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Risk Sharing and the Tax System

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Abstract

Several papers have documented that US consumers can not fully insure themselves against all their idiosyncratic risks, but little is understood about which mechanisms provide insurance. We investigate whether, as some suggest, progressive taxes provide additional insurance. The methodology distinguishes insurance from redistribution, and can by applied to testing any potential insurance mechanism. Using repeated cross-sections from the US consumer expenditure survey (CEX), we relate changes in consumption inequality to several measures of tax progressivity. Identification exploits the variation in taxes both across states and over time. Our results suggest, under weak assumptions, that progressive taxes do not induce insurance, while stronger assumptions quantify this effect.

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1 Introduction

Over the last twenty years or more, there has been considerable interest, particularly among consumption economists, about the extent to which consumers can smooth out income shocks. While the earlier literature considered consumers smoothing over time, the much of the more recent literature has looked at smoothing across states of nature, asking whether households can fully insure their idiosyncratic risks. An implication of the full insurance hypothesis is that neither temporary nor permanent shocks to income will have any impact on consumption behaviour. While this hypothesis has consistently been rejected by the literature (for US consumers, see for instance Mace 1991, Cochrane 1991, or Attanasio and Davis 1996), it seems unlikely that agents are completely autarkic: more likely, they have some, but partial, ability to smooth shocks. A natural corollary is to ask what mechanisms provide insurance? This has important welfare implications, since providing additional insurance, other things remaining equal, will make consumers better off. Thus we investigate what changes the total amount of insurance available to consumers, explicitly recognizing that any potential mechanism might merely crowd out, or substitute for, other risk-sharing mechanisms.

One particularly popular candidate instrument that might provide insurance is the tax and benefit system. This is explicitly recognized in some tax regimes: for instance, in Britain part of the tax system is labeled national insurance. Moreover, some economists, such as Varian (1980), have argued that this is a more important motivation for progressive taxes than redistribution. Several papers have studied this problem, including Attanasio and Rios-Rull (2000), and Kruegar and Perri (1999), by simulating over some plausible parameter estimates. Never-the-less, whether the tax system really does provide insurance, or merely crowds out, or substitutes for, other forms of insurance is an open issue.

In an interesting and much discussed paper, Asdrubali, Sørensen and Yosha (1996) investigate how state level shocks are insured, or smoothed, across US states. Their exercise decomposes insurance into its various constituent parts, by regressing changes in consumption against changes in the components of income. They find that federal taxes smooth 13% of income variation, but their results suggest that taxes are only half as important as credit markets, and a third as important as capital markets (e.g. holding a balanced portfolio of assets), in smoothing state level consumption. Instead, this paper looks at individual level shocks, and investigates the level of insurance between households within the state. Our approach has a number of advantages: by using individual data we can separate insurance from redistribution, something they concede they can not distinguish. We also want to know the marginal effect. We have in mind the following policy experiment: suppose the tax system was changed so that it became more redistributive; will the level of insurance change, or will consumers merely substitute from alternative insurance mechanisms. In the decomposition of Asdrubali *et. al.* (1996) this effect is not captured.

The methodology of this paper builds and develops the earlier work of Deaton and Paxson (1994). We exploit differences across US states, as well as time, to identify what effect, if any, the tax system has on the total amount of insurance available to consumers: identification follows from the fact that different US states have different tax regimes. We use household level consumption data available from the CEX for the years 1982-1997. The aim is not to reject full insurance, but rather to test whether, and how much, a progressive tax system provides insurance. For this, as will be explained, it is not necessary to explicitly state what is observed in the full insurance case, unlike the paper by Deaton and Paxson (1994). While quite general assumptions can be used to identify whether taxes provide insurance, tighter assumptions are needed to quantify how much is provided. We will find that the tax system does not help agents to insure themselves against income shocks.

The paper is organised so that first it will discuss how a progressive tax system might provide insurance. Then it discusses the literature on how to test for (complete) insurance, before explaining how the literature can be used to test for the marginal, or extra, amount of insurance that some policy instrument, such as the tax system, might provide. We then briefly discuss our data, and how the tax system works in the US, before we present the results of our regressions. Finally after discussing our results, we briefly conclude.

2 Taxes and Transfers

It has been traditional in the public economics literature to view taxation as a method of reducing cross-sectional inequality. The idea is that redistributing income from high to low income households may be a 'good thing'. Obviously, unless agents were altruistic, such a plan will be supported by low income people and opposed by high income people. If, on the other hand, agents were altruistic, there would seem to be no motivation for a public scheme of re-distribution, since agents would be privately motivated to redistribute their income. However, this argument ignores another (possible) important motivation for a redistributive tax.[1] If future income is uncertain, then, in the absence of alternative insurance mechanisms, a redistributive tax system can provide insurance against this uncertainty. Varian (1980), for instance, argued that this ought to motivate extremely high marginal tax rates.

Suppose individual i's current income y_{it} has a permanent y_{it}^p and a temporary component[2]:

$$\begin{aligned} y_{it}^p &= y_{it-1}^p + f_{it} \\ y_{it} &= y_{it}^p + \varepsilon_{it} \end{aligned} \tag{1}$$

This periods income is subject to permanent f_{it} and temporary u_{it} shocks, which are assumed to be mean zero processes. Thus income can be written:

$$y_{it} = f_{i0} + \sum_{s=1}^{t} f_{is} + \varepsilon_{it} \tag{2}$$

[1]Here a poll tax is deemed non-redistributive, and any tax that increases as income increases is deemed to be redistributive, or progressive.

[2]This analysis is similar to that presented in Deaton et. al. (2000)

Taxes are typically a function of current income: suppose taxes are levied at some flat rate level τ. In which case expected *per capita* tax revenue (where the expectation is over the i individuals) is:

$$\tau E_i \left[f_{i0} + \sum_{s=1}^{t} f_{is} + \varepsilon_{it} \right] = \tau E_i f_{i0} = \tau \bar{f}_{i0}$$

Suppose these taxes are re-distributed back to all agents as a lump sum transfer.[3] After tax and transfer income, $\tilde{y}_{it}$, would be:

$$\tilde{y}_{it} = f_{i0} - \tau \left(f_{i0} - \bar{f}_0 \right) + (1-\tau) \left[\sum_{s=1}^{t} f_{is} + \varepsilon_{it} \right] \tag{3}$$

and the change in income can be decomposed into an insurance component and a re-distribution component.

$$y_{it} - \tilde{y}_{it} = \underbrace{\tau \left(f_{i0} - \bar{f}_0 \right)}_{redistribution} + \underbrace{\tau \left[\sum f_{is} + \varepsilon_{it} \right]}_{insurance} \tag{4}$$

Re-distribution is on the initial distribution of income, while insurance acts on any income shocks. We concentrate on this second feature of the tax system. Whether, in practise, the tax system provides insurance depends on what mechanisms the agent has to smooth consumption in the presence of income shocks. If no other insurance mechanisms were available, then clearly a progressive tax system would provide insurance. On the other hand, the agent may already have alternative risk-sharing arrangements available to him, in which case the tax system may instead interrupt the agents private incentives to participate in these arrangements. In this case, a progressive tax system may provide no additional insurance, but may instead merely crowd out, or substitute for, existing arrangements, a point highlighted by Attanasio and Rios-Rull (2000).

[3] It would be simple to adjust this equation if some fixed proportion of $\bar{f}_{i0}$ is spent by the government on public goods, rather than being redistributed. This adjustment has no effect on the analysis.

We propose using the different tax systems in the different states of the US to examine how the level of insurance changes as the degree of re-distribution changes. However, rather than attempting to simulate over the possible values of the parameters in a fully structural model, an approach taken in Attanasio and Rios-Rull (2000) or Deaton, Gourinchas and Paxson (2000) among others, we will instead estimate a reduced form, and see what insights can be gained from that approach. While the structural approach can give valuable insights, we do not believe that it can successfully answer the question that we are interested in: it would require knowledge of preferences, the income process, and *all* insurance mechanisms available to the agent. This is not necessary in the reduced form approach that we take in this paper. While it can not describe the mechanism that provides insurance, it can say whether insurance is provided. This is often what a policy maker wants to know. The aim is to compare different tax systems to see how the overall level of insurance changes across regimes.

3 Empirical Framework

A number of approaches have been used to test for full insurance. The earliest tests are based on exclusion restrictions. Suppose each individual i's income y_{it} was subject to aggregate η_t and idiosyncratic u_{it} shocks each period t so that

$$y_{it} = y_{it-1} + \eta_t + u_{it}$$

By construction, the idiosyncratic component u_{it} sums to zero over the i individuals. Full insurance implies that this term does not affect changes in consumption, hence a valid test for full insurance is to regress changes in consumption Δc_{it} on the idiosyncratic component of the income shock. Mace (1991), Cochrane (1991), and Attanasio and Davis (1996) all apply this test to US households, and decisively reject this implication of the full insurance hypothesis. A second approach, due to Jappelli and Pistaferri (1999), instead tests the ordering of agents. Under full insurance, if agents, in any time period, are ordered by their level of consumption, then this ordering (after controlling for taste-shifters) will not change over time. They reject full insurance, and argue that neither measurement error, nor taste-shifters, could explain this rejection.

A third implication was investigated by Deaton and Paxson (1994). For the moment ignore taste-shifters, then, with quadratic utility (and assuming the interest rate r equals the discount rate δ) consumption follows a martingale:

$$c_{it} = c_{it-1} + \varepsilon_{it} \tag{5}$$

in which case the cross-sectional variance of consumption for a fixed membership group j evolves according to the relationship:

$$var^j\left(c_{it}\right) - var^j\left(c_{it-1}\right) = var^j\left(\varepsilon_{it}\right) + 2cov^j\left(c_{it-1}, \varepsilon_{it}\right)$$

Deaton and Paxson (1994) showed that if lagged aggregate consumption is in each agent's information set then $cov^j\left(c_{it-1}, \varepsilon_{it}\right) = 0$ (at least on average over a large enough number of time periods). If income follows the stylized process:

$$\begin{aligned} y_{it}^p &= y_{it-1}^p + f_{it} \\ y_{it} &= y_{it}^p + v_{it} \end{aligned} \tag{6}$$

then, for quadratic utility, the change in consumption is due to the permanent shock, and the annuity value of the transitory shock, i.e.:

$$\varepsilon_{it} = f_{it} + \frac{r}{1+r} v_{it}$$

Blundell and Preston (1998) used this to show, in their proposition 3, that:

$$\Delta var^j\left(c_{it}\right) = var^j\left(f_{it}\right) + \left(\frac{r}{1+r}\right)^2 var^j\left(v_{it}\right) \tag{7}$$

If the permanent and temporary shocks are fully insured, then neither should affect consumption, which would imply:

$$\Delta var^j\left(c_{it}\right) = 0$$

This implication of full insurance was rejected by Deaton and Paxson (1994). An advantage of their approach, compared to the other two, lies in the weaker data requirements. In order to test for full insurance, researchers need only observe the cross-sectional moments of the distribution of consumption. In contrast, the first approach requires controlling for idiosyncratic versus aggregate income shocks, which unlike in the Deaton and Paxson case, may not be feasible with a time-series of cross-sections, while the second approach requires the availability of panel data, and for all taste-shifters to be fully parametrized. For these reasons we build from the approach of Deaton and Paxson (1994).

While full insurance has been consistently rejected by all of the approaches discussed above, the tests are not fully constructive, in the sense that they do not help us to understand either how much insurance is available to agents, nor what mechanisms might change the overall level of insurance. The next two subsections discuss incomplete insurance under quadratic and alternative utility specifications.

3.1 Quadratic Utility

Under quadraric utility, with $r = \delta$, the permanent income hypothesis implies:

$$c_{it} = c_{it-1} + f_{it} + \frac{r}{1+r} v_{it}$$

If insurance is incomplete, so that the agent can insure the proportions ϕ of his permanent shock, and ψ of the temporary shock then:

$$\begin{aligned} c_{it} &= c_{it-1} + (1-\phi) f_{it} + (1-\psi) \left(\tfrac{r}{1+r}\right) v_{it} \\ \Rightarrow \quad \Delta var^j (c_{it}) &= (1-\phi)^2 var^j (f_{it}) + (1-\psi)^2 \left(\tfrac{r}{1+r}\right)^2 var^j (v_{it}) \end{aligned}$$

where the variance is taken for a fixed membership group j. In this framework, ϕ and ψ are determined by the characteristics of the economy in which the agent resides. They reflect *all* the mechanisms available to the agent that can insure idiosyncratic risk. Two cases are of particular interest: if $\phi = \psi = 1$ then this implies full insurance, while $\phi = \psi = 0$ reflects autarky, where none of the agents idiosyncratic risk can by insured. Further, if r is sufficiently small, or if the temporary shock can be fully insured ($\psi = 1$), then[4]:

$$\Delta var^j(c_{it}) = (1-\phi)^2 \, var^j(f_{it}) \tag{8}$$

From this last equation two things are immediately apparent. First, unless $\phi = 1$, the full insurance case, the variance (or standard deviation) of consumption will be increasing over time. Secondly, as ϕ increases (the amount of insurance increases) the growth in the variance of consumption falls.

3.2 Alternative Utility Specifications

For more complicated utility functions the simple relationship in equation 8 no longer holds. One of the simplest extensions is discussed by Attanasio and Jappelli (2001). Maintaining quadratic utility, but relaxing $r = \delta$, results in the Euler equation:

$$c_{it} = \left(\frac{1+\delta}{1+r}\right) c_{it-1} + \varepsilon_{it} \tag{9}$$

where, under the assumptions made above on the income process, consumption innovations ε_{it} are equal to a linear transformation of income shocks, i.e.:

$$\varepsilon_{it} = f_{it} + \frac{r}{1+r} v_{it}$$

And under full insurance $var^j(c_{it})$ may be growing or declining depending on whether $r > \delta$ or $r < \delta$. With incomplete insurance and under the assumptions made above on income shocks the evolution of the variances for group j takes the form:

$$var^j(c_{it}) = \left(\tfrac{1+\delta}{1+r}\right)^2 var^j(c_{it-1}) + (1-\phi)^2 \, var^j(f_{it}) \tag{10}$$

where the assumption that idiosyncratic shocks are all smoothed away is maintained.

[4]This assumption may not be too unreasonable. Attanasio and Davis (1996) offer evidence that temporary shocks can be smoothed by US consumers, but permanent shocks can not.

Attanasio and Jappelli (2001) also discuss the case of isoelastic utility functions with relative risk aversion parameter σ. In this case, consumption innovations are not a simple function of income shocks, as in the quadratic utility case. If the distribution of consumption growth was log-normal, then the Euler equation takes the form:

$$\ln c_{it} = \ln c_{it-1} + \sigma (r - \delta) + \frac{1}{2\sigma} var (\Delta \ln c_{it}) + \varepsilon_{it}$$

If the fixed membership group j is sufficiently homogeneous, so that all members faced the same uncertainty about consumption growth, then the variance of consumptions evolves according:

$$var^j (\ln c_{it}) = var^j (\ln c_{it-1}) + (1 - \phi)^2 var^j (\varepsilon_{it}) \tag{11}$$

Notice that the last term of the RHS of equation 11 is the variance for group j of the *consumption* innovation and that full insurance would now imply that there is no change in the variance of log-consumption over time.

Blundell and Preston (1998) discuss the cases of constant absolute risk aversion (CARA) and constant relative risk aversion (CRRA) preferences. For the first they use a relationship derived by Caballero (1990) who finds that when income is generated by a random walk and income shocks, ε_{it}, are log-normally distributed the growth of consumption is:

$$\Delta \ln c_{it} = \Gamma_{it} + \Lambda_{it} + \varepsilon_{it}$$

where Γ_{it} is the slope of the consumption path and Λ_{it} is a term that accounts for revisions to variance forecasts. Again, if the fixed membership group j is sufficiently homogeneous, so that Γ_{it} and Λ_{it} are constant within each group, then under incomplete insurance, the variance of the growth rate of consumption evolves according:

$$var^j (\Delta \ln c_{it}) = (1 - \phi)^2 var^j (\varepsilon_{it}) \tag{12}$$

Blundell and Preston (1998) also showed that a relationship of the same form as equation 12 holds when preferences are described by a CRRA functions and the income process is given by:

$$\ln y_{it} = \ln y_{it}^p + v_{it}$$
$$\ln y_{it}^p = \ln y_{it-1}^p + f_{it}$$

Namely, it holds that:

$$var^j\left(\Delta \ln c_{it}\right) = (1-\phi)^2\, var^j\left(f_{it}\right) + (1-\psi)^2 \left(\frac{r}{1+r}\right)^2 var^j\left(u_{it}\right) \tag{13}$$

If, as before, we assume that either the interest rate is sufficiently small, or that $\psi \approx 1$, equation 13 boils down to equation 12.

Lastly, it is worth considering completely arbitrary preferences, that nevertheless maintain that the real interest rate and the discount rate are equal. Changes in marginal utility must obey the relationship:

$$\lambda\left(c_{it}\right) = \lambda\left(c_{it-1}\right) + \zeta_{it}$$

where $\lambda(\cdot)$ is the marginal utility of consumption and ζ_{it} is its innovation at time t. Then the variance of the marginal utility consumption for group j under incomplete insurance evolves according to:

$$var^j\left(\lambda_{it}\right) = var^j\left(\lambda_{it-1}\right) + (1-\phi)^2\, var^j\left(\zeta_{it}\right) \tag{14}$$

which implies that if $\phi \neq 1$ the variance of the marginal utility of consumption is increasing over time. There are two problems in bringing 14 to the data. First, the variance of the marginal utility can be computed only if one makes specific assumptions on preferences. Second, the variance of the innovation in the marginal utility of consumption is not observable.

In the following, we show how to tackle the first problem, while the next subsection shows how our identification procedure takles the second problem. The Euler equation can be used to characterize the *changes* in the variance the marginal utility of consumption. A first order Taylor expansion around c_{it-1} gives:

$$\lambda_{it} = \lambda_{it-1} + \lambda'_{it-1}(c_{it} - c_{it-1}) + o(c_{it} - c_{it-1}) \tag{15}$$

Hence the variance of (15) is:

$$\begin{aligned} var^j(\lambda_{it}) &= var^j(\lambda_{it-1}) + E^j\left(\lambda'_{it-1}\right)^2 var^j(\Delta c_{it}) \\ &\quad + var^j\left(\lambda'_{it-1}\right) E^j(\Delta c_{it})^2 + var^j\left(\lambda'_{it-1}\right) var^j(\Delta c_{it}) \end{aligned} \tag{16}$$

where $E^j(\cdot)$ is the expected value for fixed membership group j. From equation (16) one can see that if the variance of the change in consumption increases then the change in the variance of the marginal utility of consumption also increases. This implies that those factors that cause the variance of the change in consumption to decrease cause the change of the marginal utility of consumption to decrease too, i.e. the overall amount of insurance available to individuals to increase. This allows us to identify what provides insurance at the margin, even without making the assumptions about the functional form of the utility function. In other words, there is a monotone mapping between the changes in the variance of marginal utility of consumption and the variance of changes.[5]

3.3 The Regression

The discussion above highlights that the sign of the effect of a policy instrument, as captured by ϕ, can be always identified, while the coefficient is interpretable only under specific assumptions about the utility function. In the discussion on quadratic utility above, we considered $\Delta var^j(c_{it})$, but if, in equation 5, we first difference before taking variances, we obtain:

$$var^j(\Delta c_{it}) = var^j(\varepsilon_{it}) \tag{17}$$

[5] One could obtain an entirely similar derivation using logs instead of levels.

and the implications are the same. However, in this approach, no assumption about the $cov^j(c_{it-1}, \varepsilon_{it})$ is necessary, although the disadvantage is that each household must be observed at least twice. The discussion on alternative utility specifications, culminating in equation 16, also suggests using the variance of changes rather than changes in variances. The third reason for doing this is it allows us to easily measure the insurance effect of our policy instrument. This last follows since equation 8 becomes:

$$var^j(\Delta c_{it}) = (1-\phi)^2 \, var^j(f_{it}) \tag{18}$$

which implies that if instead the standard deviations were taken then:

$$s.d.^j(\Delta c_{it}) = (1-\phi) \, s.d.^j(f_{it}) \tag{19}$$

Recall that ϕ is the amount of insurance available to households within each regime. This amount may depend on some policy instrument z^j which varies exogenously across regimes. In which case, estimation can recover ϕ as a function of z^j. Variation between regimes allows this function to be recovered. Writing:

$$\phi\left(z^j\right) = \alpha_0 + \alpha_1 z^j + \xi^j \tag{20}$$

where the error term ξ^j captures any differences in the level of insurance that are not modeled. Full insurance implies that both $\alpha_0 = 1$ and $\alpha_1 = 0$; incomplete insurance implies $\alpha_0 < 0$; while z_j provides additional insurance if $\alpha_1 > 0$. If instead z^j merely crowded out, or substituted, for other insurance mechanisms, then this would imply $\alpha_1 = 0$, while a negative coefficient would imply that there was more than complete crowding out (that is the overall level of insurance is reduced). Substituting into equation 19 results in:

$$s.d.^j(\Delta c_{it}) = \left(1 - \alpha_0 - \alpha_1 z^j - \xi^j\right) s.d.^j(f_{it}) \tag{21}$$

The regression that is run takes the form:

$$s.d.^j(\Delta c_{it}) = \beta_0 + \beta_1 z^j + error \tag{22}$$

and identifying terms implies:

$$\begin{aligned}
\beta_0 &= (1-\alpha_0)\, s.d.\left(f_{it}\right) \\
\beta_1 &= -\alpha_1 s.d.\left(f_{it}\right) \\
error &= -\xi^j s.d.\left(f_{it}\right)
\end{aligned}$$

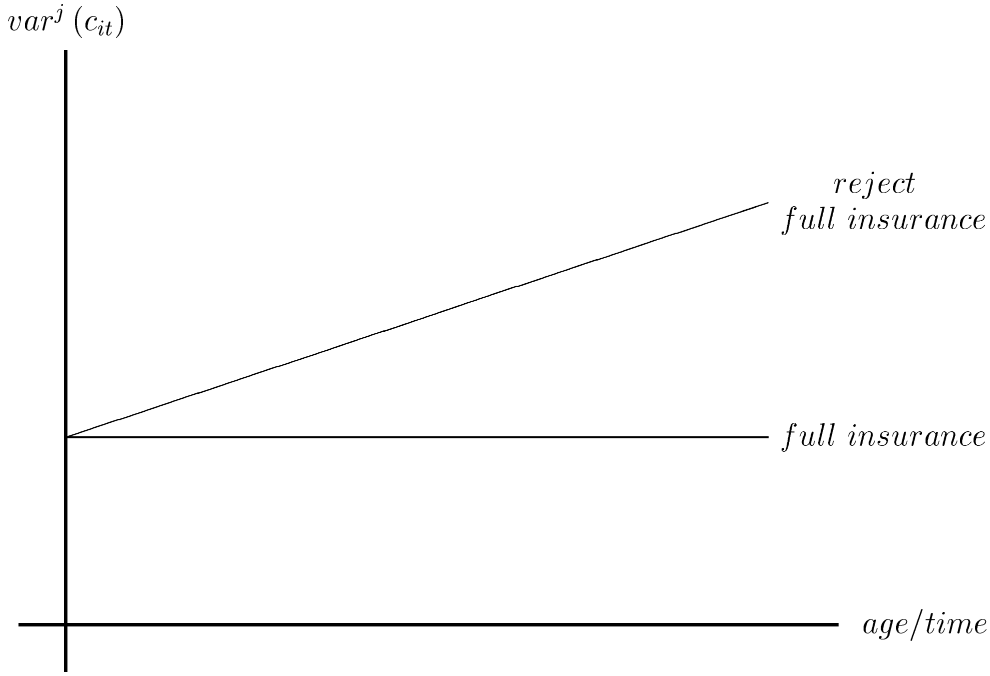
Hence if the variance of the permanent shock were known and constant across all groups j, the level of insurance, and how it changes with the policy instrument z^j, can be recovered.

For departures from the simple cases, the coefficient is no longer so easily identified but, the sign can always be interpreted. This is illustrated in figure 1. The top panel shows the simple quadratic case where $r = \delta$. Full insurance implies that $var^j\left(c_{it}\right)$ is time-invariant, while full risk-sharing is rejected if the variance is growing over time. This is longer true for more general preferences: instead full risk-sharing may imply that $var^j\left(c_{it}\right)$ is either increasing or decreasing, depending on the parameters of the model. The diagram shows the variance decreasing under full insurance. However, our aim is to compare the different policy regimes, indexed by z^j, hence we compare the $var^j\left(c_{it}\right)$ across the different regimes: in those regimes where this variance is growing more slowly, there must be more risk-sharing or insurance. This remains true even if the full insurance case can not be fully specified.

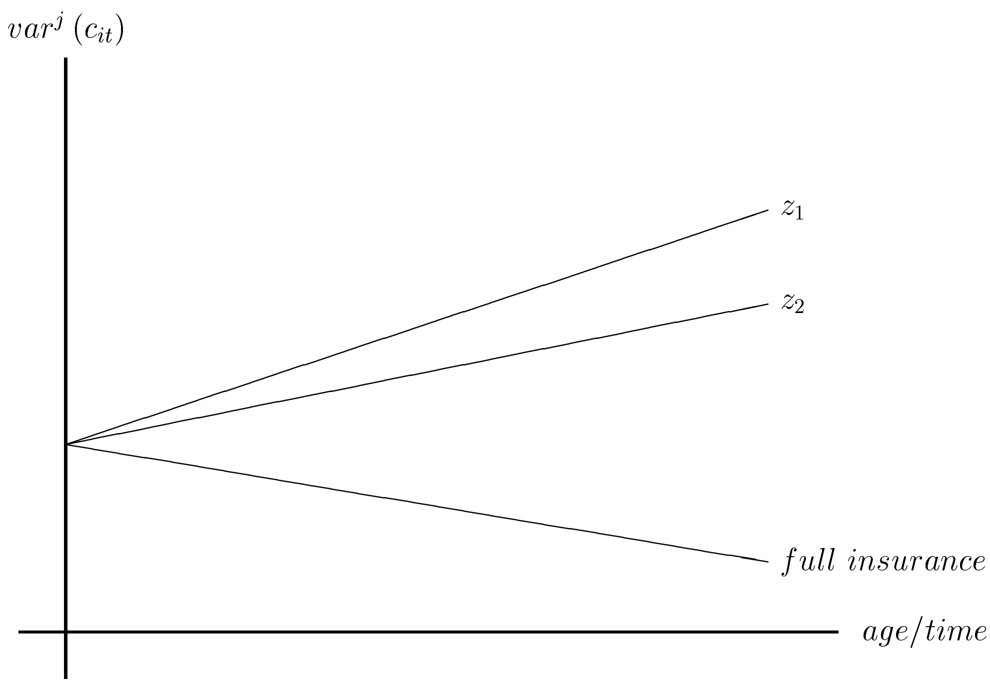
4 Data

This paper uses the Consumer Expenditure Survey (CEX): a survey of US households that has operated on a continuous basis since 1980. The data not only has detailed information on consumer expenditure, income and taxes, it also records information about the state of residence of the household (although, due to confidentiality requirements, this information has been suppressed for some observations). Comparing these states will enable us to test whether the tax (and transfer) system can provide insurance as different states have different tax policies. This paper uses a sample

Figure 1: The evolution of $var^j(c_{it})$.



(a) Quadratic preferences where $r = \delta$.



(b) A more general case, comparing regimes z_1 and z_2.

of around 100,000 households taken from the years 1982 to 1997 for which we have full state information. The data was also restricted to those households headed by individuals who were between 25 and 55 in the first year in which they are sampled.[6]

In the US taxes are raised at a variety of levels; those entitled to levy taxes include the federal and state legislators, county administrations, and school boards. Taxes include income taxes, sales taxes, property taxes and duty. This paper will concentrate on income tax, which is raised both federally and by states. While the consumer expenditure survey includes questions on the amount of taxes that the household pays, we do not believe that the answers that households give are particularly accurate or reliable. Nevertheless, some results are included using these variables. However, we have also constructed a tax liability figure using the TAXSIM programme developed by Freenberg (see Freenberg and Coutts, 1993 for details) and provided by the NBER and including state taxes since 1982. Using a variety of household variables, including husband's and wife's salary income, taxes and other costs on property, interest, dividends etc., and details about the household's characteristics (such as number of children) as well as the state of residence, the programme constructs both the state and the federal tax bracket, tax liability, and marginal tax rate for each household in the sample. The calculation specifically allows for the fact that a variety of allowances are allowed, and also includes an assessment of households entitlement to the Earned Income Tax Credit[7] (which results in some households net tax liability being negative). Tables 1-5 summarize some of the main features of the data.

The current federal marginal tax rate (see table 1) varies from 15% for those whose income is less than \$26,250 (for single people, for married couples the threshold is \$43,850) up to 39.6% for income over \$288,350. Table 2 summarizes the proportion of people in each tax bracket in our sample. It also highlights that the brackets themselves have varied over the years. For the period 1982-1986 a large number

[6] This means if we are taking the *k-th* difference they were aged 30+k to 50+k in the last year in which they were sampled.

[7] See Scholz (1996) for an explanation of the EITC.

of tax brackets were applicable: too many to give anything other than fairly broad summary statistics. However, the table demonstrates that around 15% (depending on the year) did not pay any tax, while the median household was in the 23% tax bracket. In these years the highest tax bracket for federal taxes was set at 50%. In 1987 the number of brackets was greatly reduced, and from this year every tax bracket is recorded in table 2. There was a further reduction in the following year. Between 1987 and 1996 the proportion of households who did not pay tax gradually increased to 19%. Other features are the introduction of a 31% tax bracket, for the top 5% of earners in 1991, the introduction of a 36% bracket in 1993, of a 39.6% bracket in 1996, and the abolition of the 0% bracket in 1997.

States taxes can differ quite widely among the different US states. Table 3 shows the current tax rates applicable in different US states. From this we can see 8 states, including Texas and Florida, do not to levy any income tax on their residents: state revenue in these states comes mostly from sales taxes. In addition New Hampshire and Tennessee only charge state income tax against dividend and interest income. The other states have a variety of income tax bands and exemptions (or tax credits) that are applicable. Although some states have a flat rate tax, in most states, the marginal tax rate increases with income, and there are a variety of tax allowances to which households are entitled. Table 3 provides a summary description of the state tax systems in the U.S.

The paper also exploits the transfers that typically poorer agents receive. Such transfers include social security and railroad retirement income, supplementary security income, unemployment compensation, worker's compensation and veterans payments, public assistance or welfare, pension income, and the value of food stamps received: the CEX includes questions on all these transfers. Table 4 shows that the average amount of transfer, over the whole sampled population, is $871, but that only 18.6% of households receive a transfer. Conditional on receiving at least something, households receive an average of $4,680. This is not a substantial amount, when the average household salary income in the survey is $34,574.

4.1 Measuring Tax Progressivity

In order to assess if tax systems are affecting the level of insurance available to households we need some measure of the progessivity[8] of the tax system in each state. If the marginal tax rate were the same for all households, then this could be used in the regressions. As it increases we should expect the cross-sectional variance of consumption to increase. The intuition is that higher marginal tax rates cause the after tax income distribution to be more concentrated. However, from the previous discussion, the marginal tax rate that consumers face is an increasing function of income, and furthermore, households differ in the allowances and exemptions they can claim. Under such circumstances, no completely satisfactory measure of tax progressivity exists. We choose to use two measures that capture progressivity. The first is to take the average of the households marginal tax rate, or tax bracket, within each year-state-cohort j. From table 5 the average federal bracket is 20.2%, and the average of the reported marginal tax rates (which accounts for various allowances) is 19.2%. The state rates vary from zero in Texas and Florida, which charge no taxes, to an average marginal tax rate of 7.4% in New York.

One problem with using this measure is that it ignores any heterogeneity in tax rates across households. For instance, a given mean marginal tax rate of 20% could be due to all households paying a marginal (and average) tax rate of 20%; from only the top half of the income distribution paying, but paying 40%; or from only the bottom half paying 40%. These situations differ strongly in the degree to which taxes are re-distributive. A related problem, is that the mean marginal tax rate is not invariant to the overall level of taxes that are taken. Our interest is in the degree to which taxes re-distributes income, hence we wish to construct a measure that is not

[8] Recall that we define a tax to be progressive if the tax liability increases as income increases, thus a flat rate income tax is deemed progressive.

affected by the overall tax level. This motivates a second measure of how much the tax system redistributes income, constructed as:

$$\tau = 1 - \sqrt{\frac{var^j\left(\tilde{y}_{it}\right)}{var^j\left(y_{it}\right)}} \tag{23}$$

that is, as one minus the square-root of the ratio of the variance of income after taxes compared to before taxes for each group j. If all households faced the same marginal tax rate, and there were no allowances, then this constructed τ would exactly equal the marginal tax rate. Moreover, a larger τ implies more re-distribution. Table 5 displays the constructed values for τ for the whole of the US and for the 6 largest US states. It shows that this measure averages to 32.0% over the US, but that states can differ from 27.6% in Florida (where there is no income tax), to 36.8% in New York, traditionally viewed as one of the more progressive states. This measured τ can be regressed on how much the variance of consumption changes over time. A negative coefficient implies that the variance is growing more slowly, which is interpreted as meaning more insurance is being provided by the tax system. That is, a negative coefficient means that as taxes become more re-distributive, agents are better able to smooth against uncertain income shocks. In contrast, a positive coefficient implies that taxes more than crowd out alternative insurance mechanisms, and the overall level of insurance from the tax system is reduced.

5 Results

This section discusses the results. Recall that section 3 motivated regressing the change in the standard deviation of consumption against a measure of tax progressivity, τ. The regression takes the form:

$$s.d.^j\left(\Delta c_{it}\right) = \beta_0 + \beta_1 \tau^j + \varepsilon^j$$

where j represents the state-time-cohort combination, and we difference it over nine months (the largest possible period given our data). The number of groups that could reasonably be defined (ensuring that the cell size was at least 75) was around 180, but depended on the regression.[9] Obviously, this process meant that several smaller states were never included in the analysis, since fewer observations came from these states. However, there were sufficient observations in most of the larger states.

Tables 6-9 display the results. In order to minimize the effect of sample composition, we take for each state only those households who are between 25-40 years old and those who are between 41-55 at the beginning of the sample. In column 1 of each table we report our baseline specification, where we only control for seasonality in consumption. Moreover, since the variance of the growth rate of households is likely to be affected by heterogeneity within the group, which is at large extent predictable, the regression ran in column 2 add a number of controls to the baseline regression. That is, instead of using $s.d.^{j}\left(\Delta c_{it}\right)$, column 2 uses $s.d.^{j}\left[\Delta c_{it} - E\left(\Delta c_{it}|X_{it}\right)\right]$. The set of control variables X includes age, time, education, sex, race, marital status, and changes in family size.

A second important issue is that we wish to observe the standard deviation of consumption, and for the measure of compression for the whole population in each group, but we only observe a small sample of the population. Thus errors are introduced into both the left-hand side and into the right-hand side of each regression. That is, we have:

$$s.d.^{j}\left(\Delta c_{it}\right) + \varepsilon_{jt} = \beta_0 + \beta_1\left(\tau_t^j + \varsigma_t^j\right) + u_t^j \tag{24}$$

One would expect past values of τ_t^j to be correlated its current value in its state, but measurement error induced by the small sampling sizes to be uncorrelated with the past, hence instrumenting with lagged values of τ_t^j will remove any downward bias. A further problem is that ε_t^j and ς_t^j may be correlated, hence for some of the regressions τ_t^j twice lagged will be the instrument. Columns 3,4,5 of each table host IV estimates, where the instruments are τ (or the marginal tax rate) lagged once, lagged once or

[9]Experimenting with different cell sizes did not qualitatively change the results. We also experimented with different ages, different cohorts, and different years, all without substantive effect.

twice, or lagged twice. The significance of the results is starred once for significant at the 10% level, twice for significant at the 5% level and three times for significant at the 1% level.

Table 6 shows that in the basic regression, and in the regression including a set of control variables, that the coefficient on the mean marginal tax rate, and on the tax bracket, is significant at the 1% level. However, perhaps surprisingly, the coefficient is positive. This suggests that other important insurance mechanisms are being crowded out by the introduction of a more re-distributive tax system. When the instrumented results are included, the mean marginal tax rate remains significant, at the 5% level, although this is not true for the mean tax bracket. When the change in the variance of log-consumption[10] was considered in table 7 the coefficient on the constant becomes highly significant (at the 1% level), and the marginal tax rate, and the tax bracket both remain significant. This remains true when τ is instrumented by its lag, and even in the last column, where it is lagged twice. The results in this last column are significant at the 1% level.

Tables 8 and 9 consider the constructed value of re-distribute that was created using before and after tax income. The first results refer to levels, and show, except in the less reliable case where we have used the reported tax liabilities in the CEX, that τ is positive and significant at the 5% level. However, when τ is instrumented by past values of the variable, the results are more ambiguous, and only remain significant for the middle panel that ignores transfer income. When log-consumption is considered the results are significant at the 1% level, with and without the controls and for both τ and the constant. The significance of the results remain with the IV-estimate. The last column, our most preferred regression, is also significant.

The fact that the constant was significant and positive in the regressions, at least for the log-consumption regressions, confirms the results in Deaton and Paxson (1994). This rejects full insurance, although it is open to the criticism made in Attanasio and

[10]This is a better measure of risk-sharing when preferences are not quadratic.

Jappelli (2001). The results for the coefficient for the measure of tax-progressivity have a number of interpretations. At the most basic, the coefficient on τ can be treated as an exclusion restriction: under full insurance the growth in the variance of consumption, regardless of the utility function, should be uncorrelated with anything except changes in tastes. Hence the fact that τ enters significantly rejects the full insurance hypothesis. A second interpretation says that while the coefficient is not interpretable, the fact that the coefficient is positive, and significant, means that making the tax system more progressive is reducing the amount of insurance that the agents have. There must be other mechanisms that operate privately, that are being disrupted by the imposition of the tax system: agents incentives to participate in these private insurance mechanisms is reduced since they have access to a public mechanism. However, how these private mechanisms operate is not calculated.

The final interpretation allows us to quantify how much dis-insurance the tax system provides. The theory section highlighted when this case arises and the terms can be identified:

$$\begin{aligned} \beta_0 &= (1-\alpha_0)\, s.d.\,(f_{it}) \\ \beta_1 &= -\alpha_1 s.d.\,(f_{it}) \\ error &= -\xi^j s.d.\,(f_{it}) \end{aligned}$$

For identification it is necessary to know, or estimate, the standard deviation of the permanent shock. For log-income, this has been done by MaCurdy (1982) among others.[11] His paper estimated the variance of the permanent shock to be 0.34: the implications for the estimated dis-insurance that is thus generated by a more redistributive tax system is tabulated in table 10. From the table, both the basic, and the control regression suggests, for either the marginal tax rate or the tax bracket, that households can insure roughly one third of their permanent income shock. Each one percent increase in the marginal tax rate reduces the level of insurance by 0.7%.

[11]We are not aware of any papers that have estimated this parameter when income has been measured in levels, and hence concentrate on the log-level case.

Instrumenting both increases the estimated basic level of insurance and the estimated reduction in insurance induced by the tax system. Those regressions that use the constructed τ proposed in equation 23 show similar results for the basic and the control regression. When instruments are used the results that used the estimated taxes from the TAXSIM routine described above show that households can insure roughly 45% of their permanent shock, but that each 1% increase in the measure of how re-distributive the tax system is reduces the amount of insurance by 1%. To put this in perspective, these results imply that if we examine table 5, if a household was moved from California to Florida, then the total amount of the permanent shock that the agent could insure would increase from around 9% to around 18%, that is it would roughly double.

6 Conclusions

In this paper we tried to relate the amount of insurance available to households to the system of taxes and transfers. A large strand of literature has documented the absence of full insurance, at least for the U.S. economy. However, it is likely that households *can* smooth some of their idiosyncratic shocks. Several mechanisms might provide insurance: some of them, such as financial markets, are related to formal economic interactions; others, such as family networks, relate to informal interactions. The tax system is the mechanism this paper explores.

Taxes and transfers re-distribute income across households, but also might smooth some of the income shocks households incur. This in turn affects how consumption changes over time. If the changes in consumption respond to idiosyncratic shocks, we should expect this response to be weaker as more insurance becomes available to households. Moreover, if the cross-sectional variance of consumption trends up, we should expect this trend to be flatter, the more households are able to insure their consumption against idiosyncratic income shocks. Around these two intuitions, the empirical results of the paper are organized.

We test if changes in consumption respond to the degree of compression of the income distribution induced by taxes and transfers. We measure the degree of distribution induced by taxes and transfers with (a) the marginal tax rate, and the tax bracket; (b) a constructed measure of how much taxes compress the distribution of current income. Our regressions show that increasing the degree to which taxes re-distribute income is negatively correlated with the increase in the variance of consumption growth. The paper suggests three interpretations: (i) this can be thought of as an exclusion restriction that confirms the rejection of full insurance found by previous authors; (ii) the fact that the coefficient is positive suggests that increasing the degree to which taxes re-distribute income reduces the total amount of insurance available to households; and (iii) under stronger assumptions, the coefficients themselves can be interpreted, and the results suggest that moving from a highly re-distributive state, such as California, to one that re-distributes less, such as Florida, can double the amount of insurance that is available to households.

The overall, and tentative conclusion of this paper, is that the tax system seems to be rather a poor mechanism for providing insurance against the idiosyncratic income shocks that households suffer. Instead, the tax system crowds out other mechanisms which we do not attempt to describe, although the methodology described in this paper can be extended to any potential insurance mechanism: we merely need to observe sufficient variation in our sample. This results suggests that any defense of a re-distributive tax system that appeals to the self-interest of the agents involved must argue on the grounds that *ex ante* inequality is itself a 'bad thing' since the results do not support the suggestion made by Varian (1980) that progressive taxes can be motivated by agents insurance incentives, at least for the ranges of taxes that are observed in the US.

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Table 1: Thresholds for current federal tax brackets

Tax Rate	Tax Bracket		
(%)	single	married jointly	married seperately
15	0	0	0
28	26,250	43,850	21,925
31	63,550	105,950	52,975
36	132,660	161,450	80,725
39.6	288,350	288,350	144,175

Table 2: Proportion paying at each marginal federal tax rate for 1982-1998

Year	Tax Bracket	% Paying Rate	Year	Tax Bracket	% Paying Rate
1982	0	13.4			
	10-20	19.5			
	21-30	30.8			
	31-40	25.2			
	41-50	11.1			
1983	0	14.6	1984	0	15.8
	10-20	26.8		10-20	28.2
	21-30	31.6		21-30	29.0
	31-40	21.9		31-40	19.7
	41-50	5.2		41-50	7.4
1985	0	15.2	1986	0	15.5
	10-20	26.3		10-20	26.6
	21-30	28.4		21-30	28.4
	31-40	22.5		31-40	22.3
	41-50	7.7		41-50	7.3
1987	0	17.1	1988	0	17.0
	11	2.9			
	15	38.0		15	42.4
	28	23.3		28	40.5
	35	15.9			
	38.5	2.6			
1989	0	17.2	1990	0	17.4
	15	42.4		15	42.3
	28	40.2		28	40.2
1991	0	17.1	1992	0	18.6
	15	43.9		15	43.0
	28	33.2		28	31.5
	31	5.6		31	6.7
1993	0	18.0	1994	0	17.8
	15	44.9		15	43.7
	28	30.8		28	32.6
	31	5.5		31	5.1
	36	0.5		36	0.6
1995	0	17.6	1996	0	19.4
	15	43.2		15	42.1
	28	33.3		28	32.6
	31	5.1		31	4.3
	36	0.5		36	1.2
				39.6	0.1
1997	15	61.1	1998	15	58.2
	28	32.1		28	34.2
	31	4.9		31	5.2
	36	1.4		36	1.8
	39.6	0.2		39.6	0.3

Table 3: State Individual Income Tax Rates in the US

State	Tax Rates		Exemptions		
	low	high	single	married	dependents
Alabama	2.0	5.0	1,500	3,000	300
Alaska	no state tax				
Arizona	2.87	5.04	2,100	4,200	2,300
Arkansas	1.0	7.0	20*	40*	20*
California	1.0	9.3	72*	142*	227*
Colorado	4.63	4.63		none	
Connecticut	3.0	4.5	12,000	24,000	0
Delaware	2.2	5.95	110*	220*	110*
Florida	no state tax				
Georgia	1.0	6.0	2,700	5,400	2,700
Hawaii	1.5	8.5	1,040	2,080	1,040
Idaho	2.0	8.2	2,900	5,800	2,900
Illinois	3.0	3.0	2,000	4,000	2,000
Indiana	3.4	3.4	1,000	2,000	1,000
Iowa	0.36	8.98	40*	80*	40*
Kansas	3.5	6.45	2,250	4,500	2,250
Kentucky	2.0	6.0	20*	40*	20*
Louisiana	2.0	6.0	4,500	9,000	1,000
Maine	2.0	8.5	2,850	5,700	2,850
Maryland	2.0	4.75	1,850	3,700	1,850
Massachusetts	5.6	5.6	4,400	8,800	1,000
Michigan	4.2	4.2	2,800	5,600	2,800
Minnesota	5.35	7.85	2,900	5,800	2,900
Mississippi	3.0	5.0	6,000	12,000	1,000
Missouri	1.5	6.0	2,100	4,200	2,100
Montana	2.0	11.0	1,610	3,220	1,610

*Tax Credits.

Table 3: (cont.) State Individual Income Tax Rates in the US

State	Tax Rates		Exemptions		
	low	high	single	married	dependents
Nebraska	2.51	6.68	91*	182*	91*
Nevada	no state tax				
New Hampshire	taxes unearned income only				
New Jersey	1.4	6.37	1,000	2,000	1,500
New Mexico	1.7	8.2	2,900	5,800	2,900
New York	4.0	6.85	-	-	1,000
North Carolina	6.0	7.75	2,500	5,000	2,500
North Dakota	2.67	12.0	2,900	5,800	2,900
Ohio	0.691	6.98	1,050	2,100	1,050
Oklahoma	0.5	6.75	1,000	2,000	1,000
Oregon	5.0	9.0	132*	264*	132*
Pennsylvania	2.8	2.8		none	
Rhode Island	25.5% of federal taxes				
South Carolina	2.5	7.0	2,900	5,800	2,900
South Dakota	no state tax				
Tennessee	taxes unearned income only				
Texas	no state tax				
Utah	2.3	7.0	2,175	4,350	2,174
Vermont	24% of federal taxes				
Virginia	2.0	5.75	800	1,600	800
Washington	no state tax				
West Virginia	3.0	6.5	2,000	4,000	2,000
Wisconsin	4.6	6.75	700	1,400	400
Wyoming	no state tax				
Dist. Columbia	5.0	9.0	1,370	2,740	1,370

*Tax Credits.

Table 4: The level of transfers in the US

transfer	average	average if received	% receive
social security	247	6,710	3.6
supplementary security income	74	3,328	2.2
unemployment compensation	160	2,439	6.5
worker's compensation	117	4,484	2.6
welfare	169	3,768	4.4
pension	266	8,815	3.0
food stamps	101	1,918	5.3
total *	871	4,680	18.6

*Excluding pension income

Table 5: Measuring tax progressivity

	mean marginal rate	mean tax bracket	τ
Federal	19.2	20.2	
State:			
Overall	3.7	4.2	32.0
California	5.0	5.3	36.4
Florida	-	-	27.6
New York	6.3	7.4	36.8
Ohio	3.8	4.0	33.0
Pennsylvania	2.2	2.4	29.8
Texas	-	-	28.9

Table 6: Regressing $\Delta^k sd^j(c_{it})$ against the mean tax rate (standard errors in parenthesis).

	basic	control	Instrument		
			τ_{t-1}	τ_{t-1} and τ_{t-2}	τ_{t-2}
Marginal Tax Rate					
τ	1.633***	1.636***	1.590**	2.146**	2.126**
	(0.590)	(0.583)	(0.775)	(0.854)	(0.846)
constant	0.177	0.174	0.189	0.081	0.086
	(0.127)	(0.125)	(0.172)	(0.184)	(0.182)
Tax Bracket					
τ	1.036**	1.054**	0.805	1.163	1.294*
	(0.521)	(0.515)	(0.668)	(0.754)	(0.708)
constant	0.294**	0.288**	0.349**	0.277	0.247
	(0.126)	(0.124)	(0.163)	(0.179)	(0.167)
N	185	185	176	166	166

Table 7: Regressing $\Delta sd^j(\ln c_{it})$ against the mean tax rate (standard errors in parenthesis).

	basic	control	Instrument		
			τ_{t-1}	τ_{t-1} and τ_{t-2}	τ_{t-2}
Marginal Tax Rate					
τ	0.396*	0.402**	0.481**	0.574**	0.678***
	(0.198)	(0.194)	(0.207)	(0.232)	(0.233)
constant	0.390***	0.379***	0.358***	0.339***	0.317***
	(0.042)	(0.041)	(0.045)	(0.049)	(0.050)
Tax Bracket					
τ	0.391**	0.428**	0.377**	0.423**	0.512***
	(0.172)	(0.168)	(0.148)	(0.172)	(0.175)
constant	0.379***	0.367***	0.376***	0.366***	0.346***
	(0.039)	(0.038)	(0.035)	(0.039)	(0.040)
N	185	185	176	166	166

Table 8: Regressing $\Delta^k sd^j(c_{it})$ against the τ^j (standard errors in parenthesis).

	basic	control	Instrument		
			τ_{t-1}	τ_{t-1} and τ_{t-2}	τ_{t-2}
Taxes from CEX					
τ	1.309	1.322	1.575	2.422	2.781
	(0.845)	(0.843)	(1.494)	(1.715)	(1.928)
constant	0.229	0.226	0.169	-0.021	-0.106
	(0.203)	(0.202)	(0.359)	(0.409)	(0.460)
Taxes only					
τ	1.910**	1.912**	1.851	2.812**	2.995**
	(0.829)	(0.826)	(1.382)	(1.368)	(1.414)
constant	0.098	0.097	0.117	-0.091	-0.133
	(0.190)	(0.189)	(0.323)	(0.314)	(0.322)
Taxes and Transfers					
τ	1.459**	1.459**	1.452	1.838	1.629
	(0.724)	(0.721)	(1.368)	(1.345)	(1.351)
constant	0.166	0.166	0.172	0.084	0.137
	(0.185)	(0.184)	(0.356)	(0.347)	(0.349)
N	188	188	179	169	169

Table 9: Regressing $\Delta^k sd^j(\ln c_{it})$ against the τ^j (standard errors in parenthesis).

	basic	control	Instrument		
			τ_{t-1}	τ_{t-1} and τ_{t-2}	τ_{t-2}
Taxes from CEX					
τ	0.374**	0.395**	0.619**	0.627**	1.161**
	(0.181)	(0.182)	(0.279)	(0.279)	(0.485)
constant	0.381***	0.376***	0.319***	0.317***	0.192*
	(0.042)	(0.042)	(0.067)	(0.067)	(0.115)
Taxes only					
τ	0.520***	0.519***	0.589**	0.624**	0.633*
	(0.184)	(0.184)	(0.279)	(0.287)	(0.356)
constant	0.350***	0.350***	0.331***	0.324***	0.322***
	(0.041)	(0.041)	(0.065)	(0.065)	(0.081)
Taxes and Transfers					
τ	0.493***	0.490***	0.634***	0.653***	0.611**
	(0.185)	(0.185)	(0.243)	(0.251)	(0.305)
constant	0.344***	0.344***	0.304***	0.300***	0.311***
	(0.046)	(0.046)	(0.062)	(0.063)	(0.077)
N	186	186	176	166	166

Table 10: Estimated parameters in the insurance function $\phi(\tau) = \alpha_0 + \alpha_1 \tau + error$ from tables 7 and 9.

	basic	control	Instrument		
			τ_{t-1}	τ_{t-1} and τ_{t-2}	τ_{t-2}
Marginal tax rate					
α_0	0.33	0.35	0.38	0.41	0.45
α_1	-0.67	-0.69	-0.82	-0.98	-1.16
Tax Bracket					
α_0	0.35	0.37	0.35	0.37	0.40
α_1	-0.67	-0.73	-0.64	-0.72	-0.87
Incomes from the CEX					
α_0	0.34	0.35	0.45	0.45	0.67
α_1	-0.64	-0.67	-1.06	-1.07	-1.99
Taxes only using TAXSIM					
α_0	0.39	0.39	0.43	0.44	0.44
α_1	-0.89	-0.89	-1.01	-1.07	-1.08
Taxes and Transfers using TAXSIM					
α_0	0.41	0.41	0.47	0.48	0.46
α_1	-0.84	-0.84	-1.08	-1.11	-1.04