for at least a fifth of the increase.

Our work provides theoretical and empirical support for why state redistributive programs persist despite the mobility of families. The insurance value is derived from the risk of

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rather large increase in insurance value for the lowest income groups, which appears to be due to a sort of boundary problem generated by zero or near zero income and/or net benefits. For this reason, we have not implemented this "additive adjustment" in our results.

shocks to income and family structure. Assuming families recognize these risks, they may value (and support through voting) redistribution programs even if they do not currently benefit. This is, of course, just one possible explanation for the large and increasing role of states in redistribution policies. Federal policies may mandate state spending (such as in Medicaid) or incentivize it (through matching formulas) as discussed in Baicker et al. (2010). States may have an advantage over the federal government in implementing redistribution programs because of better information about preferences or lower monitoring costs. Finally, Gordon and Cullen (2010), in analyzing the equilibrium government redistribution in a fiscal federation, find that state redistribution programs can persist even with substantial mobility, as long as mobility is not perfect.

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Appendix: Details of Transfer Calculators

A. AFDC/TANF

Cash assistance for low-income families with children has been available in all states since 1935 with the introduction of the Aid to Families with Dependent Children (AFDC) program. The basic structure of eligibility and benefits was relatively unchanged for the AFDC program until the most recent period of welfare reform. Beginning in the late 1980s, many states received waivers and implemented reforms to their AFDC programs. This widespread experimentation led to the passage of the 1996 Personal Responsibility and Work Opportunity Act, which eliminated AFDC and replaced it with Temporary Assistance for Needy Families (TANF).

Eligibility for AFDC required satisfying an income and asset requirement and primarily served single-parent households. The key elements of reform in the state waivers and TANF legislation include work requirements, lifetime time limits, financial sanctions, and enhanced-earnings disregards. For a detailed discussion of the policy changes, see Grogger and Karoly (2005).

We calculate eligibility and benefits under AFDC and TANF using a simple benefit calculator. The benefit formula under AFDC and TANF takes the following form:

AFDC/TANF Benefit = Maximum Benefit - $\tau \times$ (Earnings - D) - Unearned Income,

where τ is the tax rate (or benefit-reduction rate) and D is the flat earnings disregard. Benefits are reduced by τ for each \$1 increase in earnings and by \$1 for each \$1 increase in unearned income. Using this formula, a family receives benefits if the family has children under age 18 and the calculated AFDC/TANF benefit is greater than zero. Further, we limit receipt to single parent families. We do not implement any asset requirement.

Maximum benefits vary by state, year and family size. We compiled the maximum benefits from the Green Book (U.S. House of Representatives, various years) and the University of Kentucky Center for Poverty Research state-level data file. Prior to welfare reform, the tax and benefit-reduction rates (τ, D) were fixed across all states but varied depending on how long the person had been receiving benefits (and varied with legislative changes over time). For example, in the early 1990s prior to state or federal welfare reform, for the first 4 months of work the flat disregard was \$120 and the tax rate was 67%, for the next 8 months the flat disregard was \$120 but the tax rate increased to 100%, and after 12 months, the flat disregard fell to \$90 a month and the tax rate stayed at 100%.[29] Our calculator uses the most generous tax and disregards for all calculations.

Under waivers and TANF, many states loosened these rules to allow families to keep a larger share of their earnings. This occurred through changes to D (the flat disregard) and τ (the tax rate).[30] Our eligibility and benefits are calculated to account for the income-disregard rules in each state-year. Our TANF calculator does not take into account lifetime time limits or work requirements.

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[29] The benefit-reduction rate was 67 percent from 1967-1980 and 100 percent beginning in 1981.
[30] Information about post-welfare reform state disregards came from table W-4 of U.S. Department of Health and Human Services (1999).

Not all eligible families receive AFDC. Take-up rates prior to welfare reform are about 80% and decline after welfare reform, perhaps falling to as low as 45% by the mid-2000's (Table IND 4a from U.S. Department of Health and Human Services 2007). However, as discussed in Blank (2001), our take-up rates need to compare administrative caseload totals to our imputed eligibility (using the PSID and our crude eligibility calculator). Blank finds, and we confirm, that our eligibility calculations compare favorably with the administrative totals. Therefore, following Blank, we use a take-up rate of 100%.

B. Medicaid/SCHIP

Medicaid, which was created by the Social Security Amendments of 1965, provides health insurance for eligible low-income persons. Eligibility for Medicaid was originally limited to families receiving cash assistance. So for our nonelderly sample, this means that if a family received AFDC then they would also be eligible for Medicaid. Beginning in 1987, Medicaid expanded eligibility for children and pregnant women in families with incomes above the AFDC income eligibility limits. As described in Gruber (2003), state expansion of Medicaid took the form of complying with federal mandates and, for many states, expanding Medicaid beyond the federally mandated levels. These expanded Medicaid thresholds take the form of income limits relative to the poverty line and are specifically set for pregnant women and certain child's ages. For example, in California in 1993 pregnant women and children up to age 10 in families with income up to 200% of poverty were eligible for Medicaid.

We assign Medicaid eligibility taking into account the income eligibility rules that vary by state, year, and, for the later period, child's age. Prior to Medicaid expansions, we assign Medicaid if and only if a family is eligible for AFDC (using rules described above). After the Medicaid expansions, we first assign the family as Medicaid eligible if they are eligible for AFDC/TANF. If they are not eligible for AFDC/TANF, then we determine the eligibility for each child in the family given their age and family income relative to poverty. We calculate eligibility under the pregnant women expansions for women in year t who have an infant in year $t+1$.

The sources for the Medicaid calculator for child eligibility include:
- Marianne Bitler for 1988-2002
- Gruber (2003) for 1988, 1989, 1991 & 1993 (Table 1.3)
- National Governor's Association (various years) for 1/90, 7/90, 1/91, 7/91, 7/92, 1/93, 7/93, 1/94, 7/94, 2/95, 8/95, 8/96, 10/97, 8/98, 10/99, 10/01
- The Kaiser Family Foundation (2010) for 7/00, 1/02, 4/03, 7/04, 7/05, 7/06. 1/08, 1/09, 12/09

The source for the Medicaid calculator for pregnant women is from Peter Huckfeldt and Douglas Miller.

Once we have eligibility assigned, we assign Medicaid "benefits" to each eligible family using administrative data on average Medicaid expenditures per adult and child (by state and year). For example, if an eligible family consists of a mother and two children we set Medicaid benefits equal to $A + 2 \times C$ where A is average program expenditures per nonelderly adult recipient and C equals average program expenditures per child recipient. Our sources for Medicaid expenditure

and recipient data include:
- Robert Moffitt for years prior to 1981
- 1981-1988 average expenditures for adults and children provided in U.S. House of Representatives (various years) Green Books
- 1989-1998 expenditures and caseloads for adults and children from U.S. House of Representatives (various years) Green Books (which we use to calculate average expenditures per recipient)
- 1999-2008 expenditures and caseloads for adults and children Centers for Medicare and Medicaid Services (2010a, 2010b), (which we use to calculate average expenditures per recipient)
- Kosali Simon provided expenditures and caseloads (for cross checking)

As with AFDC/TANF, not all eligible families enroll in Medicaid. If a family is eligible for Medicaid through AFDC/TANF, we assign a take-up rate of 100%. For children eligible through the Medicaid expansions, we use take-up rates from Jonathan Gruber and Kosali Simon which vary by year from 80% to 66%.

C. State Sales Taxes

We calculate sales taxes paid for each family using family income and state-year varying sales tax rates. In particular, we use the Consumer Expenditure Survey to calculate the share of family income spent on items subject to the state sales tax. We calculated an average share for each of five income quintiles. Sales tax amounts are calculated by multiplying state-and-year specific sales tax rate by imputed taxable expenditures (equal to family income times the taxable-expenditure share).

We obtained the sales tax rates for 1967-2002 from Gary Wagner and Jon Rork and for 2000, 2003-2008 from Kim Reuben at the Tax Policy Center. The sources for these data are the reports "Significant Features of Fiscal Federalism" from the Advisory Commission on Intergovernmental Relations.

D. Federal Personal Income Taxes

We use the NBER TAXSIM calculator to calculate payroll taxes, federal income taxes and the Earned Income Tax Credit (EITC). For details on that calculator, see Feenberg and Coutts (1993). We adjust EITC amounts using a 90% take-up rate (Scholz 1994).

E. State Personal Income Taxes

For 1977 and later, we use the NBER TAXSIM calculate state income taxes and, for states that offer them, state EITC. For 1968-1976 we use Jon Bakija's state tax calculator (Bakija 2009). We adjust EITC amounts using a 90% take-up rate (Scholz 1994).

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U.S. House of Representatives (various years). *Background Material and Data on Programs within the Jurisdiction of the House Committee on Ways and Means*.

Figure 1

Income, Net State Transfers and Net Federal Transfers, by year

Figure 2

State Transfers Net of Taxes, by year
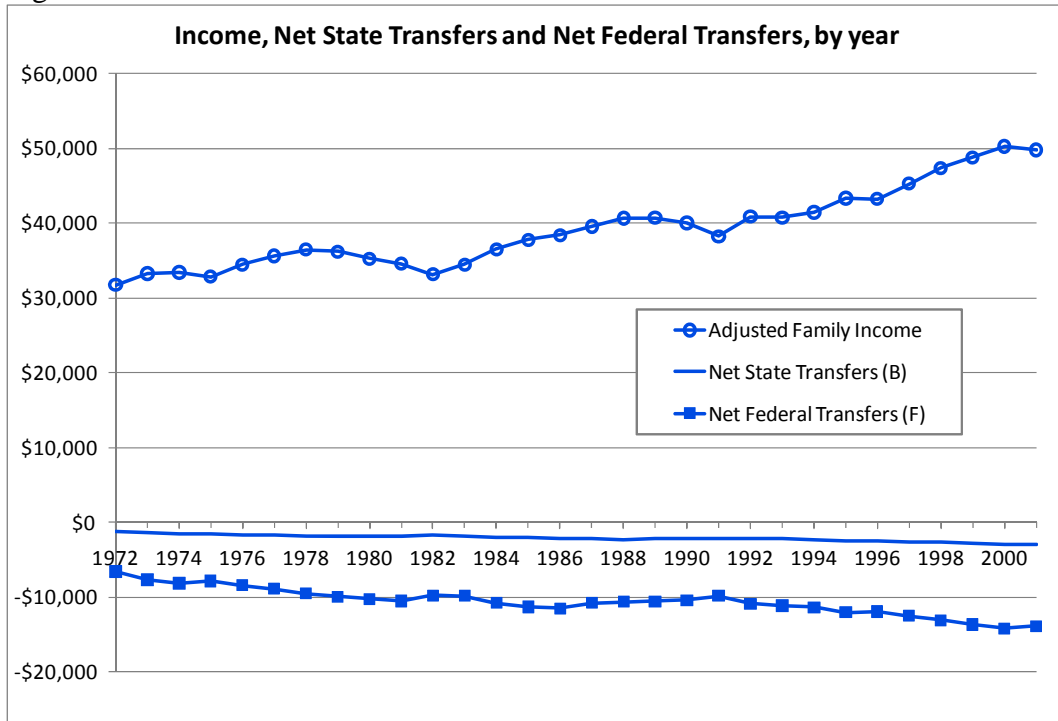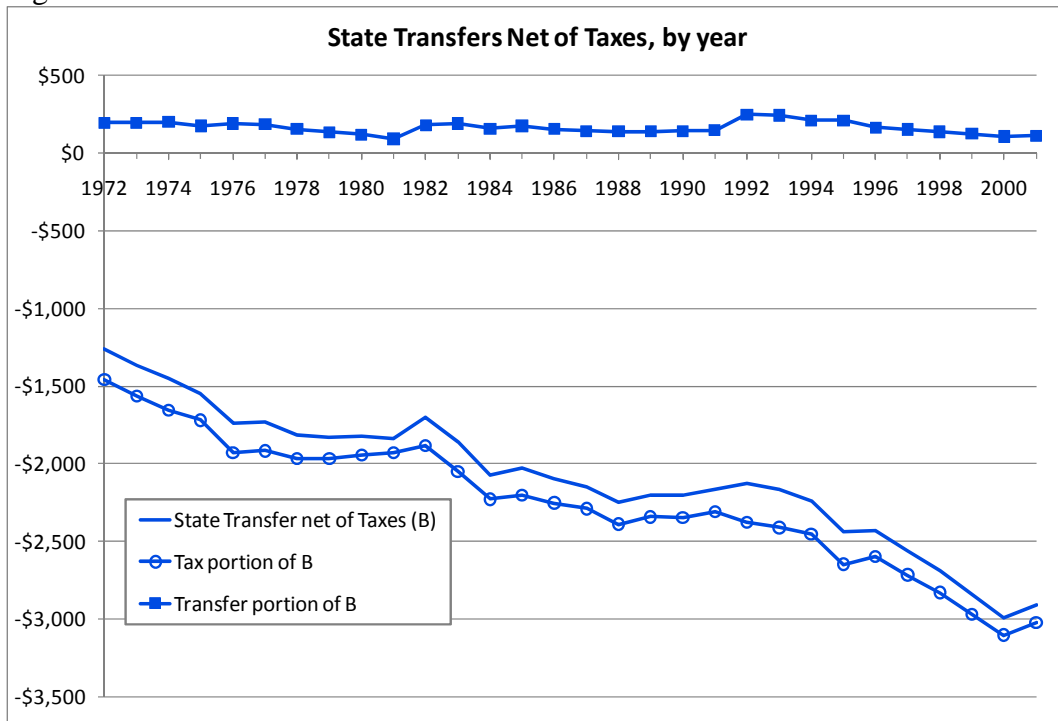

Notes: Authors' tabulations using the PSID. Definitions for federal taxes and transfers (*F*) and state taxes and transfers (*B*) are found in Table 1.
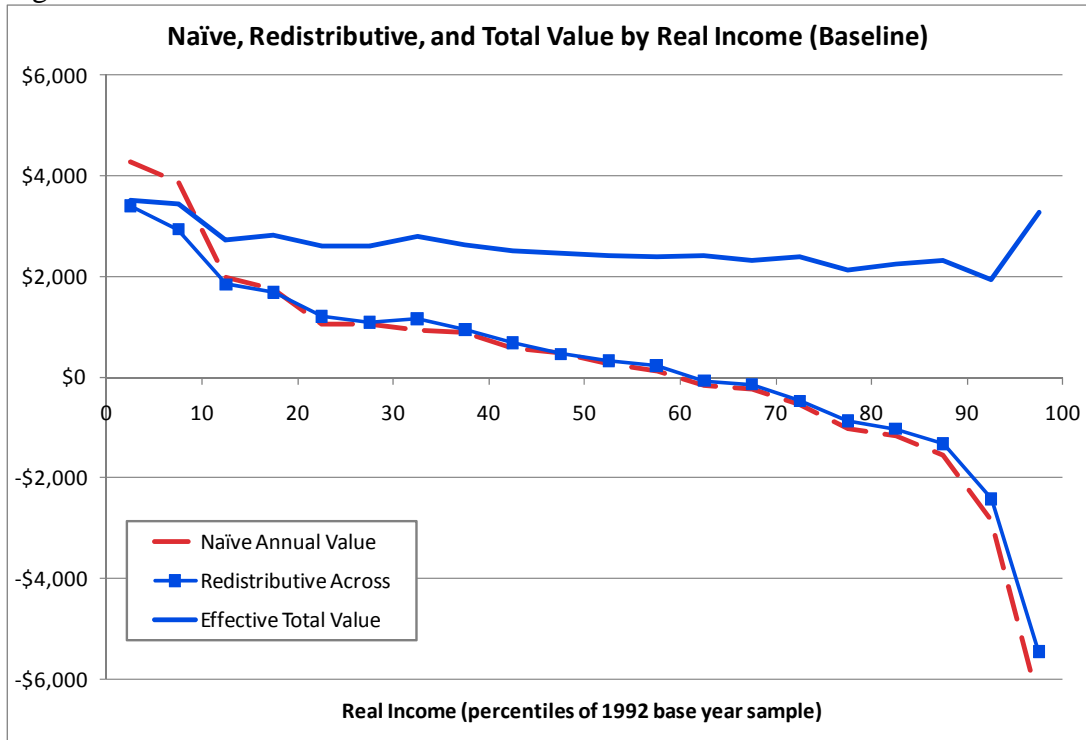
46

Figure 3

Naïve, Redistributive, and Total Value by Real Income (Baseline)

Notes: Authors' tabulations using the PSID. All values are equivalence-scale adjusted and are in 2005 dollars. All parameters are for base-case assumptions and calculated using the decade-3 sample of the PSID (1992 baseline). See text for details.

47

Figure 4: Effective Total Value for 1ˢᵗ Quartile Income Families, Averages by State

N/A
1000 – 2000
2000 – 3000
3000 – 4000
4000 – 5000
5000 – 6000

Value: Z Effective Total, Quartile: 1, Base Year: 1992
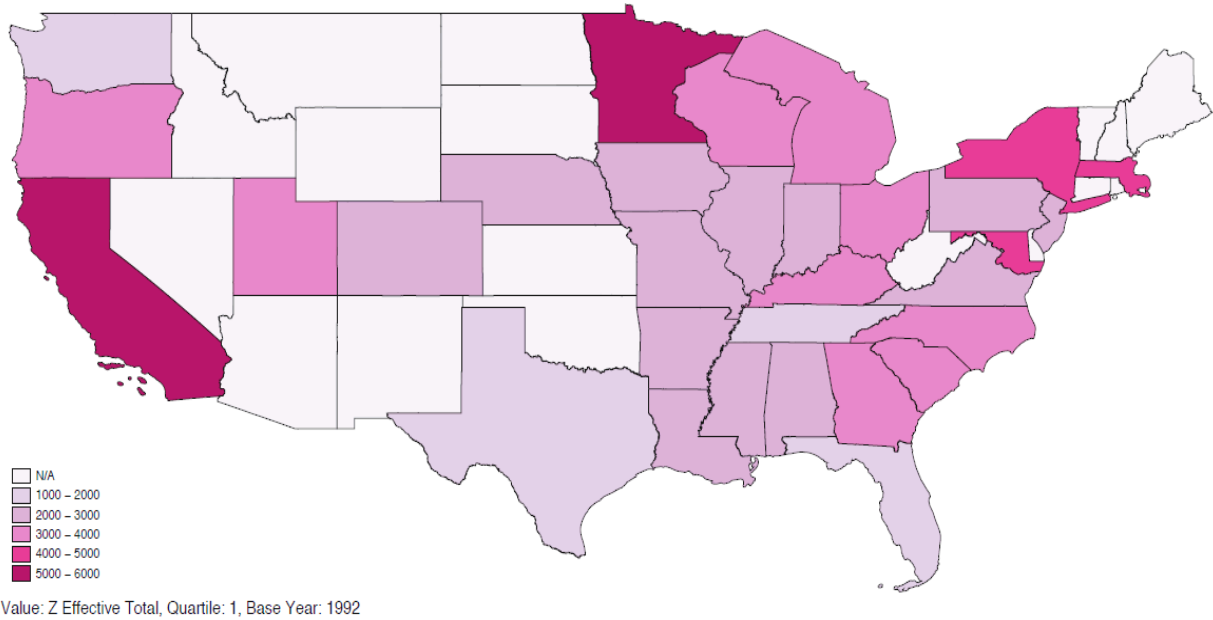
Figure 5: Effective Total Value for 4th Quartile Income Families, Averages by State
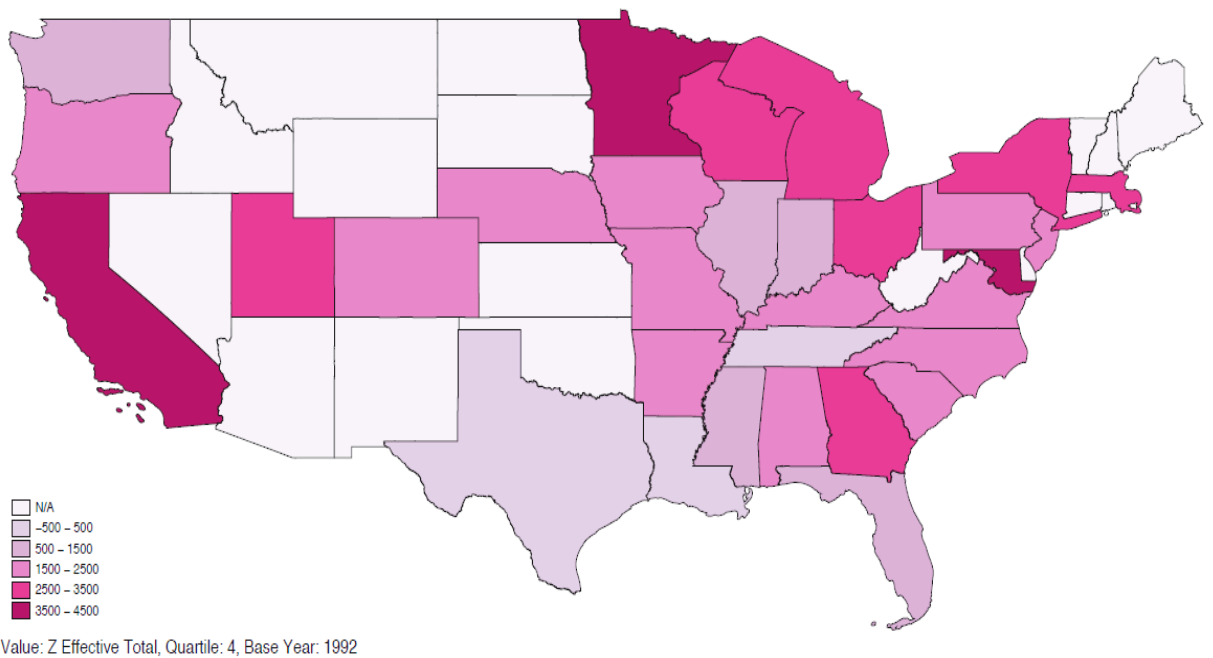
N/A
−500 – 500
500 – 1500
1500 – 2500
2500 – 3500
3500 – 4500

Value: Z Effective Total, Quartile: 4, Base Year: 1992

Notes: Authors' tabulations using the PSID. All values are equivalence-scale adjusted and are in 2005 dollars. Values for states are averages within income quartile 1 or 4. States with fewer than 5 observations in the base year are dropped (and shaded white). All parameters are for base-case assumptions and calculated using the decade-3 sample of the PSID (1992 baseline). See text for details.

Figure 6

Sensitivity of Effective Total Value to Risk Aversion

Legend:
- Baseline (rho=3)
- Rho = 1
- Rho = 5

X-axis: Real Income (percentiles of 1992 base year sample)

Figure 7

Effective Total Value by Base Year Age

Legend:
- Age 25-33
- Age 34-43
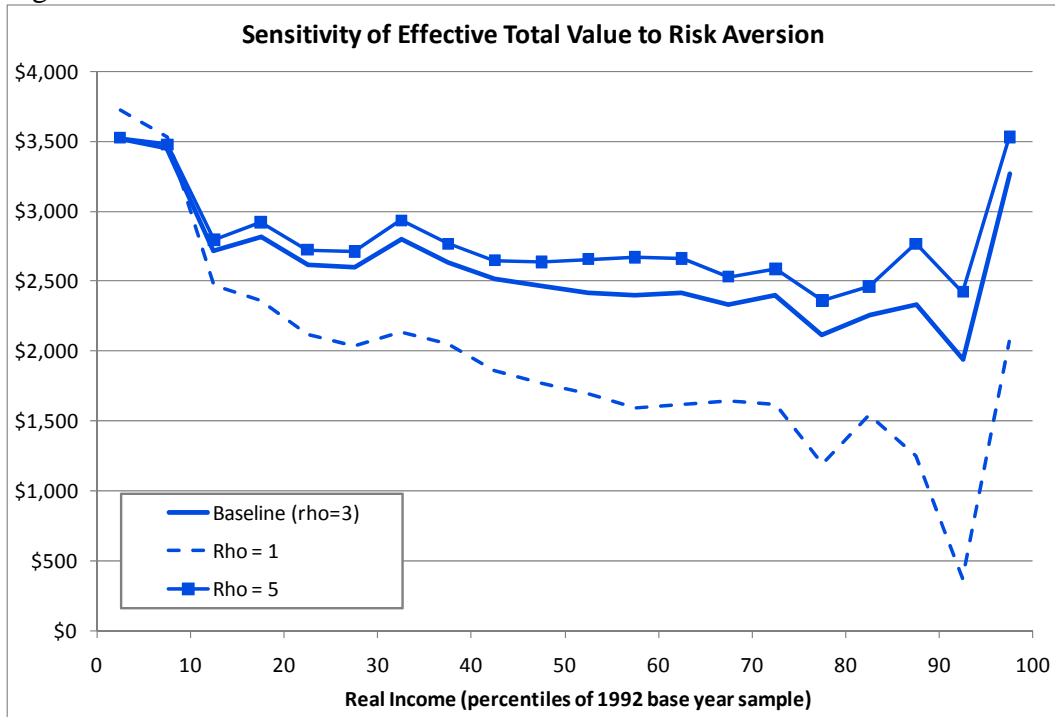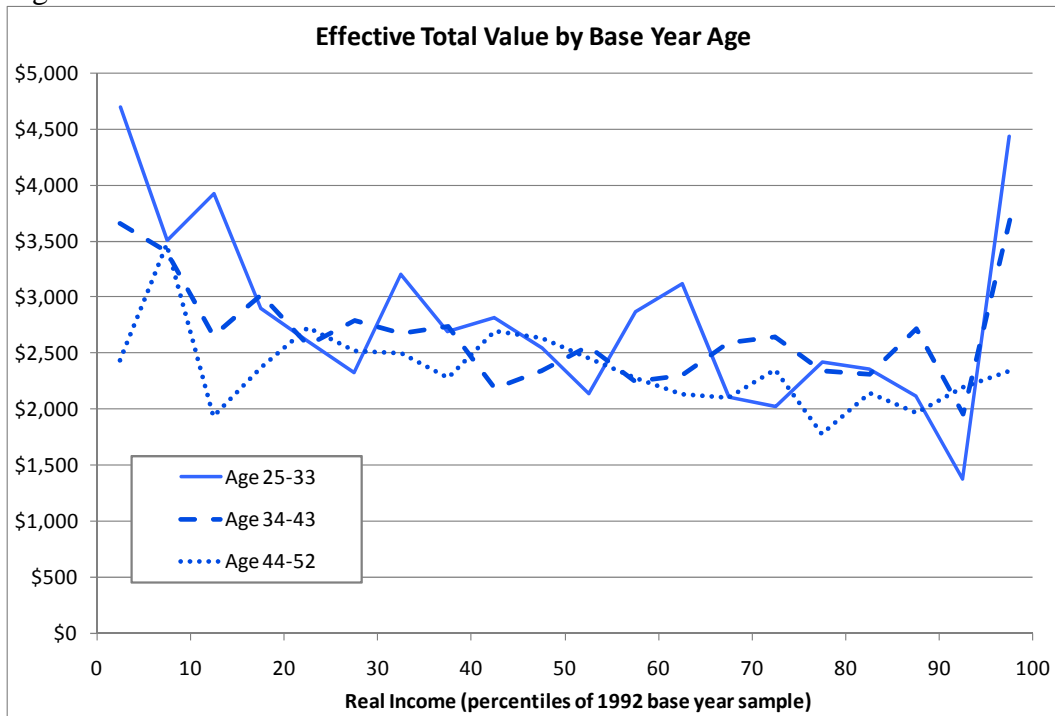- Age 44-52

X-axis: Real Income (percentiles of 1992 base year sample)

Notes: Authors' tabulations using the PSID. All values are equivalence-scale adjusted and are in 2005 dollars. Figure 6 varies the CRRA risk parameter. All other parameters are for base-case assumptions and calculated using the decade-3 sample of the PSID (1992 baseline). See text for details.
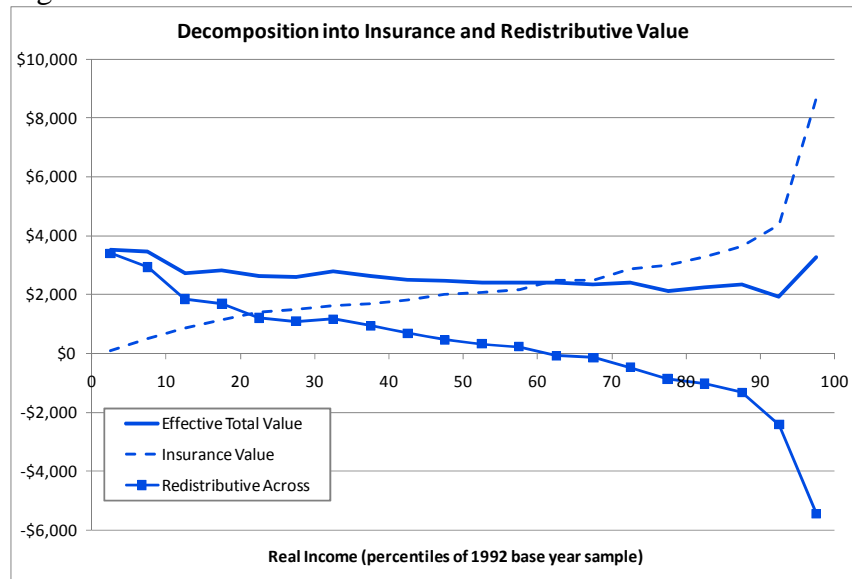
Figure 8

Decomposition into Insurance and Redistributive Value

Effective Total Value
Insurance Value
Redistributive Across

Real Income (percentiles of 1992 base year sample)

Figure 9

Decomposition into Insurance and Redistributive Value, as a Fraction of Consumption

Effective Total Value
Insurance Value
Redistributive Across

Real Income (percentiles of 1992 base year sample)

Figure 10

Decomposition of Insurance Value into Within- and Across-Person Components

Total Insurance Value
Within-Person Insurance
Across-Person Insurance

Real Income (percentiles of 1992 base year sample)

Figure 11

Decomposition of Redistributive Value into Within- and Across-Person Components

Total Redistributive Value
Within Person Redistributive
Across Person Redistributive

Real Income (percentiles of 1992 base year sample)

Notes: Authors' tabulations using the PSID. All values are equivalence-scale adjusted and are in 2005 dollars. All parameters are for base-case assumptions and calculated using decade-3 sample of the PSID (1992 baseline). See text for details.

50

Figure 12

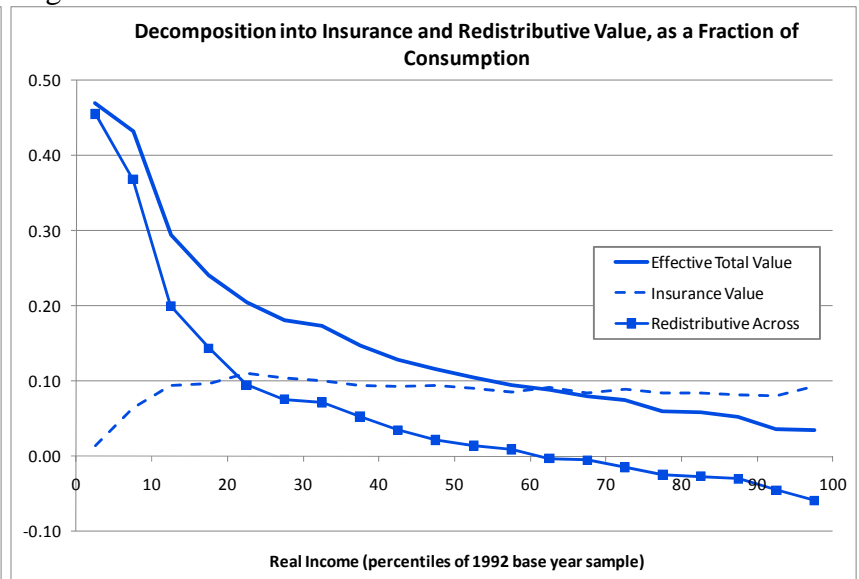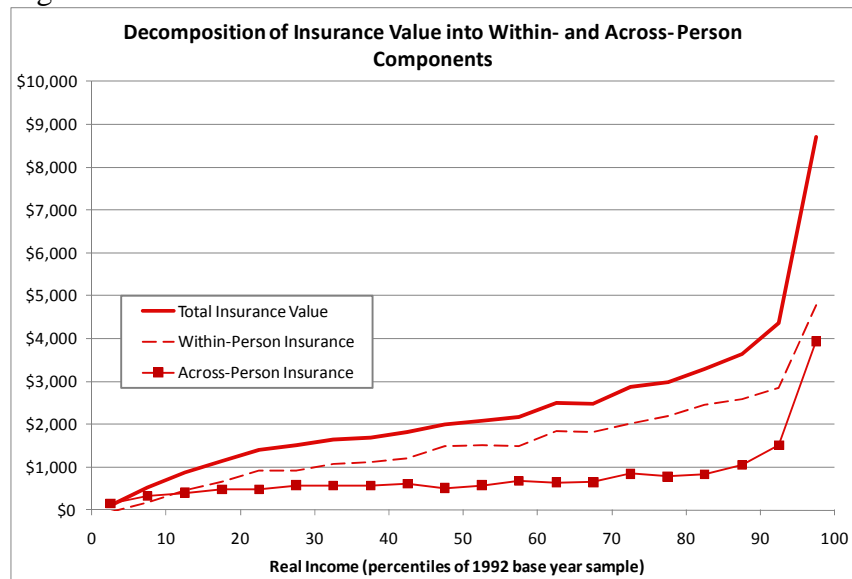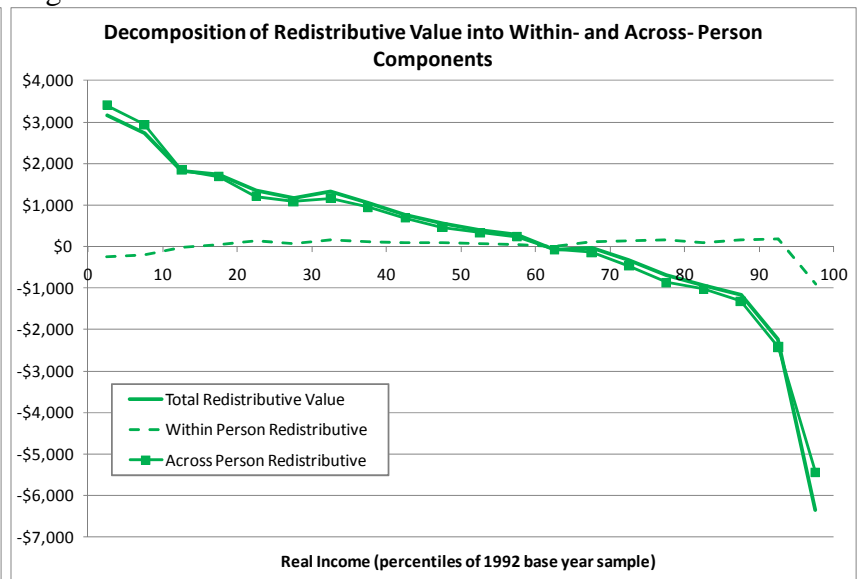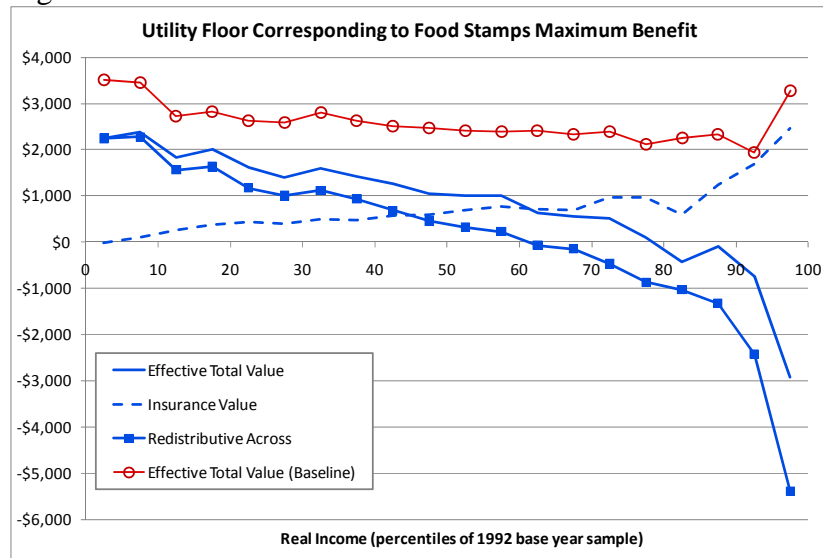**Utility Floor Corresponding to Food Stamps Maximum Benefit**

- Effective Total Value
- Insurance Value
- Redistributive Across
- Effective Total Value (Baseline)

Real Income (percentiles of 1992 base year sample)

Figure 13

Utility Floor Equal to 10% of Assets

- Effective Total Value
- Insurance Value
- Redistributive Across
- Effective Total Value (Baseline)

Real Income (percentiles of 1992 base year sample)

Figure 14

Effective Total Value , By Component of Tax and Transfer System

- State Income Tax
- State Sales Tax
- AFDC
- Medicaid

Real Income (percentiles of 1992 base year sample)
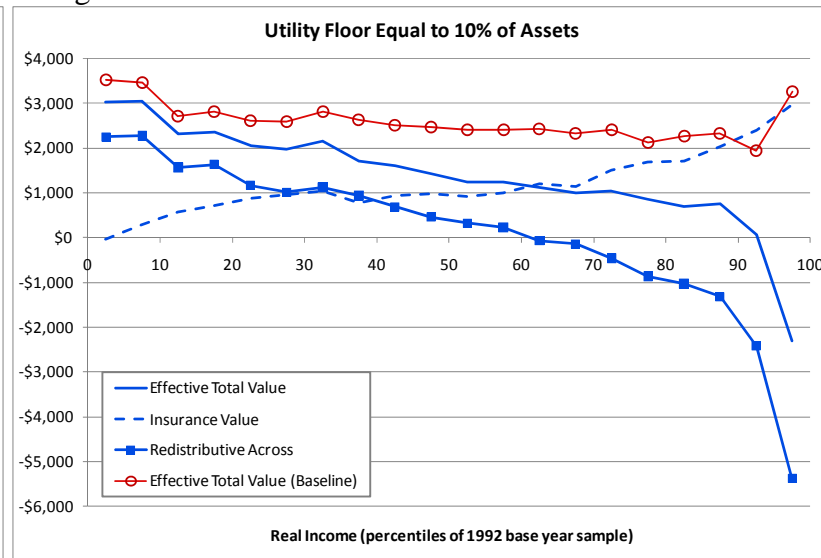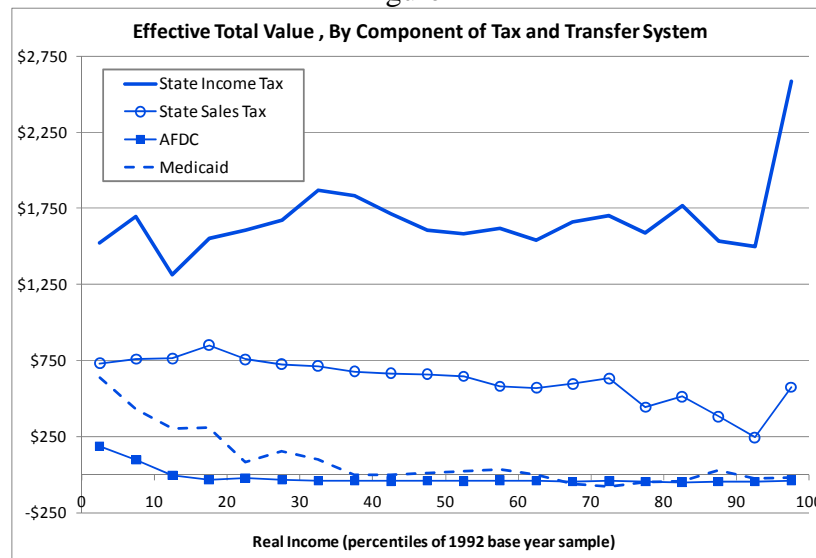
Notes: Figures 12 and 13 add a utility floor to the base-case model. Figure 14 presents the effective total value for each component of the state tax-and-transfer system. All values are equivalence-scale adjusted and are in 2005 dollars. All calculations use the decade-3 sample of the PSID (1992 baseline). See text for details.

51

Figure 15

Income Distribution, by Decade

x-axis: Real Income (percentiles of 1992 base year sample)

Legend:
- 1992 (baseline)
- 1982
- 1972

Figure 16

Effective Total Value, by Decade

x-axis: Real Income (percentiles of 1992 base year sample)

Legend:
- 1992 (baseline)
- 1982
- 1972

Figure 17

Decomposition of 1972-1992 Change In Effective Total Value

x-axis: Real Income (percentiles of 1992 base year sample)

Legend:
- Change in Effective Total Value
- Change in Insurance Value
- Change in Redistributive Across
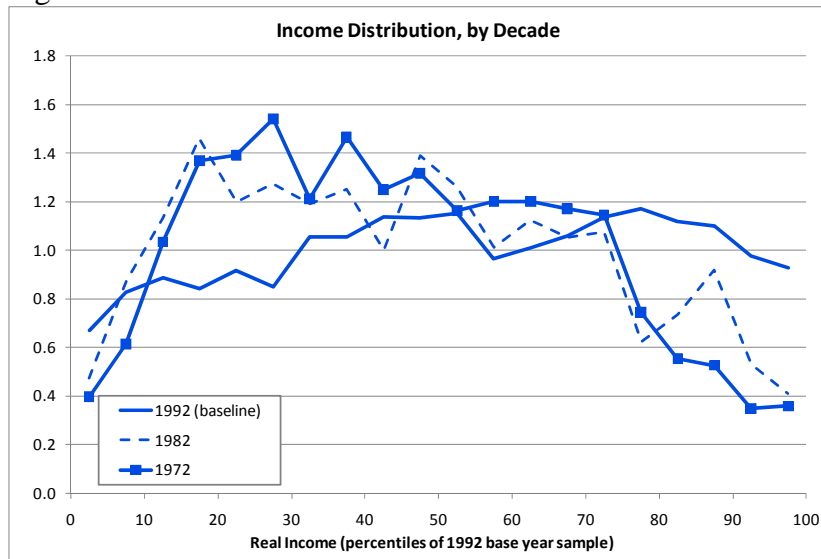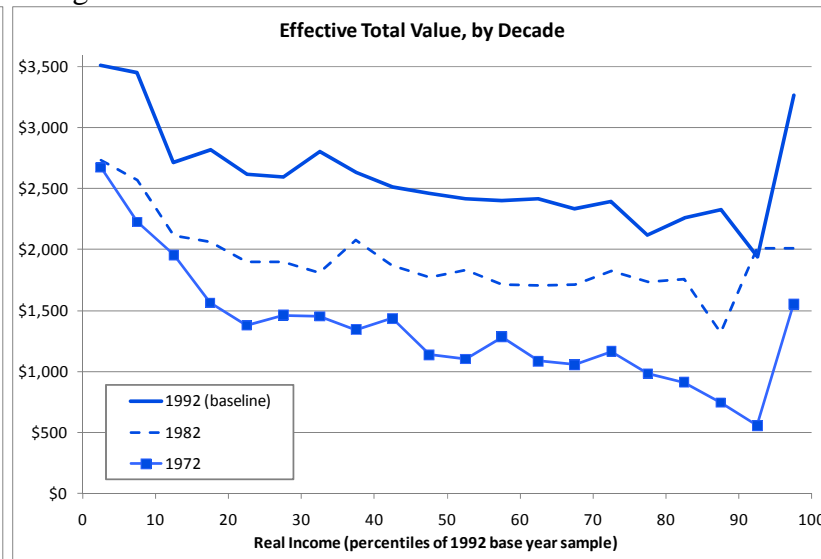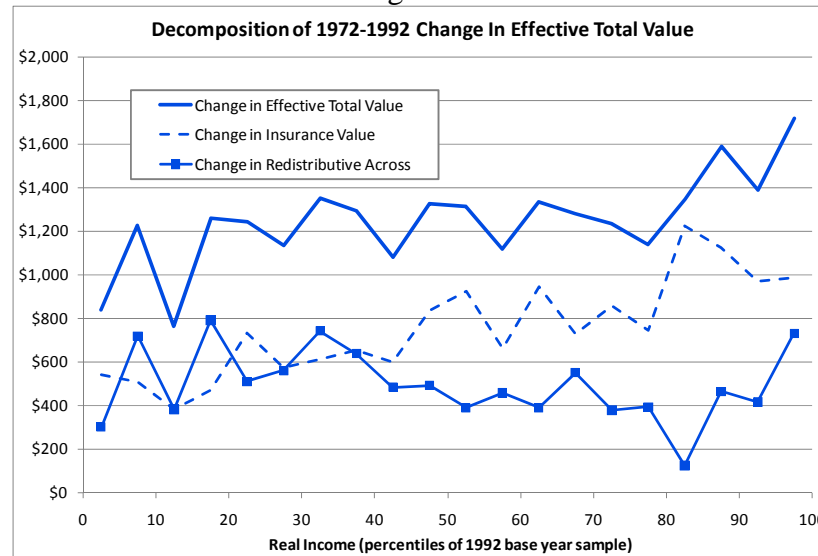
Notes: These figures use the PSID data for decades 1, 2, and 3. Effective total values are shown separately for the three decades. All values are equivalence-scale adjusted and are in 2005 dollars. See text for details.
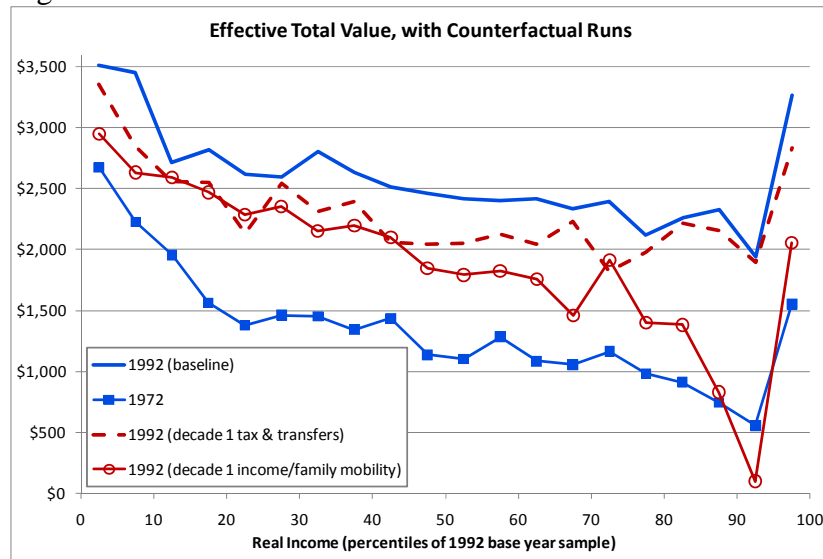
Figure 18

Effective Total Value, with Counterfactual Runs

Real Income (percentiles of 1992 base year sample)

- 1992 (baseline)
- 1972
- 1992 (decade 1 tax & transfers)
- 1992 (decade 1 income/family mobility)

Figure 19

Insurance Value, with Counterfactual Runs

Real Income (percentiles of 1992 base year sample)

- 1992 (baseline)
- 1972
- 1992 (decade 1 tax & transfers)
- 1992 (decade 1 income/family mobility)

Figure 20

Redistributive Value, with Counterfactual Runs

Real Income (percentiles of 1992 base year sample)

- 1992 (baseline)
- 1972
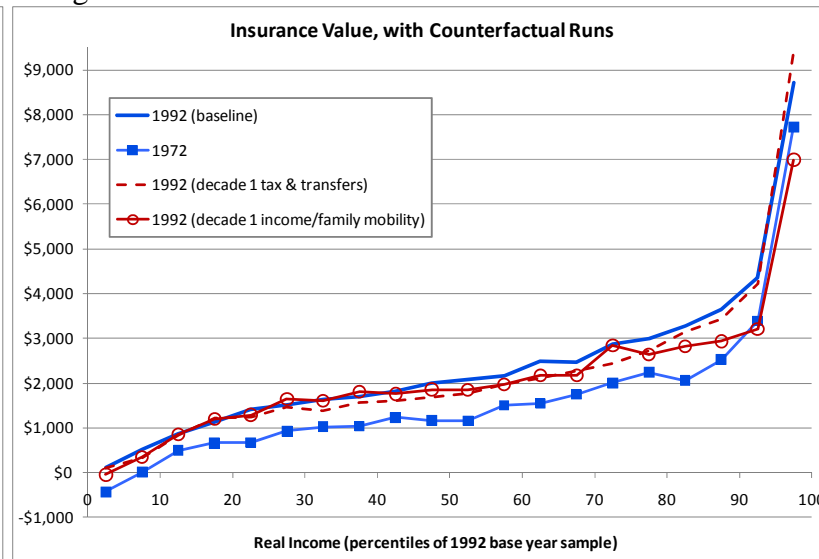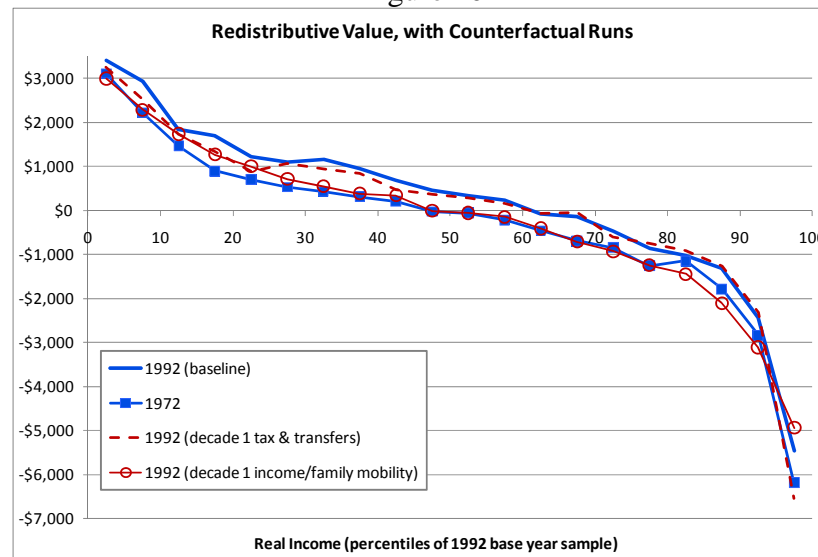- 1992 (decade 1 tax & transfers)
- 1992 (decade 1 income/family mobility)

Notes: These figures show counterfactual calculations to decompose the change in the value of state tax-and-transfer programs between the decade-1 and decade-3 samples. All values are equivalence-scale adjusted and are in 2005 dollars. See text for details.

53

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 Inc. Food Stamps	AFDC/TANF Unemployment Insurance General Assistance & Other Worker's Compensation
Tax and Transfers modeled using calculators		(-) Federal Tax Liability (-) FICA Liability	AFDC/TANF Medicaid (value of) SCHIP (value of) (-) State Tax Liability (-) State Sales Tax
Definitions used to calculate value of state tax and transfer programs	Labor Earnings Child Support & Alimony Income from Assets Lumpsum Payments Private transfers from relatives Other private transfers Unemployment Insurance General Assistance & Other Worker's Compensation	Social Security Supplemental Security Inc. Food Stamps (-) Federal Tax Liability (-) FICA Liability	AFDC/TANF Medicaid (value of) SCHIP (value of) (-) State Tax Liability (-) State Sales Tax

Table 2: Descriptive Statistics from PSID

	1972 Mean	SD	1982 Mean	SD	1992 Mean	SD
Age	38.4	8.0	36.8	7.5	39.3	6.3
Male	0.46	0.50	0.47	0.50	0.48	0.50
Female	0.54	0.50	0.53	0.50	0.52	0.50
White	0.88	0.33	0.87	0.34	0.86	0.35
Black	0.09	0.29	0.10	0.30	0.13	0.34
Other	0.03	0.18	0.03	0.17	0.01	0.11
<HS	0.28	0.45	0.18	0.38	0.09	0.28
HS	0.40	0.49	0.41	0.49	0.37	0.48
HS, Some Coll	0.13	0.34	0.19	0.39	0.24	0.43
College +	0.18	0.39	0.23	0.42	0.30	0.46
Married	0.87	0.34	0.75	0.43	0.70	0.46
Household Size	4.2	1.9	3.4	1.5	3.2	1.4
Children Present	0.76	0.43	0.66	0.47	0.60	0.49
Single Parent	0.06	0.24	0.09	0.28	0.11	0.31
Adjusted HH Income	31,737	22,441	33,164	25,832	40,860	36,738
Below Poverty Line	0.10	0.30	0.07	0.25	0.06	0.23
Any State Transfers t	0.02	0.15	0.03	0.18	0.06	0.23
Any State Transfers t,t+10	0.04	0.20	0.04	0.20	0.06	0.23
Log Adjusted Real HH Income	10.1	0.8	10.1	1.0	10.3	1.0
Delta Log Adjusted HH Income t+1	0.052	0.432	0.040	0.533	-0.039	0.675
Delta Log Adjusted HH Income t+5	0.033	0.645	0.129	0.736	0.016	0.826
Delta Log Adjusted HH Income t+10	-0.024	0.886	0.074	0.983	0.129	0.945
Moved t+1	0.02	0.15	0.03	0.18	0.03	0.18
Moved Out of State t+1	0.02	0.15	0.03	0.18	0.03	0.18
Moved t+5	0.07	0.26	0.09	0.28	0.08	0.27
Moved Out of State t+5	0.06	0.25	0.08	0.26	0.07	0.26
Moved t+10	0.12	0.33	0.15	0.36	0.13	0.33
Moved Out of State t+10	0.10	0.30	0.12	0.33	0.11	0.31
N	3615		4160		2808	

Notes: Mean and standard deviation shown separately for the 3 decade samples. The unit of observation is the individual. Individuals are included in the sample if they are observed for the entire 10-year window (from the base year 1972, 1982, or 1992) and are ages 25-62 in each year. See text for details.