THE INSURANCE VALUE OF STATE TAX-AND-TRANSFER PROGRAMS

Hilary W. Hoynes
Erzo F.P. Luttmer

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ABSTRACT

This paper estimates the 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 total value still declines with income, but not nearly as sharply as the redistributive value. Hence, the insurance value mitigates the incentives for mobility that would "undo" state redistributive spending.

Hilary W. Hoynes
Department of Economics
University of California, Davis
One Shields Ave.
Davis, CA 95616-8578
and NBER
hwhoynes@ucdavis.edu

Erzo F.P. Luttmer
6106 Rockefeller Center, Room 305
Department of Economics
Dartmouth College
Hanover, NH 03755
and NBER
Erzo.FP.Luttmer@Dartmouth.Edu

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, cash transfers have declined yet redistributive health care expenditures have increased for states—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 the 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 develop a framework to calculate the 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. Importantly, our framework allows us to decompose this total value into a redistributive component and an insurance component. Our identification of and attention on the insurance component of state redistributive policies provide the major contribution of our analysis. In this setting, the redistributive component is due to predictable changes in income (and family circumstances) while the insurance component is due to unpredictable changes in income. For example, if an individual is expected to receive a transfer of $1500 but the average person in his state receives a transfer of $1000, we call the difference ($500) the redistributive value of the state tax-and-transfer system to this individual. If the realized transfer is higher when income is lower (and vice versa), the individual values the realized transfer more (say $1800) than its expected value. This difference ($300) is the insurance value of the state tax-and-transfer system to the individual. 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 only redistribute across people with different levels of expected income but also 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 sales and income taxes.

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, as expected, the redistributive value of state tax-and-transfer systems falls rather sharply with income. This feature alone provides incentives for higher income groups to out-migrate, thereby avoiding paying for the redistributive system. However, the insurance value of state tax-and-transfer system is positive across the income distribution and, furthermore, increases with income. We find that the sum of these two components — the total value — is positive for three quarters of the population and declines much less sharply with income than the redistributive value. 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 addition, our analysis shows that between 1972 and 1992 the total value has increased at each income level; and we find that changes in income and family composition mobility account for virtually all of the increase in total value.

2

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, Section 6 provides caveats of our analysis, and Section 7 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 earnings depends, of course, on the costs of mobility and so on. Feldstein and Wrobel present empirical results that show that decreases in marginal tax rates in the state lead to substantial reductions in pre-tax earnings. Grant et al. (2010) find that states with more redistributive taxes have lower variation in consumption. Their approach is complementary to ours; providing a different approach to investigating the importance of an insurance value of state tax-and-transfer programs.

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

The goal of our analysis is to identify and empirically estimate the total value that individuals receive from the state tax-and-transfer system. In particular, we seek to decompose this total value into the redistributive and insurance components and examine how these components vary across income groups, across the tax-and-transfer programs, and over time. The redistributive component is due to predictable changes in income (and family circumstances) while the insurance component is due to unpredictable changes in income. Because our framework is dynamic, we can distinguish both *across*-person value (redistribution and insurance across individuals at a point in time) and *within*-person value (redistribution and insurance across periods for the same person). Thus, ultimately we can 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. In this section, we lay out our framework (in sections 3.1-3.3) and discuss the implementation details (in sections 3.4-3.6). The data and empirical implementation are then discussed further in Section 4.

3.1 The Value of State Tax-and-Transfer Systems

The starting point of our methodology is the total value that an individual receives from a state tax-and-transfer system. Our framework is based on an equivalent-variation approach and the 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 in a given state and year pays the same lump-sum tax to finance state 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

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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

realized tax-and-transfer system. Because of data limitations, we will look forward 10 years, rather than forever, when calculating the total value.

We assume that individuals have CRRA utility functions, have rational expectations, and only derive utility from consumption:

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

where i indexes individuals, t indexes years, s indexes state of residence, and 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.

Consumption opportunities are determined by pre-tax incomes and government taxes and transfers. We 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] Thus, 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 ("net benefits," B_{ist}):

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

The federal and state transfers net of taxes, F_{it} and B_{ist}, 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). In our framework, pre-tax income and net benefits are exogenous; hence, we are not modeling the labor supply or family structure incentives of tax-and-transfer programs. Further, as is clear in (2), we assume that individuals fully consume their disposable income in each year, ruling out buffer-

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government consumption along the income distribution. We further discuss the scope of our approach in Section 6 below.

[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.

stock savings and tax-and-transfer induced savings behavior. We return to these important issues below.[3]

Defining the total value of the state tax-and-transfer system, and decomposing that value into the redistributive and insurance components, requires forming expectations about future income and net benefits. Let X_{ist} be the characteristics that we use to form those expectations (such as state of residence, income, education, age, family composition). We then define $\mathcal{X}(i,t)$ as the set of individuals who have the same (or very similar) values of the conditioning variables as individual i in year t. 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 total value (the sum of the insurance and redistributive values) for individual i from the perspective of year t as the solution for Z_{ist}^{Total} to the following equation:

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

where $\bar{B}_{s,t+k}$ denotes the mean net benefit in state s in year $t+k$ and $R_{jt}(t+k)$ denotes 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. The indicator $R_{jt}(t+k)$ ensures that we only measure the value of the tax-and-transfer system of the individual's current state of residence. K denotes the individual's planning horizon, which in practice we set to 10 years. Values in year $t+k$ are discounted by the discount factor $(1+r)^{-k}$ times the probability the individual still resides in the same state in year $t+k$.[4]

Once we have the total values for each person, we can calculate the average value of the Z_{ist}^{Total} for income groups (which in practice we define by income percentile) to explore how the redistributive and insurance benefits of the state tax-and-transfer system vary across the income

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[3] Our focus is somewhat different from the widely used spatial general equilibrium models of Rosen (1979) and Roback (1982). Of course, labor supply responses to pre-tax wage changes or to changes in family circumstances are implicit in our measure of income as will be seen below.

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

distribution. 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.

Next, we decompose the total value Z_{ist}^{Total} into the redistributive and insurance components. 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 $(R_{jt}(t+k)=1)$:

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

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

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

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 can 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 in the opposite direction to the same individual. Let a tilde denote this discounted average, so for any variable $W_{j,t}$ for individual j from the perspective of year t:

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

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

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

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

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

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:

$$\sum_{j\in\mathcal{X}(i,t)} \sum_{k=0}^{K-1} \Big(U(Y_{j,t+k} + \mathrm{E}_{\mathcal{X}(i,t)}[B_{s,t+k}] + F_{j,t+k} + Z_{ist}^{I}) -$$
$$U(Y_{j,t+k} + \overline{B}_{s,t+k} + F_{j,t+k} + Z_{ist}^{I} + Z_{ist}^{R}) \Big) R_{jt}(t+k)(1+r)^{-k} = 0. \tag{9}$$

Equation (9) shows that the redistributive value is the equivalent variation of the expected net benefit relative to a baseline in which the individual receives the population average net benefit. The total redistributive value is based on our 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 remove the component associated with within-individual redistribution, and thus define the across-person redistributive value

$Z_{ist}^{R,Across}$, we recalculate equation (9), but replace all time-indexed variables by the average value (denoted by a tilde):

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

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

(10)

Because both expected net benefits $\mathrm{E}_{\mathcal{X}(i,t)}[\tilde{B}_{s,t}]$ and realized population average net benefits $\tilde{\bar{B}}_{s,t}$ are constant for all j in $\mathcal{X}(i,t)$, we can solve (10) explicitly:

$$Z_{ist}^{R,Across} = \mathrm{E}_{\mathcal{X}(i,t)}[\tilde{B}_{s,t}] - \tilde{\bar{B}}_{s,t}.$$

(11)

Equation (11) shows that the across-person redistributive component does not depend on the curvature of the utility function (i.e., is independent U and 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:

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

(12)

The decomposition between insurance value and redistributive value, of course, 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.[5] In other words, the predictable component of net transfers is counted as redistribution and the unpredictable component of net transfers provides insurance value. Thus, the distinction between the insurance and redistribution rests completely on the predictability of net transfers.

3.2 Commitment Issues and Interpersonal Smoothing

The insurance value is defined relative to the situation in which individuals receive their expected net benefit (see equation 5). In practice, however, the expected net benefit is negative, i.e. an expected net tax, for many individuals. Thus, for these individuals, we calculate their insurance value relative to a situation in which they are committed to having to pay a net tax even if their income and federal net transfers fall below the amount of this net tax (in which case their consumption would become negative). 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. In other words, this net tax acts as a consumption commitment (Chetty and Szeidl, 2007). While this valuation of insurance is valid in 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). We refer to this phenomenon of insurance values being driven by a risk of negative consumption caused by a net tax commitment as the "commitment issue."

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 (possibly negative) from the within-person redistributive component. Nevertheless, in light of the generally well-functioning capital markets in the U.S., we believe

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[5] 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.

that the most credible estimate of the total value of the tax-and-transfer system is formed by excluding the within-person redistributive 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.[6]

While we believe that the within-person insurance component does provide value, it turns out that the within-person insurance component is very sensitive to the "commitment issue," described above. Moreover, as we will show in the results section, due to the commitment issue, the within-person insurance component is especially high for high-income individuals (who, in expectation, have negative net benefits). However, these high insurance values all but disappear if we provide a very minimal utility floor (e.g., equivalent to consumption equal to 10% of assets or consumption equal to the food stamp benefit level). In contrast, the across-person insurance value is not noticeably affected by the commitment issue (because individuals can deal with tax commitments if we allow them to smooth consumption over a 10-year period). Because the within-person insurance component is biased up (due to buffer-stock saving and borrowing not being modeled) and is driven by the commitment issue (especially for high incomes), we exclude it from our baseline measure of total value. This renders our baseline value somewhat conservative (an underestimate of the total value) because we believe that in truth individuals do derive some value from the within-person insurance component. In sum, we define our baseline measure of the total value of state tax-and-transfer systems as the sum of the across-person

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[6] 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.

redistributive component and the across-person insurance component. We will henceforth refer to this sum as the "total-across value."

3.3 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 define the "naïve annual value" of his state's tax-and-transfer system, $Z_{ist}^{Na\"ive}$:

$$Z_{ist}^{Na\"ive} \equiv B_{ist} - \bar{B}_{st} . \tag{13}$$

By comparing actual net benefits to population-average net benefits, 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 $Z_{ist}^{Na\"ive}$ and $Z_{ist}^{R,Across}$ shows the importance of expected income mobility. If individuals are expected to retain their position in the income distribution, the plots of $Z_{ist}^{Na\"ive}$ and $Z_{ist}^{R,Across}$ will be very close. In the presence of mean reversion, the plot of $Z_{ist}^{R,Across}$ is will have a weaker gradient with respect to current income than the plot of $Z_{ist}^{Na\"ive}$ because those with current low income expect higher income (and thus lower net benefits) in the future and those with current high income can expect lower income (and thus higher or less negative net benefits) in the future.

Third, we plot the total-across value:

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

The difference between $Z_{ist}^{Total,Across}$ and $Z_{ist}^{R,Across}$ 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 $Z_{ist}^{Total,Across}$ must lie weakly above

the plot of $Z_{ist}^{R,Across}$.

Of course, the redistributive value decreases with income. If higher income individuals derive more insurance value from the state tax-and-transfer system than lower income individuals (i.e., the insurance value rises with income, which we find) then the gradient of our total-across value with respect to income will be less strong than the gradient of the redistributive value. Thus, modeling the insurance value of tax-and-transfer system may generate important insights on the incentives for high-income individuals and the motivating "puzzle" for the persistence of state redistribution policies.

3.4 Calculating Conditional Moments

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

total-across 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

14

observations. The drawback of this approach 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).[7] 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 them. Finally, the income path and the family composition paths are not independent, but subject to correlated shocks.

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 these three variables. 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 a tax-and-transfer calculator for i's state of residence (the calculators are discussed below). This yields $B_{j,s,t+k}$ for equation (3). We use the actual realizations for j's income, family composition, and federal net benefits, so we use the measured values of $Y_{j,t+k}$ and $F_{j,t+k}$ in equation (3). To define the

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[7] Blundell et al. (2008), for example, take an approach similar to this to examine the relationship between consumption and income inequality. They examine the insurance of tax-and-transfer policies in a more parametric income generation model that allows for self-insurance through savings.

conditioning variable "effective state benefit percentile" we take all individuals in person i's current income group in year t and calculate their state net benefit using 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 the variables that ideally would be part of the conditioning set, but that we omit because of the dimensionality problem.

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, including interactions of the income shock with the generosity of the state's tax-and-transfer system. In other words, the mobility model explicitly allows individuals become more likely to move out of a high tax-and-transfer state after a positive income shock and more likely to move out of a low tax-and-transfer state after a negative income shock. 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 persons j in set $\mathcal{X}(i,t)$ live in year t in person i's state of residence and have exactly the same demographic characteristics as 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 $k=0\ldots10$ from that person's predicted mobility rate.

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

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[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.
[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.

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 parametric assumptions), but the drawback is that, in fact, individuals' expectations were probably conditioned on more factors than we assume. While the omission of certain conditioning variables could in theory decrease absolute value of the conditional covariance between Y and $B(Y)$, we believe that in all likelihood the fact that our conditioning sets are relatively course leads to an upward bias in absolute value of the conditional covariance between Y and $B(Y)$, and thus in an upward bias in our estimate of the insurance value.[10]

3.5 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

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[10] By definition, adding conditioning variables weakly decreases the conditional variance. If the correlation between Y and $B(Y)$ is largely constant, as seems likely because this correlation is driven by program rules rather than conditioning variables, then the conditional covariance is roughly proportional to the conditional variance, which is biased up by the omission of conditioning factors.

17

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.

3.6 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 "close to" observation i. We define the distance of observation j to observation i using the three conditioning variables stated above: current income, effective state net benefit percentile, and age. We define the distance as:

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

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

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: $h^{income} = 10$ 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

In the above section, we described our core framework for the analysis. In particular, we defined the total value, and showed how we decompose it into the across- and within-person redistributive and insurance values. We also discussed implementation details around generating expectations of future income and benefits, and defining the conditioning variables used in that process. Our framework and implementation makes significant demands for our empirical analysis. First, we need panel data spanning many years with the necessary variables to measure state and federal net of tax benefits. Second, we need state tax-and-transfer calculators in order to perform the many counterfactual calculations. Third, we need to estimate mobility rates in order to implement the forward-looking model. In this section, we discuss our data, the measurement of the state and federal tax-and-transfer system, the tax-and-transfer calculators, and the estimation of the mobility model.

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. All results use the weights provided by the PSID to account for the oversampling of low-income groups in the original PSID sample.

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 (1967 income year) 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 made every effort 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 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

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[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 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.

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.[15]

We limit further our base year 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. 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 over time. We refer to 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). In modeling the state tax-and-transfer system B, we include the following components: (1) cash welfare for low income families through Aid to Families with Dependent Children or AFDC, now Temporary Assistance for Needy Families or TANF, (2) health insurance for low income families and children through Medicaid and the State Health Insurance Program or SCHIP), (3) state general sales taxes, and (4) state income taxes including state Earned Income Tax Credit or EITC. While this is an incomplete set of state transfer or tax policies, it does cover the most important income conditioned transfers and state taxes. Data from the 2008 Annual Survey of State and Local Finances shows that the state taxes we model

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[15] It is important to point out that by eliminating individuals 62 and over, we have an incomplete population of voters, one biased toward supporting programs that affect families with children. In addition, by limiting the sample

account for about half of state revenue (excluding intergovernmental transfers) and our state transfers account for almost a third of state expenditures (U.S. Department of Census 2008). The largest state expenditures that are not part of our project include higher education, transportation, and hospitals. 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.

The federal transfers net of taxes 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). In the paper, we seek to estimate the total value of the state tax-and-transfer system. Nonetheless, F is included to more accurately measure disposable income. Our methodology does not require making counterfactual calculations for federal benefits so throughout the paper 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; see below.)

Finally, Y includes total family pre-tax-and-transfer income plus all state transfers that we observe in the PSID but 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 depends on family composition and other factors that we cannot model well. We therefore feel

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to those observed for nine years after the base year, we may be biased toward a sample with smaller shocks (if large shocks increase the probability of attriting from the survey).

[16] 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.

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 $Y+F+B$.[19]

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 and 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 receives 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. 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). Hence, we rely on realized values for components of F measured in the PSID to the extent possible, and include F only to fully capture the family's total post-tax and transfer income. Specifically, we use *realized* values (i.e., PSID provided values) for federal transfers (Social Security, SSI, and Food Stamps) but use *calculated* values for federal taxes

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[18] One implication of this interpolation is that it mechanically leads to a reduction in the within-person insurance value. This will only affect the decade-3 calculations.

[19] Because of measurement error in the PSID values or imprecision in the calculated components of F and B, our measured values for consumption are occasionally 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 bottomcode 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.

(because federal taxes paid are not provided in the PSID). We use the NBER TAXSIM tax model to calculate federal personal income and FICA taxes (Feenberg and Coutts 1993).[20]

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 j of the information set $\mathcal{X}(i,t)$ under the rules in the state-year of the observation i. Specifically, we model the 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 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

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[20] Because of the deductibility of state income taxes, there are important interactions between federal and state income taxes. We ignore this interaction, to reduce the computational burden of calculating F for the many counterfactuals. We find (results available on request) that this simplification has little impact on our qualitative or quantitative findings for our baseline results.

(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.[21]

- 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 described 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).[22] 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.[23] Importantly, therefore, our estimated mobility model allows for individuals to, for example, be more likely to move if they experience a negative income shock in a low tax-and-transfer state.

5. Results

5.1 Baseline Results

Using the framework presented in Section 3 above, we begin by calculating for each observation the redistributive and insurance values. Given our focus on comparing the value of the tax-and-transfer system for high- versus low-income groups, for all our results we report averages of these individual values by real adjusted (using equivalence scale) family income. Family income, however, is very right skewed. To reduce the skewness, and to insure an adequate density of observations across the income distribution, 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. In addition, for our baseline specification, we select a coefficient of relative risk aversion of three ($\rho=3$) and report results for decade 3.

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

[22] 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).

[23] 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

Figure 3 reports the naïve annual value, the across-person redistributive value, and the total-across value by real adjusted family income in the base year of decade 3. In this, and all subsequent graphs, we present averages for 20 five-percentile bins for real family adjusted income. 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 (compared to their current income and 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 total-across value (defined in equation 14), which equals the across-person redistributive value plus the across-person insurance value. The total-across value is positive for three quarters of the income distribution, and declines much less sharply with income than the across-person redistributive value. This illustrates one of the main findings in our analysis—including an insurance value of the state tax-and-transfer system leads to a flattening of the income gradient,

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the cubics in the level and change in income by the β_s, thereby allowing for state-variation in the impact of income

suggesting less incentive for high-income persons to avoid states with more extensive tax-and-transfer systems.

To get a better idea of how states vary in the value of the tax-and-transfer policies, Figures 4 and 5 show the total-across value by state in decade 3. Specifically, Figure 4 illustrates the total across-value for individuals in the bottom quartile of the 1992 real income distribution, while Figure 5 shows the total-across value for those in the top quartile.[24] Note that we measure the total-across 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 a baseline where everyone pays a state- and year-specific lump-sum tax to finance the existing level of state consumption. Thus, differences in the total-across 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. Generally, we find high total-across values for the lowest income quartile in states with a reputation for a generous transfer system (the top three states are Minnesota, California, and, Massachusetts) and low total-across values for the lowest income quartile in states not known for their social safety net (the bottom three states are Texas, Tennessee, and Washington). The total-across value for the top income quartile does not follow a clear pattern across states. Indeed, both Minnesota (the state with the highest across-total value for the first income quartile) and Washington (the state with the lowest across-total value for the first income quartile) form, together with Utah, the top three states with the highest total-across value for the top income quartile. More generally, the correlation between the across-total value at the bottom and top income quartile is basically zero (1.5%). The reason for this lack of a correlation is that there are two offsetting effects. On the one hand, states with more generous transfer systems need to tax high-income groups more heavily. On the other hand, states with more generous transfer systems also tend to provide greater insurance benefits to high-income groups.

Figure 6 explores the sensitivity of the relationship between real income and the total-across 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 line for $\rho=0$

on mobility.

28

corresponds to the across-person redistributive value because the insurance value is zero in this case. As we noted in Section 3.1, the across-person redistributive value does not depend on risk aversion, so all the variation in the total-across value by risk aversion is driven by the insurance component. There are two findings evidence from this figure. First, the total-across value increases monotonically with the coefficient of relative risk aversion, increasing from an average of about $500 for a coefficient of relative risk aversion of 1 to an average of about $1400 for relative risk aversion of 5. Second, the figure shows that the total-across value declines less with income for higher coefficients of risk aversion. This flattening of the income gradient is a result of the insurance value increasing in income (which we discuss more fully below). The fraction for whom the total-across value is positive ranges from just under 70% for $\rho=1$ to just over 90% for $\rho=5$.

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 total-across value under the assumption of 100% take-up is very similar to the total-across 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 the total-across value is very similar whether we assume partial or full take-up of benefits.

One might expect that the total-across 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, for Medicaid and SCHIP, the ages of children. Figure 7 shows the total-across 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 total-across value is quite close for these three age groups, although the lowest income percentiles indeed show lower value for older persons. The same is the case for the insurance value and the redistributive value separately (figures not shown).

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[24] In Figures 4 and 5, we omit states with fewer than 5 observations in the decade-3 sample (shaded in white).

5.2 Decomposition into Insurance and Redistributive Components

In Figure 8, we decompose the total-across 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 $3,500) for the bottom 5 percentiles of the income distribution and declines to become negative (around -$5,500) for the top 5 percentiles. The insurance value, in contrast, is positive throughout the income distribution 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 partly offsets the decline of redistributive value with income so that the total-across value declines much less sharply 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 3 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.

Figure 10 shows not only the across-person insurance value (which is the component included in our baseline), but also within-person insurance value and the sum of these two components. The figure shows that the within-person component is about twice as large as the across-person component, which implies that our estimate of insurance value would have been about three times larger if we had included the within-person component in our baseline. As we argued in Section 3.2, we believe that some fraction of the within-person insurance component provides true insurance value. However, as Figure 11 shows, we even find that within-person insurance value for individuals with a linear utility function defined over non-negative consumption (the ρ=0 line)[25] is almost identical to the within-person insurance value for the baseline risk-aversion parameter, ρ=3. Hence, the within-person insurance value is almost entirely driven by the fact that utility goes to minus infinity for negative consumption values, not by the curvature of the utility function per se. In other words, the within-person insurance value is driven by the commitment issue that we discussed in Section 3.2.

Moreover, Figure 11 shows the within-person insurance value when we impose a

minimal utility floor. In particular, we consider three utility floors corresponding to the consumption level provided by: (1) the food stamp guarantee, (2) 10% of family's assets, or (3) 50% of the poverty line.[26] These results in Figure 11 show that the imposition of a utility floor eliminates almost all of the within-person insurance value, which confirms that the commitment issue gave rise to the bulk of the within-person insurance value. While insurance value that is driven by the commitment issue is valid if the thought experiment that defines insurance value is taken literally, we believe that in practice much of value driven by the commitment issue would disappear because individuals could engage in precautionary savings or rely on other forms of catastrophic insurance (charity, help from family or friends, etc.). We therefore believe it is reasonable to exclude the within-person insurance component from our baseline estimates.

In contrast, Figure 12 shows that the across-person insurance component is not affected by the commitment issue: the across-person insurance value is effectively zero when $\rho=0$, and consumption floors do not affect the across-person insurance value except at low income levels, where they crowd out the insurance provided by the state tax-and-transfer system.

Figure 13 shows the within-person and across-person components of the redistributive value. Recall that we only include the across-person redistributive component in our baseline estimates because, as we argued in Section 3.2, individuals with access to capital markets can perfectly smooth foreseen movements in income. Figure 13 shows that within-person redistributive value is miniscule anyways, so that our baseline estimates are barely affected by whether or not the within-person redistributive value is included.

5.3 Decomposition By Program

In this subsection, we examine the contributions of the different state tax-and-transfer programs to the total-across 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 state- and year-specific population-average net benefit of that program while all the other tax-and-transfer programs are left in place. Because we measure

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[25] Specifically, the $\rho=0$ line is formed by assuming the utility function is given by $U(C) = C$ for $C \geq 0$ and $U(C) = -\infty$ for $C \geq 0$.

[26] Specifically, for the first utility floor we use the maximum food-stamp benefit, which varies by family size and year. The second utility floor is equal to the utility that one receives from consuming 10% of one's net worth per year. Net worth is defined as liquid assets minus debt plus home equity and is assigned for the base year for each observation i. The final utility floor is the utility of a consumption level equal to 50% of federal poverty line, which varies by year and family size.

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 total-across value by each component of the state tax-and-transfer system that we consider. As expected, the figure indicates that the state personal income tax makes the largest marginal contribution of all the tax-and-transfer programs. The contribution of state personal income taxes is positive for three quarters of the population. Part of the reason that it is positive is that we measure a program's value relative to the population-average net benefit of that program, so state income taxes provide positive value for lower income individuals because they pay less than the average person. The other reason is that state income taxes provide insurance value, which is positive. The figure shows a similar pattern for state sales taxes, except that the average the total-across value for sales taxes is about a third the size of that for state income taxes, which is consistent with the fact that state income taxes are generally substantially larger than state sales taxes. In addition, the total value of sales taxes has a flatter income gradient compared to state personal income taxes, reflecting the flatter rate profile for sales taxes.

As one would expect, the patterns across the income distribution are quite different for the means-tested transfer programs. The total-across value of AFDC/TANF is large for the bottom two deciles of the income distribution, but zero or negative elsewhere. A positive total-across value for Medicaid/SCHIP extends slightly beyond the third decile, reflecting the higher income eligibility thresholds in Medicaid/SCHIP (compared to AFDC/TANF). Thus, while Medicaid and SCHIP provide positive value for a somewhat larger segment of the population, the benefits of both programs are heavily concentrated among the bottom quartile of the income distribution.

5.4. Decomposition Over Time

We now examine how the total-across 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 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 total-across value of state tax-and-transfer programs has risen from 1972 (square markers) to 1982 (dashed line) to 1992 (solid line). The magnitude of the increase in the total-across value is economically meaningful — for a given level of real income, the total-across value increased on average by about $700 real 1992 dollars per equivalent person from 1972 to 1992. Figure 17 decomposes the change in the total-across value from 1972 to 1992 (solid line) into its insurance (dashed line) and redistributive (square markers) components, both of which have increased over time at all income levels. At given real income levels, 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 population-average redistributive value is zero by definition, and therefore is constant over time. For a given real income, the insurance value increased by about $200 real 1992 dollars per equivalent person between 1972 and 1992. The population-average insurance value, in contrast, increased by about $400 real 1992 dollars per equivalent person over this period. This means that the population-average insurance value approximately doubled in real terms, and that about half of the increase can be attributed to rising real income levels (since insurance value increases with income) and that the remainder is due to increases in insurance value at given levels of real income. Because the population-average total-across value is by definition equal to the population-average insurance value, it also increased by about $400 real 1992 dollars per equivalent person over this period.

Next, we examine what factors drove the change in the total-across value between 1972 and 1992. We note that, by definition, the population-average redistributive value is constant, and that Figure 17 had shown that the slope of the redistributive value with respect to real income did not noticeably change between 1972 and 1992. Figure 18 shows that if we apply the decade 1 (base year 1972) tax-and-transfer program rules[27] to our decade 3 (base year 1992) data, we would have found virtually the same result for the redistributive value. Hence, the fact

the slope of redistributive value did not change between 1972 and 1992 is not a result of offsetting effects of changes in tax-and-transfer program rules and changes in mobility.

Given that there were virtually no changes to the redistributive value from 1972 to 1992, we focus on what caused changes to the insurance value in order to explain why total-across value increased over this period. Figure 19 shows that if we apply the decade 1 tax-and-transfer program rules to our decade 3 data, we find an insurance value that is very close to our baseline estimates of insurance value (which are based on decade 3 rules and decade 3 data).[28] Hence, virtually none of the increase in the insurance value can be attributed to changes in tax-and-transfer program rules. Nor is the increase explained by changes in residential mobility, because if we use decade 1 residential mobility with our decade 3 data and program rules, we find insurance values that are essentially the same as our baseline estimates (line not shown in the figure because it visually lies on top of our baseline line). In sum, we find that almost all of the increase in insurance value and total value between our decade-1 and decade-3 samples is caused by changes in income mobility and family dynamics.

6. Limitations, Caveats, and Plausible Range of Estimates

In Figure 20, we provide a summary of our main findings and illustrate the robustness of those findings. There are six measures presented in the figure. First, we present the across-person redistributive value (thick solid black line) and our baseline total-across value (thick solid blue line). The difference between these two lines highlights the importance of the insurance value, leading to a larger range of the population with positive value of the tax-and-transfer system and a flatter income gradient. Second, we show the sensitivity of the total-across value to the amount of risk aversion ($\rho=1$, blue short dashed line and $\rho=5$, blue long dashed line) and, as expected, the total value of the tax-and-transfer program is increasing in the amount of risk

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[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.

[28] 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.

aversion. Third, we expand the total value to include the within-person insurance value (square markers) and finally we show the sensitivity of this value to the utility floor at 50% poverty (red line with circle markers).[29] Our main finding is well illustrated in this figure—across these varying modeling assumptions the insurance value has a quantitative and qualitatively important impact on the value of the state tax-and-transfer system. That is, all the lines are clearly and economically meaningfully above the redistributive across value. Incorporating the insurance value mitigates the incentives for mobility that would "undo" state redistributive spending.

While Figure 20 well illustrates the robustness of our main findings, the findings are the result of many modeling decisions, some of which may lead to systematic biases in our estimated value of the state tax-and-transfer system. 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.[30] 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 total-across value. Moreover, since the insurance value generally increases with income, this upward bias likely increases with income. Thus, we suspect that in truth the total-across value declines more with income than our estimates show.

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[29] Note that the utility floor of 50% of the federal poverty line makes utility functions convex around the floor, so people become locally risk loving. In particular, this leads to negative within-insurance value for bottom three income deciles which is why the baseline plus within-person insurance line with the utility floor lies below the baseline for the lowest income groups.

[30] 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 figures (5 percentiles). Thus, as a first approximation, redistributive value by income bin is not biased by misspecification of the information sets.

In addition, we don't model saving and borrowing behavior. To get an accurate measure of within-person value, this would be necessary. Because of this limitation, we choose to exclude the within-person value from our baseline. This omission matters most for insurance, so it likely biases the slope of the total-across value down (i.e., more negative). Related to this, we do not take into account forms of insurance outside the government tax-and-transfer programs. The value of state tax-and-transfer programs may be lower if people have access to alternative forms of insurance such as help from family or friends, help from charities, or even bankruptcy.

We limit the scope of our exercise to the main state tax-and-transfer programs—on the tax side modeling general sales tax and personal income tax and on the transfer side modeling cash welfare (AFDC/TANF) and health insurance (Medicaid/SCHIP). This excludes state transfer programs such as unemployment compensation, housing benefits, general assistance, and worker's compensation. The later three programs are relatively small and unlikely to substantively change the results. We exclude unemployment insurance because, unlike the programs we model, this is a social insurance program funded by payroll taxes with benefits related to prior earnings. As such, it does not fit into our formulation of government insurance. Because we limit the scope of our exercise to state tax-and-transfer programs, we do not need to assign the incidence of other state spending, which would include spending on higher education, transportation, the judicial system, and hospitals. Measuring the redistributive and insurance value of all state spending would be a much more extensive project that would require individual-level longitudinal data on utilization of state services and that would entail strong assumptions in order to value these services. We leave this task to future research.

Our approach utilizes a relatively rich, parametric geographic mobility model. In particular, our model allows mobility to depend on realizations of income shocks and interactions of these realizations with the generosity of the state tax-and-transfer system. Because we only count the value of the state tax-and-transfer system of the state of residence, we do not estimate the option value of tax-and-transfer systems in other states to which the individual could move in response to income shocks. 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.

Finally, we assume that the incidence of state tax-and-transfer programs fully falls on individuals, which is consistent with the modeling choice in Cullen and Gordon (2010) but

36

contrary to the empirical results in Feldstein and Wrobel (1998). We also assume that correlated income shocks (e.g., due to a local economic decline) are not insured or compounded through movements in housing prices, which is contrary to the empirical results in Notowidigdo (2010) that indicate movements in rents provide partial insurance for lower-income individuals.

7. 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 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 insurance value of state tax-and-transfer programs is economically meaningful in size. Second, because the insurance value is increasing in income, the total-across value of state tax-and-transfer programs falls much less rapidly with income than the redistributive value. Third, we find that the insurance value approximately doubled in real terms from 1972 to 1992, and that about half of the increase can be attributed to rising real income levels (since the insurance value increases with income) and that the remainder is due to increases in insurance value at given levels of real income. The rise in insurance values at given levels of real income can be almost completely explained by changes in income mobility and family dynamics. Importantly, very little of the changes over time can be explained by changes in the tax-and-transfer system or changes in geographic mobility patterns.

Our work provides theoretical and empirical support for why state redistributive programs persist despite the mobility of families. Because these programs partly insure against shocks to income and family structure, individuals may value (and support through voting) such 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%.[31] 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). [32] 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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[31] The benefit-reduction rate was 67 percent from 1967-1980 and 100 percent beginning in 1981.
[32] 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.*
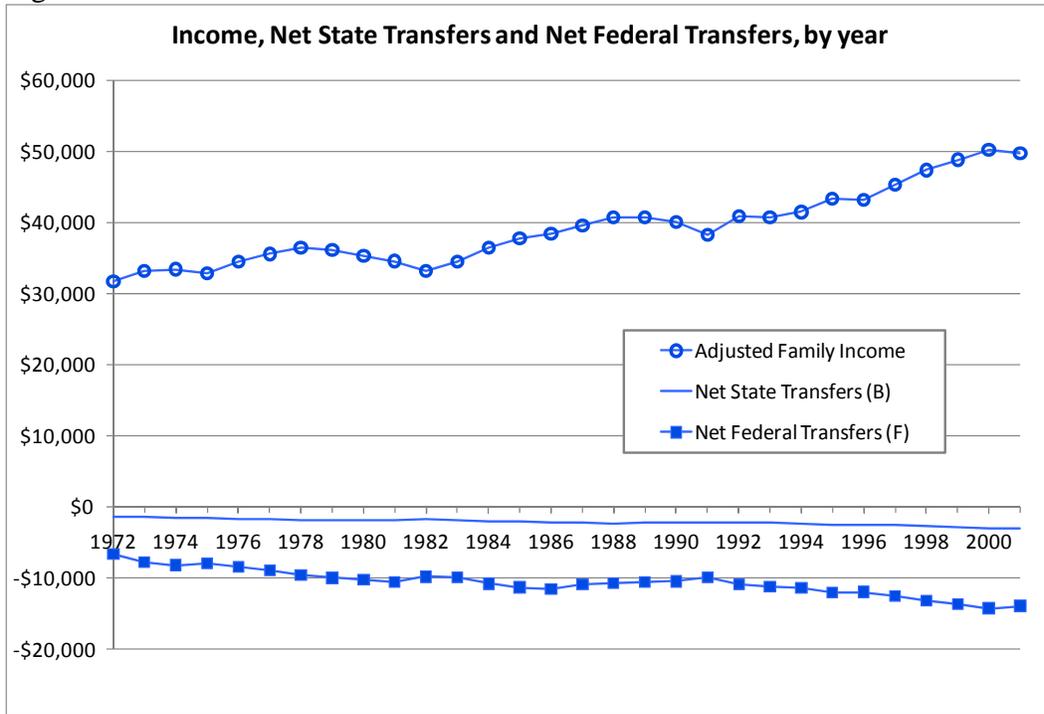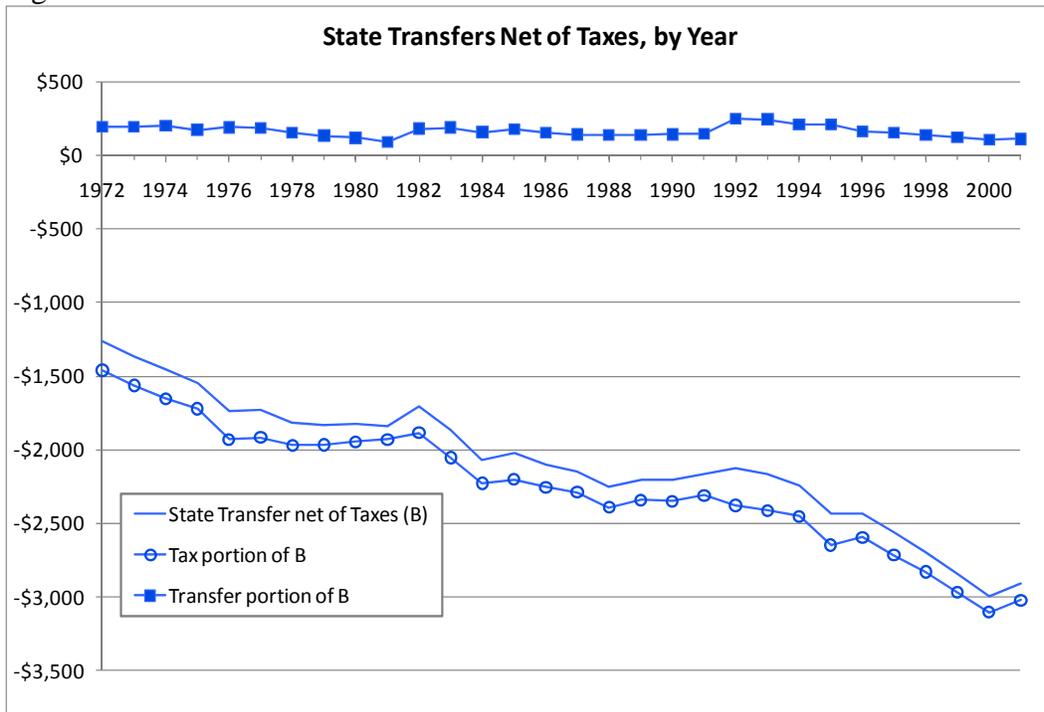
Figure 1

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

Figure 2

State Transfers Net of Taxes, by Year
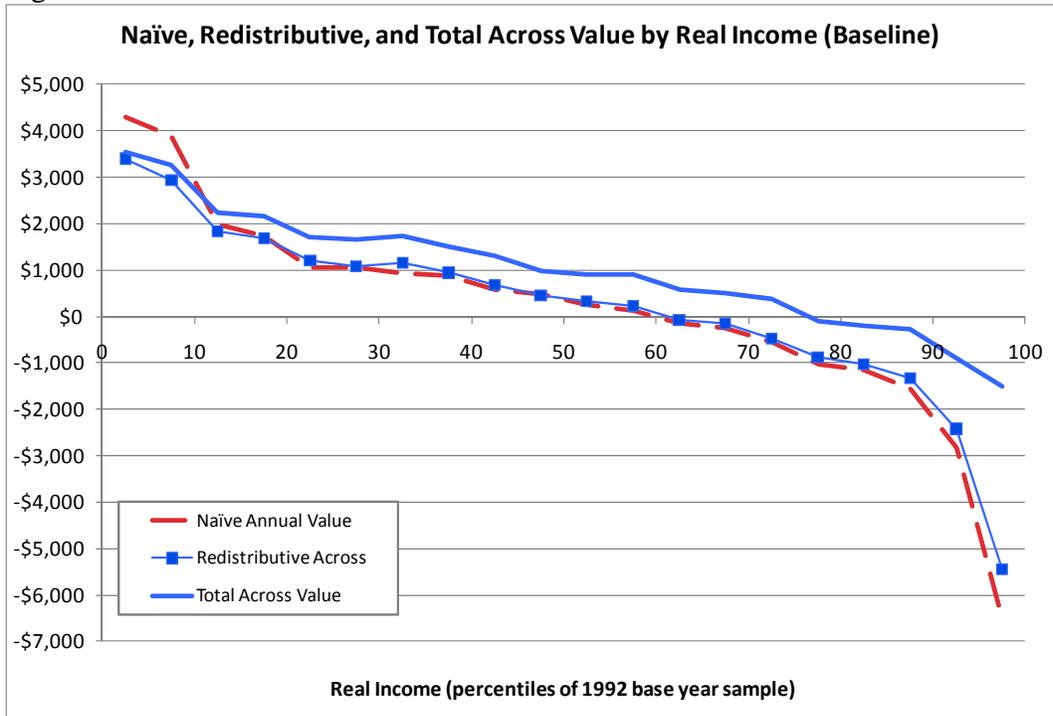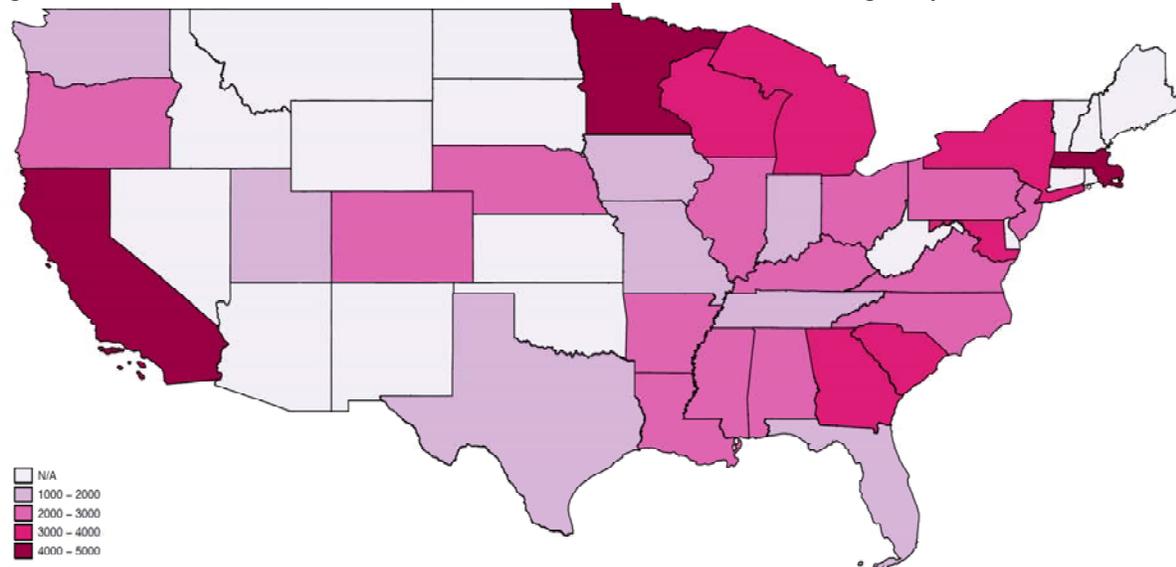

Notes: Authors' tabulations using the PSID. Definitions for federal taxes and transfers (*F*) and state taxes and transfers (*B*) are found in Table 1.

Figure 3

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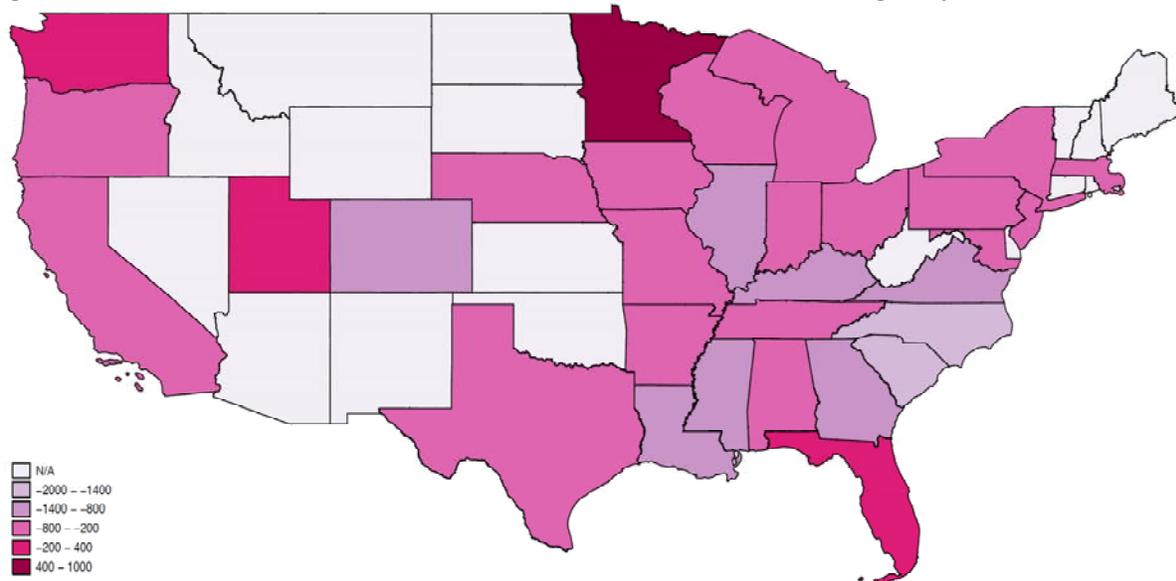

Notes: Authors' tabulations using the PSID. All values are equivalence-scale adjusted and are in 2005 dollars. All parameters are for base-case assumptions and calculated using the decade-3 sample of the PSID (1992 baseline). See text for details.

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

Value: Z Across Total, Quartile: 1, Base Year: 1992

Figure 5: Total Across Value for 4th Quartile Income Families, Averages by State

Value: Z Across 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 Total Across Value to Risk Aversion

Legend:
— Baseline (rho=3)
—■— Rho = 5
– – Rho = 1
· · · · Rho = 0

Real Income (percentiles of 1992 base year sample)

Figure 7

Total Across Value by Base Year Age

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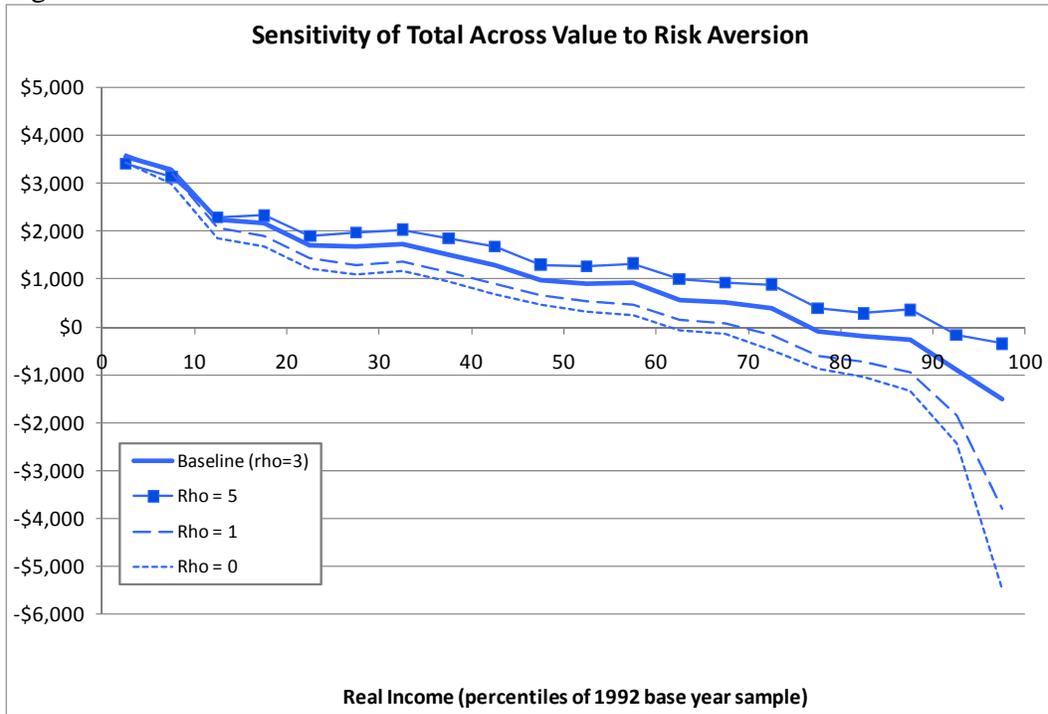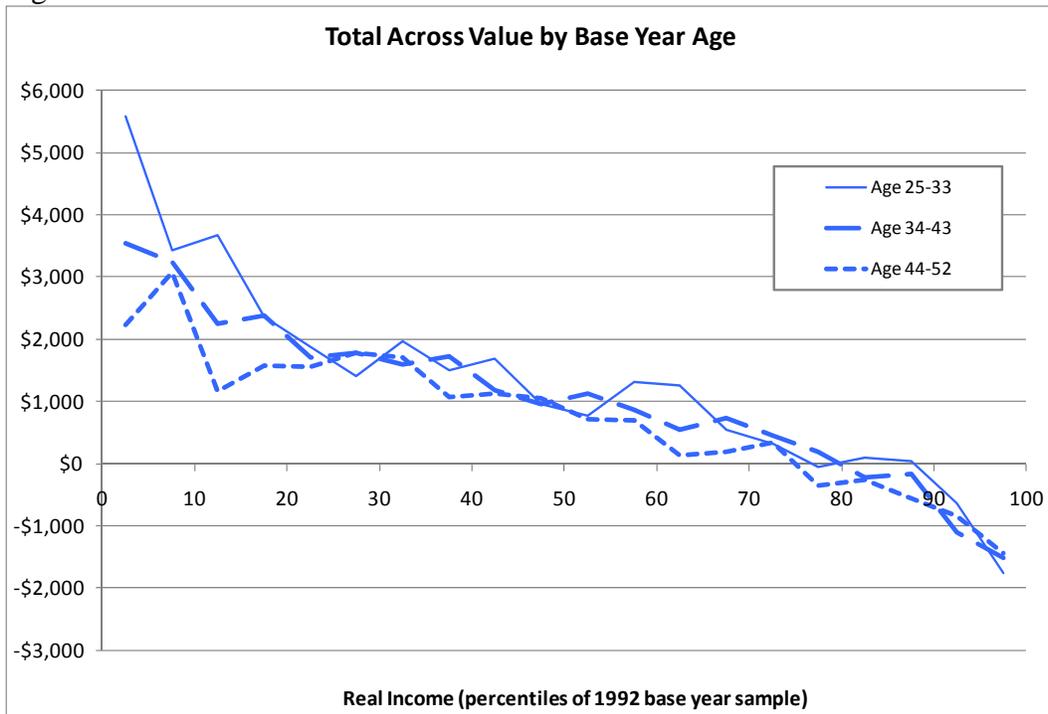– – Age 44-52

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.
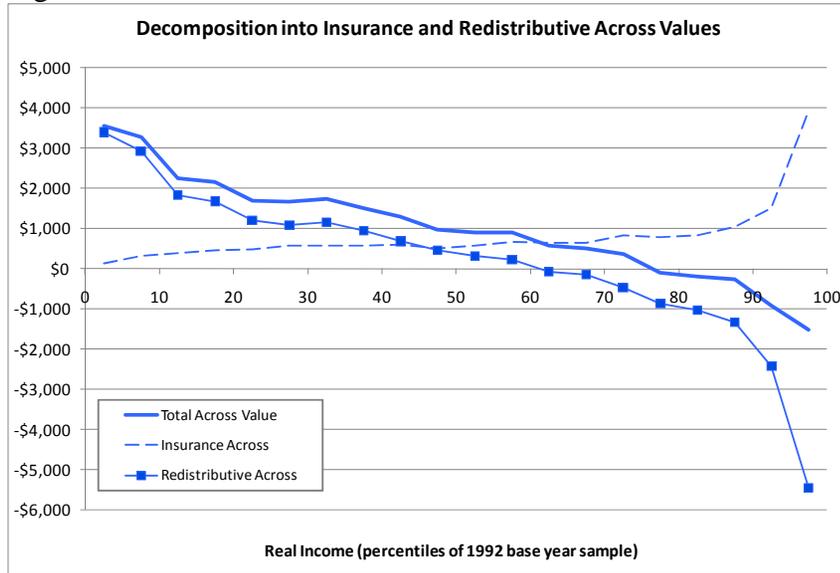
Figure 8

Decomposition into Insurance and Redistributive Across Values

Real Income (percentiles of 1992 base year sample)

Figure 9

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

Real Income (percentiles of 1992 base year sample)

Figure 10

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

Real Income (percentiles of 1992 base year sample)
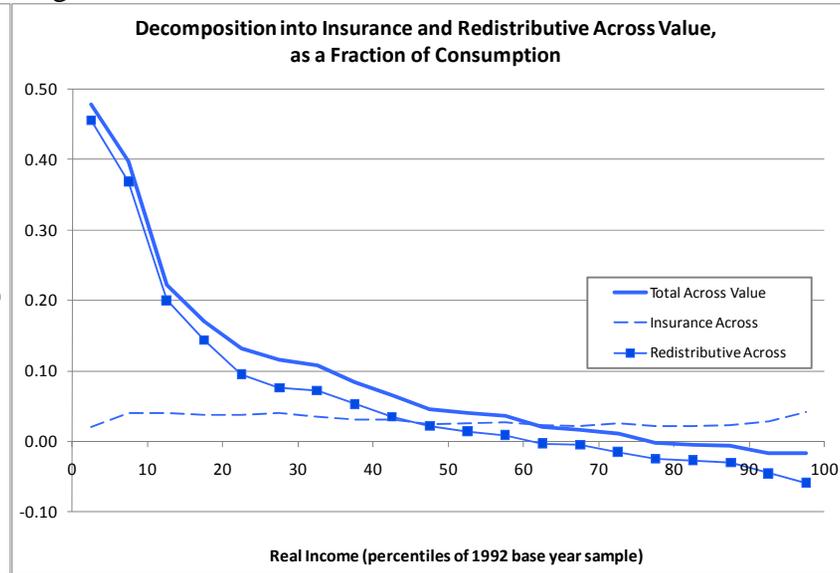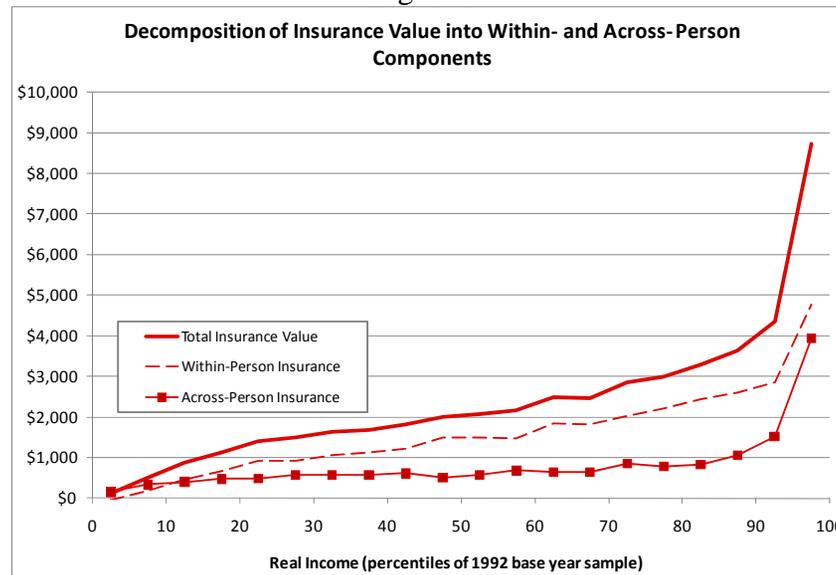
Notes: Authors' tabulations using the PSID. All values are equivalence-scale adjusted and are in 2005 dollars. All parameters are for base-case assumptions and calculated using decade-3 sample of the PSID (1992 baseline). See text for details.
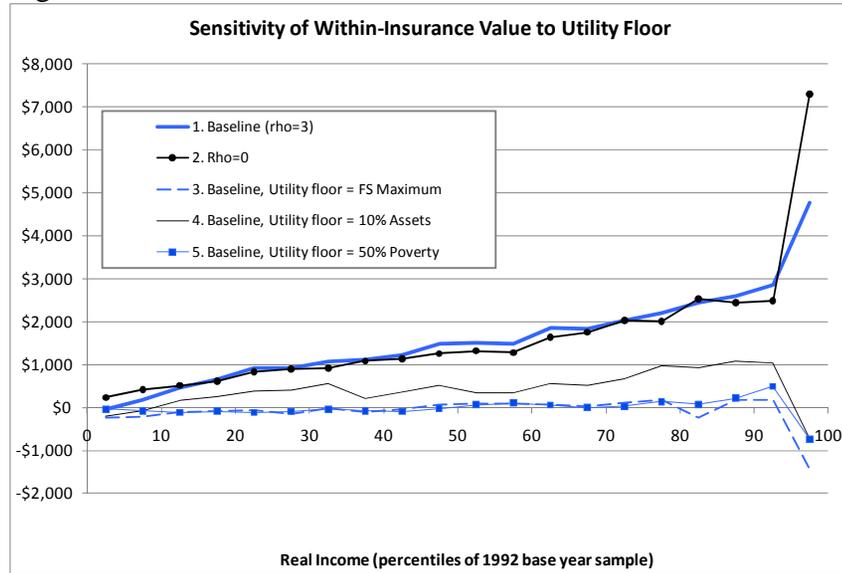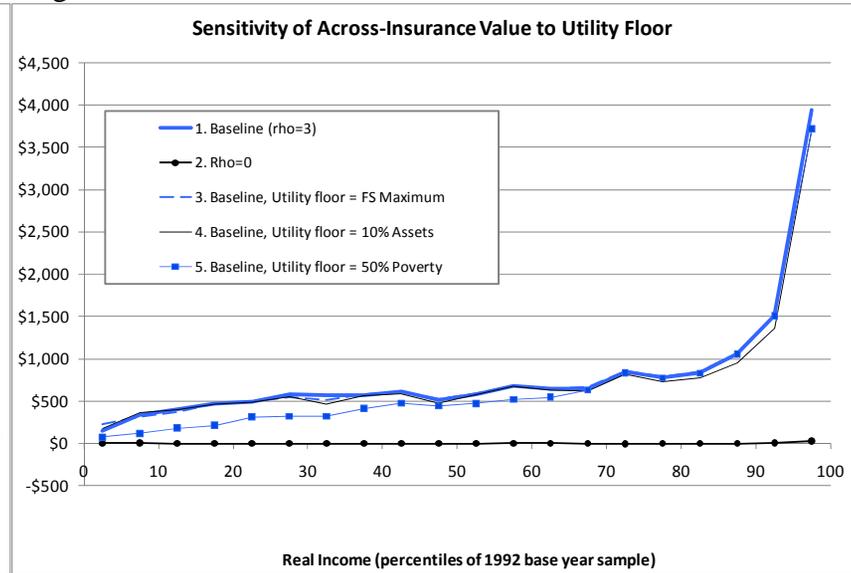
Figure 11

Sensitivity of Within-Insurance Value to Utility Floor

- 1. Baseline (rho=3)
- 2. Rho=0
- 3. Baseline, Utility floor = FS Maximum
- 4. Baseline, Utility floor = 10% Assets
- 5. Baseline, Utility floor = 50% Poverty

Real Income (percentiles of 1992 base year sample)

Figure 12

Sensitivity of Across-Insurance Value to Utility Floor

- 1. Baseline (rho=3)
- 2. Rho=0
- 3. Baseline, Utility floor = FS Maximum
- 4. Baseline, Utility floor = 10% Assets
- 5. Baseline, Utility floor = 50% Poverty

Real Income (percentiles of 1992 base year sample)

Figure 13

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)

Figure 14

Total Across Value , By Component of Tax and Transfer System

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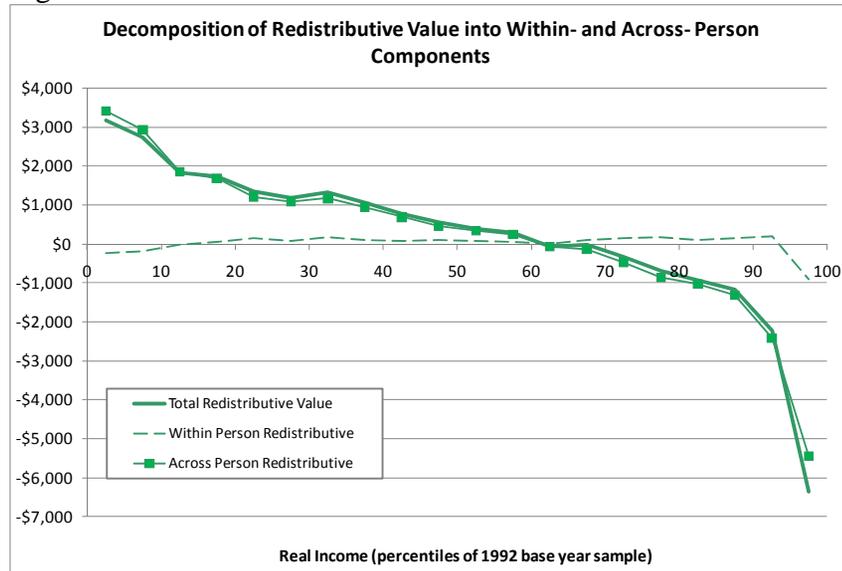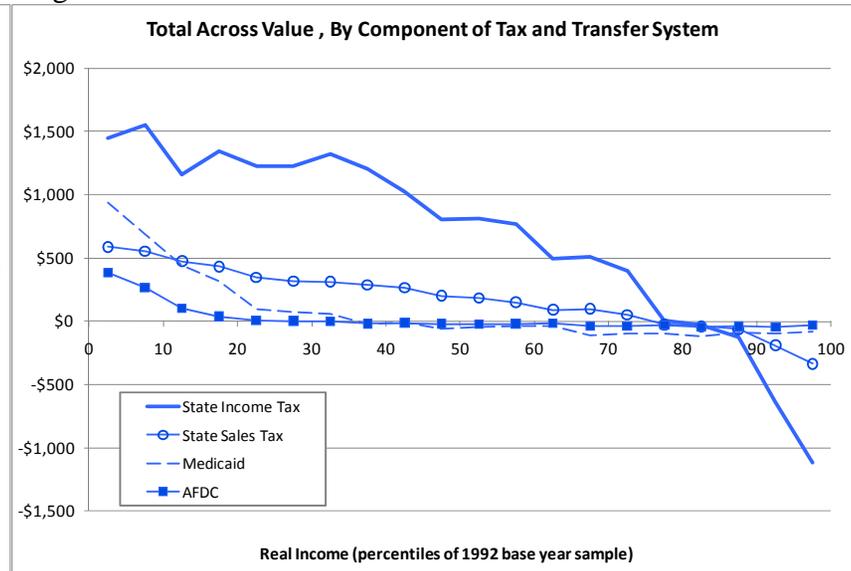- Medicaid
- AFDC

Real Income (percentiles of 1992 base year sample)

Notes: 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.
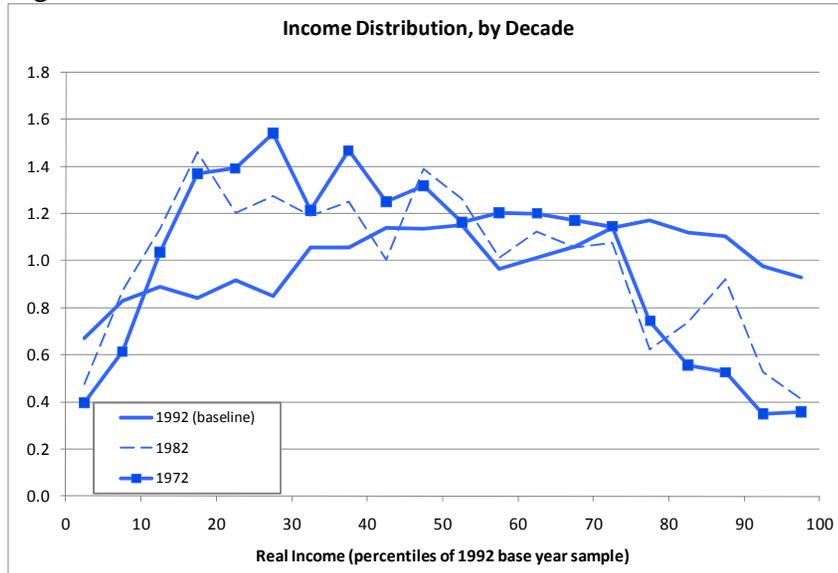
Figure 15

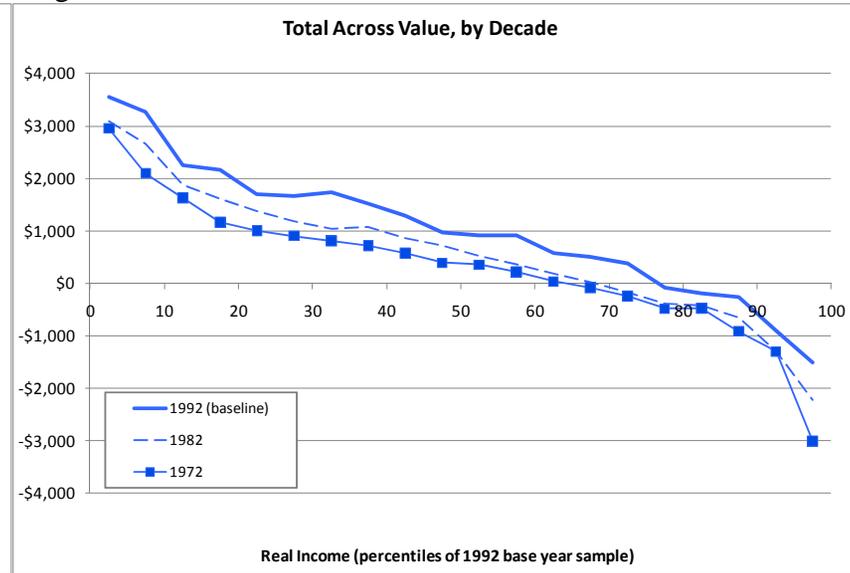**Income Distribution, by Decade**

Real Income (percentiles of 1992 base year sample)

Legend: 1992 (baseline), 1982, 1972

Figure 16

Total Across Value, by Decade

Real Income (percentiles of 1992 base year sample)

Legend: 1992 (baseline), 1982, 1972

Figure 17

Decomposition of 1972-1992 Change In Total Across Value

Real Income (percentiles of 1992 base year sample)

Legend: Change in Total Across Value, Change in Insurance Across, Change in Redistributive Across
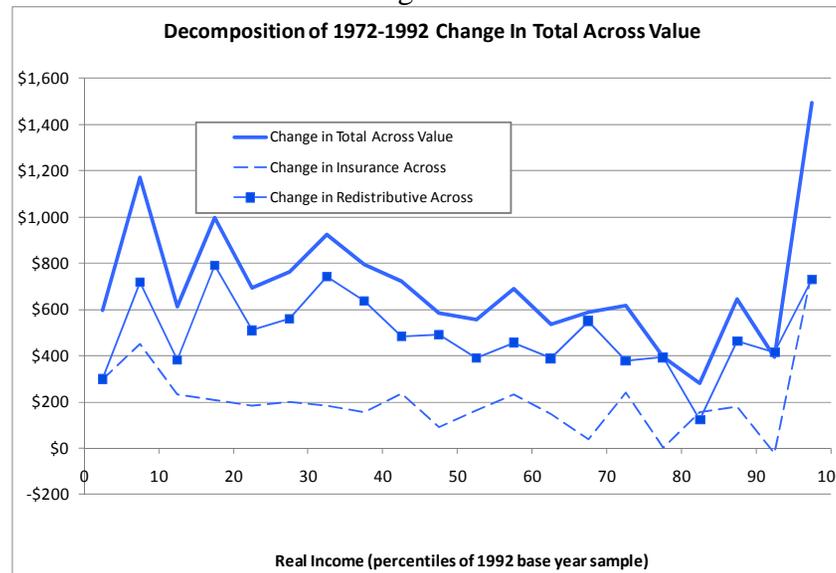
Notes: These figures use the PSID data for decades 1, 2, and 3. All values are equivalence-scale adjusted and are in 2005 dollars. See text for details.
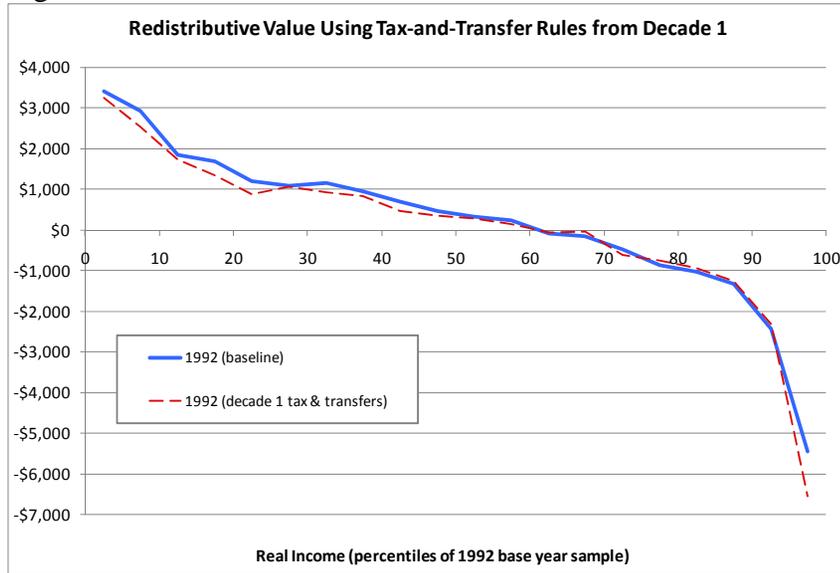
53

Figure 18

Figure 19

Redistributive Value Using Tax-and-Transfer Rules from Decade 1

Insurance Across Value Using Tax-and-Transfer Rules from Decade 1

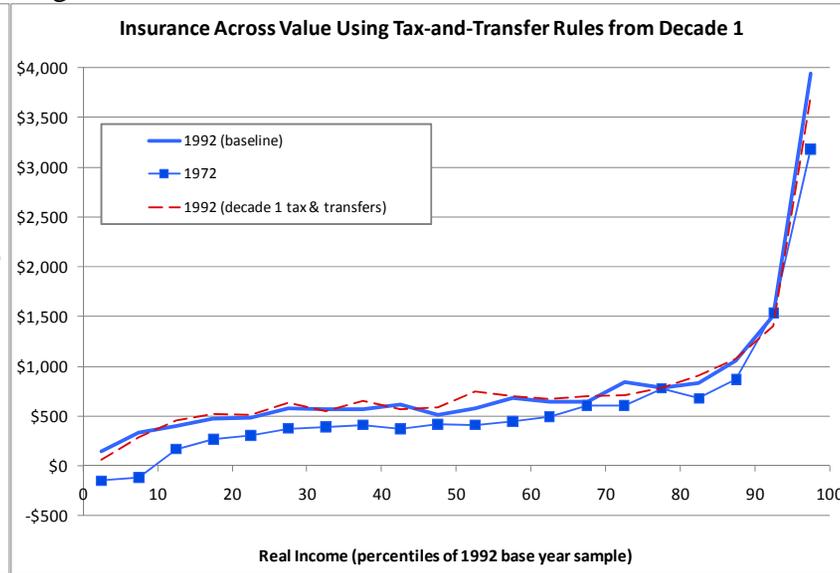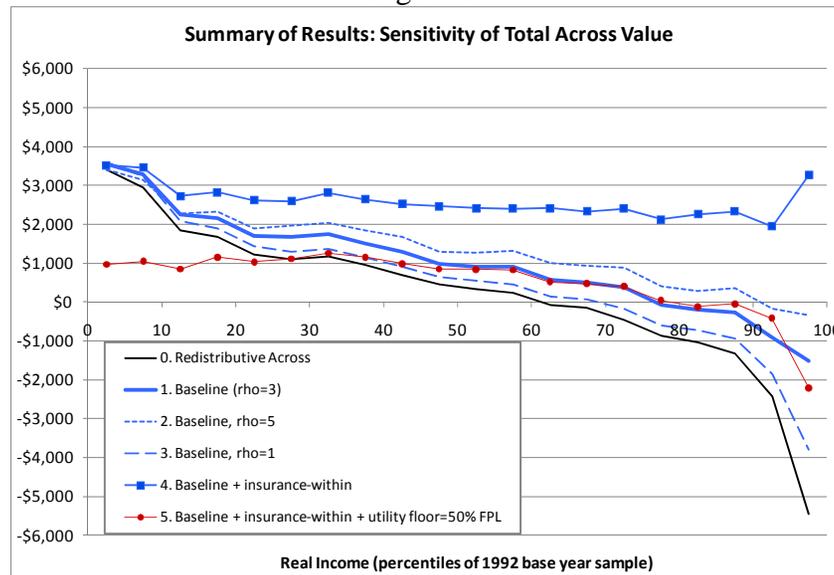Figure 20

Summary of Results: Sensitivity of Total Across Value

Notes: Figures 18 and 19 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.

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		1982		1992	
	Mean	SD	Mean	SD	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.