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The effect of marginal tax rates on income: a panel study of ‘bracket creep’

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Abstract

This paper uses a panel of individual tax returns and the ‘bracket creep’ as source of tax rate variation to construct instrumental variables estimates of the sensitivity of income to changes in tax rates. From 1979 to 1981, the US income tax schedule was fixed in nominal terms while inflation was high (around 10%). This produced a real change in tax rate schedules. Taxpayers near the top-end of a tax bracket were more likely to *creep* to a higher bracket and thus experience a rise in marginal rates the following year than the other taxpayers. Compensated elasticities can be estimated by comparing the differences in changes in income between taxpayers close to the top-end of a tax bracket to the other taxpayers. These estimates, based on comparisons between very similar groups, are robust to underlying changes in the income distribution, such as a rise in inequality. The elasticities of taxable income and adjusted gross income are around 0.4 and significant but the elasticities of wage income are in general insignificant and close to zero.

Keywords: Income taxation; Behavioral responses; Bracket creep

JEL classification: H31; J22

1. Introduction

The response of taxpayers to changes in marginal rates has long been of interest

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to economists. The magnitude of this response is of critical importance in the formulation of tax and transfer policy. However, the empirical literature has failed to generate a consensus on the magnitude of the elasticity of income with respect to marginal tax rates. The empirical estimates range from no effect to extremely large effects.

The labor supply literature focuses mostly on the elasticity of hours of work with respect to marginal tax rates and finds in general small responses to taxation.[1] The results of this literature might not be fully relevant to tax policy issues because hours of work are not the only dimension of behavioral responses to taxation. For example, individuals may vary effort on the job or the type of job they choose when taxes change.

Recent studies have looked directly at the sensitivity of overall income with respect to marginal rates using tax reforms to identify the parameters of interest. Therefore, these studies capture the response of taxpayers along all dimensions and not only hours of work. Most of these studies have used the US tax reforms of 1981, 1986, and 1993 to estimate taxpayers' responses. The results from this literature are controversial. The earliest studies by Lindsey (1987) and Feldstein (1995) using the tax reforms of 1981 and 1986 (respectively) found very large elasticities in excess of one. More recent studies by Navratil (1995) and Auten and Carroll (1999), using the same reforms but better data, found smaller elasticities (around 0.7). Finally, studies using the recent 1993 income tax rates increases have found large short-term responses but small medium-term responses (Sammartino and Weiner, 1997; Goolsbee, 2000). Gruber and Saez (2000) summarize this literature and provide estimates based on the entire period 1979 to 1990 that are of modest size (around 0.4 for taxable income and 0.2 for gross income).

Two reasons might explain the discrepancies between the findings. First, most of the tax reforms introduced many changes in the definition of taxable income besides tax rate changes. As a result, it is often problematic to compare reported income before and after the tax reform. Second, these studies often rely on comparisons of high income taxpayers (who experienced large tax rate changes) to low and middle income taxpayers (who experienced almost no tax rate changes). Therefore, this methodology amounts to attributing the widening in inequality to the tax reforms of 1981 and 1986[2] but economists have proposed many other explanations for increased income inequality.

These objections suggest that a research design to estimate behavioral responses to marginal tax rates should meet two conditions. First, the tax change should affect only marginal tax rates without introducing many changes in tax rules. Second, the tax change should affect differently groups of taxpayers that are comparable (i.e., whose incomes and other economic characteristics are close).

[1] Blundell and MaCurdy (1999) provide a comprehensive survey.

[2] Note that the bias goes in the other direction for the tax increases of 1993.

The 'bracket creep' in the US income tax of the early 1980s provides a source of tax rate variation meeting these two conditions.

From 1979 to 1981, inflation was high (around 10%) but the tax schedule was fixed in nominal terms. Because the income tax was highly progressive, inflation had a strong real impact. The effect of bracket creep on the US income tax was so strong that it increased substantially the average marginal rates and was the main cause of the 'tax revolt' of the late 1970s and early 1980s.[3] By comparison, the income tax cuts of 1981–84 were in fact just enough to bring total federal income tax receipts over GNP back to their 1977 level. Because of inflation, a taxpayer near the top-end of a bracket was likely to *creep* to the next bracket even if his income did not change in real terms. The other taxpayers (far from the top-end of a bracket), however, were not as likely to experience an increase in marginal rates the following year. This characteristic of 'bracket creep' is exploited to estimate the elasticities of income with respect to marginal rates. The spirit of the empirical strategy is to compare changes in income of taxpayers near the top-end of a bracket to changes in income of taxpayers near the bottom-end of the same bracket using tax return panel data.

This identification strategy has three advantages relative to the tax reform experiments of the 1980s. First, I compare groups of taxpayers whose incomes are very close. Therefore, the estimates are likely to be robust to changes in the underlying distribution of income and in particular to underlying increases in inequality. Second, 'bracket creep' did not affect the definitions of reported income and thus incomes can be easily compared across years. Third, as a theoretical matter, I show that the estimates obtained using 'bracket creep' are not a mix of income and substitution effects but rather pure compensated elasticities of income with respect to marginal tax rates.

Four other important characteristics and limitations of the 'bracket creep' tax change should be mentioned. First, because I compare year to year changes, the study captures only short-term responses to tax changes which might be different from medium- or long-term responses. The elasticities estimated in this study can be interpreted as intertemporal elasticities of substitution.[4] Second, changes in tax rates due to 'bracket creep' were relatively small compared to the changes induced by the large tax reforms of the 1980s and thus it is harder to obtain precise estimates. Third, because 'bracket creep' was not a legislated change, it might have been harder for taxpayers to understand the effect of this change on marginal tax rates. However, as discussed above, given the size of the increase of the real income tax burden produced by 'bracket creep', it is unlikely that a large fraction

[3]See Steuerle (1991, Chapters 2 and 3) for a detailed discussion.

[4]The literature on the elasticity of taxable income with respect to tax rates adopts in general a static framework and does not explicitly model intertemporal decisions. These studies distinguish short-term versus long-term responses in a crude way by varying the number of years between which changes in income are computed (see, e.g., Gruber and Saez, 2000).

of taxpayers was unaware of this change. Last, because in many cases taxpayers do not have perfect control of their incomes, the jumps in marginal tax rates at each bracket might be partially smoothed out. Consequently, the change in tax rates created by 'bracket creep' might be larger than the perceived change, implying a downward bias in estimated elasticities. The last three caveats suggest that elasticity estimates using 'bracket creep' are a lower bound for behavioral responses. I come back to these important points in more detail in the concluding section. In spite of these limitations, 'bracket creep' provides a useful natural experiment to look for direct and convincing evidence of behavioral responses to taxation.

The paper proceeds as follows. Section 2 presents in detail the effects of 'bracket creep' on the tax schedule. The data, summary statistics and raw differences-in-differences results are presented. Section 3 introduces the regression framework and specification and Section 4 describes the results. Section 5 presents caveats and concludes.

2. Background, 'bracket creep', data and descriptive statistics

2.1. Background

The goal of this study is to analyze the effect of marginal tax rates on income reported on tax returns. The literature has focused on estimating the elasticity of income with respect to one minus the marginal tax rate. This parameter is central to evaluate the efficiency costs of income taxation. However, because marginal tax rates are not randomly assigned across individuals, but are an endogenous function of individual characteristics such as family structure, and income, a direct OLS regression of log income on log (one minus) marginal tax rates would produce a biased elasticity estimate. Therefore, the effective marginal tax rate right-hand-side variable needs to be instrumented with a variable that is correlated with it but that does not affect the income outcome other than through its effect on marginal tax rates (exclusion restriction). Tax reforms or tax changes often provide potentially good instruments because they introduce changes in marginal tax rates that may not be correlated with changes in income unrelated to the change in marginal tax rates. The basic idea is then to compare changes in income of taxpayers affected by the tax change (who face different marginal tax rates before and after the reform) to taxpayers unaffected by the tax change. However, as discussed in the Introduction, for the large tax reforms of the 1980s used in previous work estimating the behavioral response of taxable income, the exclusion restriction assumption may not hold because it is conceivable that, because of an underlying increase in inequality unrelated to tax changes, high incomes would have increased faster than low incomes, even in the absence of the tax change. We describe in the remainder of this section how 'bracket creep' introduces a change in marginal tax rates that allows us to construct instruments that are more likely to satisfy the exclusion restriction.

It is also interesting and important to try to understand the 'anatomy' of the behavioral response of income (Slemrod, 1996). The first step in that direction is to see how each of the various components of taxable income such as gross income, wage income, or deductions respond to marginal tax rates. This is attempted in this paper simply by replacing the taxable income left-hand-side variable by specific components of taxables such as wages or gross income. Ideally, one would like to analyze the response of each component of taxable income to cast light on the mechanisms of the behavioral response. We explain below why our methodology does not allow us to carry this analysis up to such a detailed point.

2.2. 'Bracket creep'

From 1979 to 1981, the tax schedule was not indexed even though inflation was on the order of 10% per year. Because the income tax was progressive, inflation produced a real change called 'bracket creep'. Fig. 1 displays the effect of inflation on marginal rates faced by married taxpayers from 1979 to 1980. Marginal rates as a function of before-tax *real* income are plotted in Fig. 1 for years 1979 (straight line) and 1980 (dashed line). If taxable income stays constant in *real* terms, then some taxpayers will face a higher rate: this is the 'treatment' group. The other taxpayers will still face the same rate: this is the 'control' group.

As displayed in Fig. 1, brackets are regularly spaced along the whole income distribution. Therefore, control and treatment groups can be constructed over a large portion of the income distribution. Also noteworthy is the fact that controls and treatments *alternate* and thus for a given kink the treatment group and the two surrounding control groups are very similar in terms of income and very likely to share the same economic characteristics. Therefore, any systematic difference in income changes between these groups can be confidently attributed to marginal rates effects. As we describe later on, this characteristic of bracket creep can be exploited to construct instruments for the change in marginal tax rate from year 1 to year 2.

However, the changes in marginal rates are not very large because there were many kink points at that time and the jumps in marginal rates were in general of 4–7% (see below). This is small compared to a decrease from 50 to 28% in marginal rates for the very high income earners following the TRA of 1986. However, Steuerle (1991) provides evidence that the 'bracket creep' of the late 1970s and early 1980s was perceived as a major tax event. 'Bracket creep' triggered the strongest increase in marginal tax rates since World War II in just a few years. Federal income tax receipts over GNP increased very quickly from 1978 to 1981. According to Steuerle, this was the main cause of the 'tax revolt'

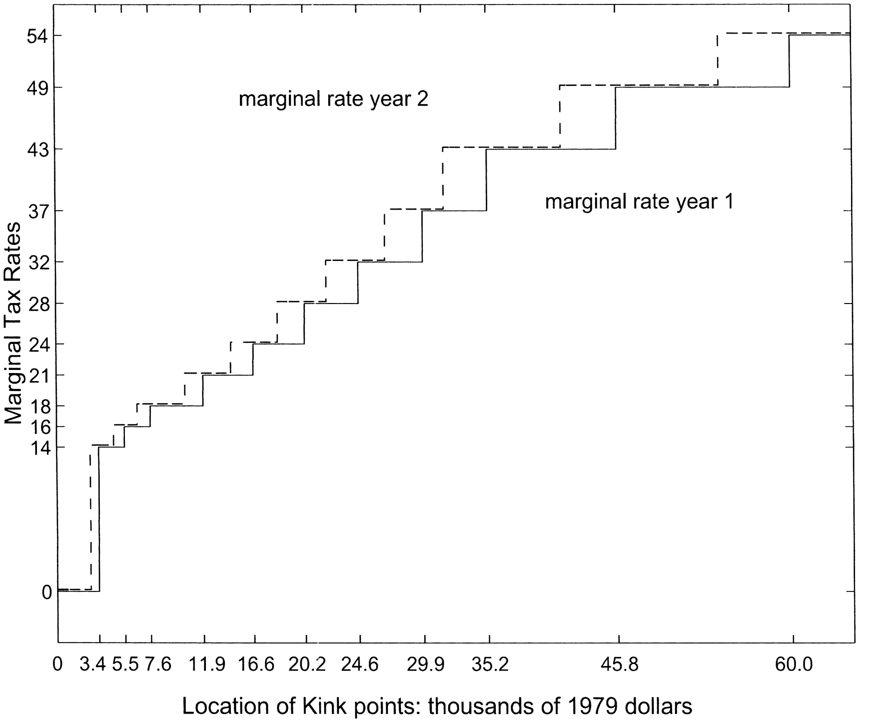


Fig. 1. Shift in marginal tax rates for married taxpayers.

and the tax cuts which took place in the 1980s. As 1980 was not the first experience of ‘bracket creep’ in the US (inflation was also high in the 1973–1975 period), it is likely that ‘bracket creep’ was noticed and understood by most taxpayers.

2.3. Data

The analysis presented here uses the publicly available panel of tax returns known as the University of Michigan tax panel. The data cover the period 1979 to 1990 but only the first three years are used in the present paper. The panel contains most items on Form 1040, as well as numerous other items from the other forms and schedules. The panel contains about 40,000 observations per year. Attrition in the panel can occur due to late filing or no filing (which can happen, for example, if the taxpayer does not owe any taxes and does not expect a refund from the IRS).[5] Attrition may also result from a change in marital status if the name of the

[5]However, because most individuals with positive income expect a refund from the IRS, the attrition due to a decrease in income is very small.

primary taxpayer listed on the return changes. It should be noted that tax return data provide information on tax related incomes that are almost completely free of measurement error and allow us to compute marginal effective tax rates very accurately. As this study requires to know precisely the location of each taxpayer on the tax schedule, standard survey data like the Panel Survey of Income Dynamics (PSID) or the Current Population Survey (CPS) could not have been used. Tax rate schedules differ by marital status (Singles, Married, or Heads of household). As singles and married taxpayers constitute about 90% of all tax returns, only these two categories are considered in the study.

The analysis focuses on year to year changes in income. Income in 1979 is compared to income in 1980 and income in 1980 is compared to income in 1981. These two changes are stacked to obtain a single dataset of about 75,000 observations. Each observation contains data on year t and year $t+1$ (t being either 1979 or 1980). To simplify the presentation, I call year t (representing either 1979 or 1980) the year 1 and I call year $t+1$ the year 2. Therefore, income and tax rates in year 2 are compared to income and tax rates in year 1.

Since some individuals appear in all three years (1979, 1980, and 1981), there might be individual-specific correlation in how income changes over time. As a result, all standard errors presented are corrected for intra-personal correlation. I exclude taxpayers whose marital status changes from year to year. It is unlikely that 'bracket creep' affected specifically marriage strategies and therefore discarding those observations should not bias the results. I also exclude taxpayers who do not use the regular tax schedule in year 1.[6]

Real growth of GDP was small in 1980 and 1981: −0.5% in 1980 and 1.8% in 1981. The GDP deflator was 10.5% in 1980 and 9.5% in 1981. These figures are very close to the nominal growth of Adjusted Gross Income for each year. We take these two values, 10.5% for the change 1979–1980 and 9.5% for the change 1980–1981, as our 'inflation' parameters. The results are not sensitive to small changes in these inflation parameters.

Table 1 reports the composition of AGI in its main components for the sample, as well as the rate of nominal growth of each component from 1979 to 1980 and from 1980 to 1981. Wages and salaries constitute about 83% of Adjusted Gross Income, Capital income (interest, dividends, capital gains, royalties, rents, and fiduciary income) is about 11% of AGI, while business income (self-employment income, small business income, partnership income, and farm income) is about 6% of AGI.[7] It should be noted that nominal capital income increased more quickly

[6] Most of these excluded taxpayers used the average income tax schedule which allowed taxpayers to replace their taxable income by an average of the last few years taxable income. This reduced the tax liability of taxpayers who had experienced a sharp rise in income. I also exclude taxpayers using the Maximum Tax Rate on Personal Service Income. The aim of the Maximum Tax Rate was to constrain the top rate on earned income to 50% (instead of 70%).

[7] As income increases, the share of wage income declines slightly, while the share of capital income and business income increases. However, even for the largest incomes considered here, wage income represents always more than two-thirds of gross income.

Table 1
Summary statistics

	Mean 1979 (current $)	Nominal percentage increase		Nominal percentage increase
		1979 to 1980	Mean 1980 (current $)	1979 to 1980
	(1)	(2)	(3)	(4)
Adjusted gross income	$17,260	10.9	$19,010	9.8
Wages and salaries	$14,530	9.8	$15,780	10.0
Non wage income	$3020	16.2	$3560	9.2
Capital income	$1640	29.4	$2150	23.3
Business income	$860	−10.5	$770	−16.9
Itemized deductions (itemizers in both years 1 and 2 only)	$7210	13.3	$7890	12.5
Taxable income	$13,560	11.2	$15,000	9.8
Percent itemizing	31.9	9.1	34.5	8.1
Number of observations	35,770		35,910	

Notes: Summary statistics given for all observations present in the panel for both year 1 and year 2 and with same marital status (single or married) in both years. All dollar values are expressed in current dollars. Itemized deduction levels computed for itemizers in both year 1 and year 2 only. Non-wage income defined as gross income less wages and salaries. Capital income is defined as interest income, dividends received, rents, royalties, and fiduciary income. Business income is defined as Schedule C income, farm income, partnership, and small business income.

than nominal wages during this period, while the growth of nominal reported business income was actually negative. The number of itemizers also grew significantly by about 8–9% from year to year, as the standard deduction remained fixed in nominal terms, while itemized deductions were growing. For those itemizing in both years 1 and 2, reported itemized deductions grew at a slightly higher rate than AGI (around 12%). As discussed above, it is useful to analyze which components of taxable income are the most responsive to marginal tax rates. Therefore, we also focus on wage income (which forms by far the largest component of gross income), and on Adjusted Gross Income (AGI) which is basically taxable income before excess itemized deductions (see below) and is a measure of gross income.[8] Because sources of income other than wages are small and relatively few taxpayers report significant shares of income from other sources, elasticity estimates of other sources of income are not precise and are sensitive to outliers (individuals reporting very small amounts). We come back to this issue later on.

Taxable income is the key item to divide the sample into control and treatment

[8] The adjustments to gross income made to compute AGI are very small (around 1.5% of gross income).

groups. Taxable income is equal to AGI minus personal exemptions ($1000 for each member of the household), and minus itemized deductions in excess of the standard deduction (which is $3400 for Married households and $2300 for singles).[9]

I denote by $taxinc_i$ the *nominal* taxable income in year $i = 1,2$ and $taxinc_p$ predicted taxable income which is $taxinc_1$ expressed in year 2 dollars. The taxpayer is assigned to the control group when the marginal rates associated with $taxinc_1$ and $taxinc_p$ are the same. If the rates differ, the taxpayer is assigned to the treatment group. I denote $taxinc_{2R}$ taxable income in year 2 expressed in terms of year 1 dollars. Finally, I denote by $T'_i = T'(taxinc_i)$ the effective marginal rate in year i and $T'_p = T'(taxinc_p)$ the predicted marginal rate in year 2 if *real* income does not change. The fact that different sources of incomes grow at different rates could in principle be used to construct more refined measures of predicted income in year 2 based on the composition of income in year 1 to improve the accuracy of our estimates. However, as discussed below, using a uniform inflation rate does not invalidate the identification strategy.

2.4. Descriptive statistics

Tables 2 and 3 display the summary statistics for each control and treatment group, for married and single filers respectively. The groups are ordered by increasing taxable income in year 1. For each bracket, the nominal level of taxable income at which the jumps in marginal rates takes place and the corresponding tax rates are presented in columns (2) and (3).[10] Low incomes in year 1 tend to experience larger increases of income because of the mean reversion phenomenon. In order to illustrate and assess the extent of this problem, it is useful to divide the control group below the first treatment group into two groups. These groups are called Control N and Control 0. Control N contains all taxpayers whose year 1 taxable income falls between $900 and $1600 for marrieds and between $900 and $1500 for singles. Control 0 contains all taxpayers below Treatment 1 whose incomes are above $1600 for marrieds and above $1500 for singles.[11] The number of observations for each group is reported in column (4). Note that income and control groups are of similar size.

In column (5), the predicted log change in net-of-tax rates ($\log[(1 - T'_p)/(1 - T'_1)]$) is reported. By definition, this is zero for the controls. In column (6), the mean log change of effective net-of-tax rates, $\log[(1 - T'_2)/(1 - T'_1)]$, is reported for each group. Because individual real incomes change from year to year, figures in column (5) and (6) differ. The corresponding values are plotted in Fig. 2 for

[9] Since the Tax Reform Act of 1986, the standard deduction is no longer included in taxable income.

[10] I have not reported statistics for the top brackets because there are few observations for those groups (less than 100 observations per group) and thus measurement is very imprecise.

[11] Taxable incomes below $900 suffer from an even more severe mean reversion phenomenon and are excluded from the study.

Table 2
Summary statistics for married taxpayers

Group	Kinks		Number of observations	$\text{Log}(1-T'_p/1-T'_1)$	$\text{Log}(1-T'_2/1-T'_1)$	dlog of taxable income	dlog of adjusted gross income	dlog of wages
	Location	Jump						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Control N			392	0	−0.0723	0.684	0.131	0.103
Control 0			852	0	−0.0861	0.340	0.0859	0.069
Treatment 1	$3400	0/14	605	−0.1508	−0.1134	0.141	0.0700	0.0537
Control 1			1383	0	0.0143	0.0865	0.0262	0.0180
Treatment 2	$5500	14/16	783	−0.0233	−0.0049	0.022	0.0111	−0.0185
Control 2			1222	0	0.0072	−0.0258	−0.00797	−0.0265
Treatment 3	$7600	16/18	1084	−0.0243	−0.0066	−0.0506	−0.0109	−0.0307
Control 3			3550	0	−0.0043	−0.0533	−0.0275	−0.0536
Treatment 4	$11,900	18/21	1615	−0.0377	−0.0247	−0.0716	−0.0420	−0.0542
Control 4			3264	0	−0.0065	−0.0727	−0.0458	−0.0531
Treatment 5	$16,000	21/24	2241	−0.0387	−0.0284	−0.0691	−0.0414	−0.0545
Control 5			2991	0	−0.0104	−0.0665	−0.0448	−0.0553
Treatment 6	$20,200	24/28	2580	−0.0545	−0.0354	−0.0737	−0.0513	−0.0613
Control 6			2294	0	−0.0093	−0.0578	−0.0364	−0.0560
Treatment 7	$24,600	28/32	2230	−0.0576	−0.0338	−0.0782	−0.0508	−0.0470
Control 7			1908	0	−0.0116	−0.0605	−0.0445	−0.0535
Treatment 8	$29,900	32/37	1634	−0.0769	−0.0444	−0.0816	−0.0571	−0.0797
Control 8			883	0	−0.0109	−0.0644	−0.0459	−0.0487
Treatment 9	$35,200	37/43	971	−0.0998	−0.0440	−0.0681	−0.0521	−0.0669
Control 9			1057	0	0.0045	−0.0439	−0.0390	−0.0723
Treatment 10	$45,800	43/49	418	−0.1109	−0.0390	−0.0968	−0.0741	−0.0754
Control 10			339	0	0.0264	−0.0703	−0.0712	−0.0797
Treatment 11	$60,000	49/54	151	−0.1031	−0.0400	−0.0659	−0.0560	−0.0945
Control 11			195	0	0.0179	−0.0809	−0.0742	−0.0685
Treatment 12	$85,600	54/59	67	−0.1154	−0.0794	−0.0097	0.0413	0.142
Control 12			73	0	0.0554	−0.1137	−0.0812	0.0167
Treatment 13	$109,400	59/64	31	−0.1301	−0.0374	−0.0790	−0.0430	0.591
Control 13			102	0	0.0388	−0.111	−0.0891	−0.104
Treatment 14	$162,400	64/68	22	−0.1177	−0.0037	−0.181	−0.0448	0.181
Control 14			26	0	0.1480	−0.423	−0.2588	−0.169

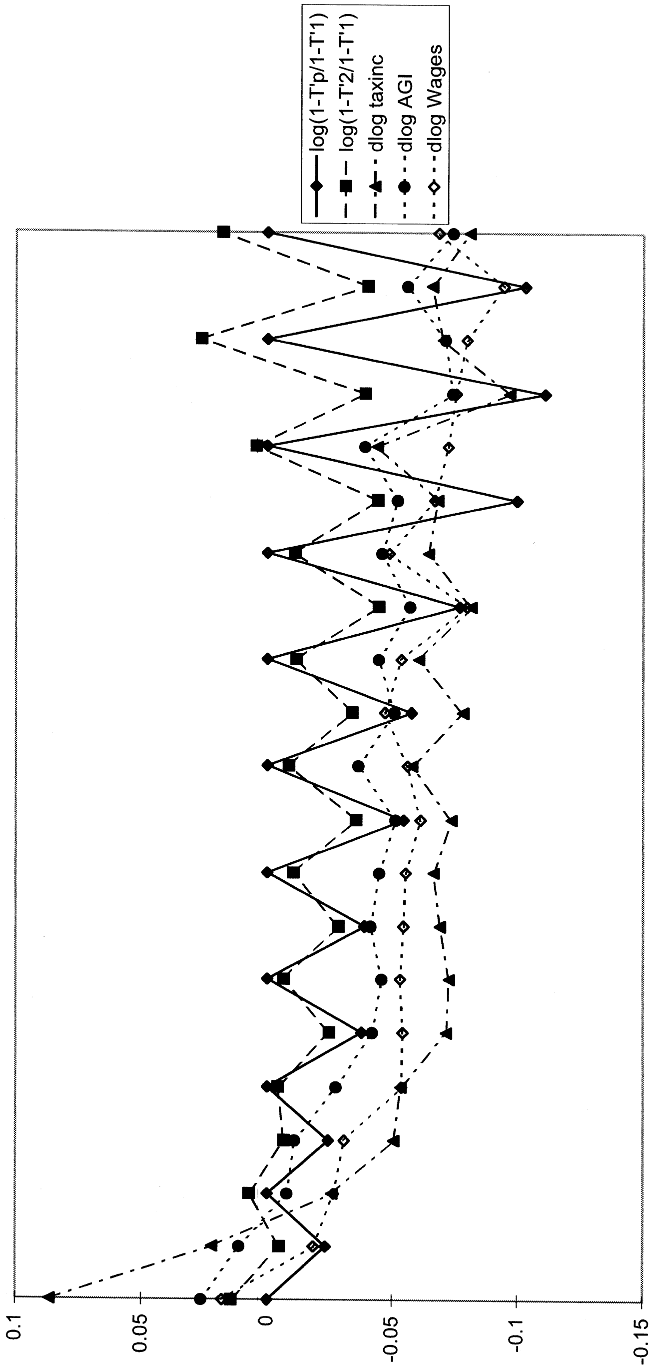
Notes: Control N contains taxpayers whose taxable income in year 1 is between $900 and $1600. Control 0 contains all taxpayers below Treatment 1 with taxable income in year 1 above $1600.

married taxpayers and Figs. 3 and 4 for singles. The curve corresponding to column (5) is plotted as a straight line while the curve corresponding to column (6) is plotted as a dashed line. The curve of real changes in marginal rates goes up

Table 3
Summary statistics for single taxpayers

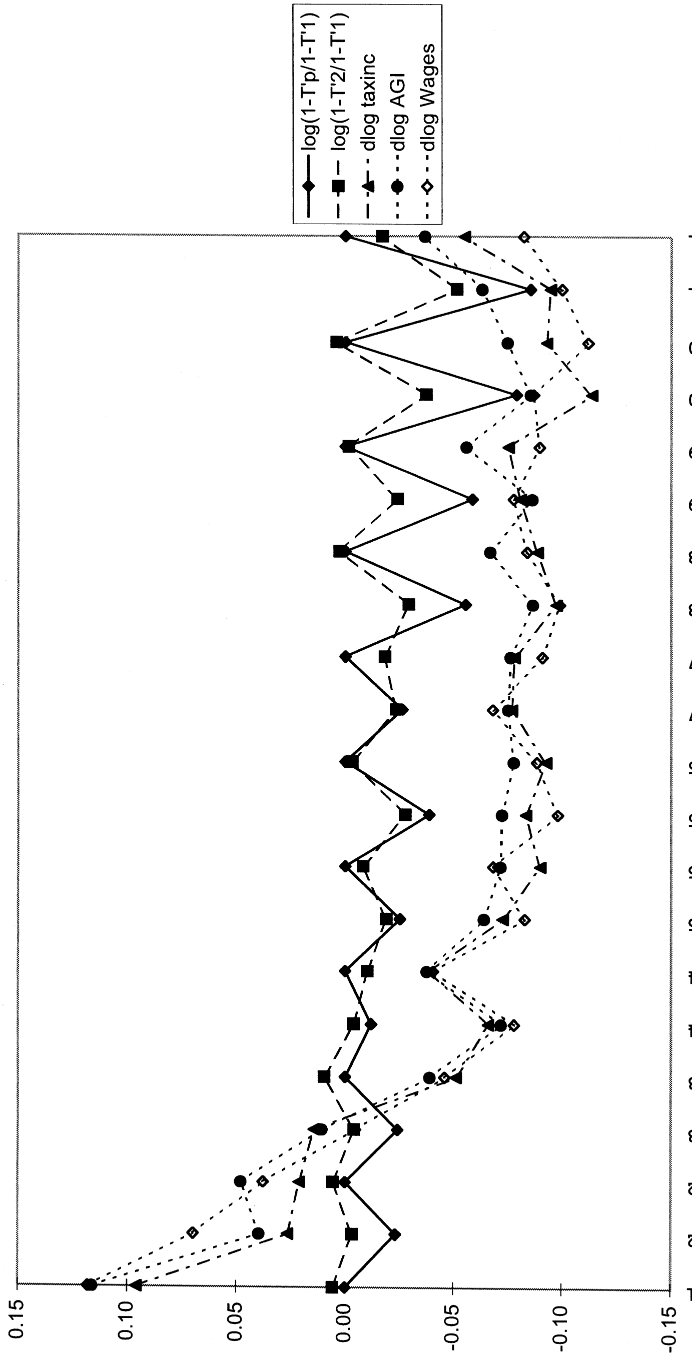
Group	Kinks		Number of observations	$\text{Log}(1-T'_p/1-T'_1)$	$\text{Log}(1-T'_2/1-T'_1)$	dlog of taxable income	dlog of adjusted gross income	dlog of wages
	Location	Jump						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Control N			1633	0	−0.0911	0.535	0.263	0.272
Control 0			1341	0	−0.113	0.316	0.203	0.205
Treatment 1	$2300	0/14	741	−0.1508	−0.120	0.174	0.0687	0.0615
Control 1			1764	0	0.0057	0.0959	0.116	0.118
Treatment 2	$3400	14/16	879	−0.0233	−0.00355	0.0264	0.0395	0.0698
Control 2			1045	0	0.0056	0.0211	0.0478	0.0376
Treatment 3	$4400	16/18	975	−0.0243	−0.0042	0.0142	0.0106	−0.0048
Control 3			2678	0	0.0096	−0.0512	−0.0392	−0.046
Treatment 4	$6500	18/19	1155	−0.0121	−0.00396	−0.066	−0.072	−0.078
Control 4			1770	0	−0.0102	−0.039	−0.0378	−0.0407
Treatment 5	$8500	19/21	1273	−0.0253	−0.0189	−0.0727	−0.0641	−0.0828
Control 5			1619	0	−0.0082	−0.090	−0.0718	−0.0684
Treatment 6	$10,800	21/24	1161	−0.0387	−0.0276	−0.0834	−0.0725	−0.0981
Control 6			868	0	−0.0031	−0.0926	−0.0778	−0.0884
Treatment 7	$12,900	24/26	1085	−0.0263	−0.0235	−0.0769	−0.0753	−0.0681
Control 7			522	0	−0.0183	−0.0781	−0.0764	−0.091
Treatment 8	$15,000	26/30	972	−0.0555	−0.0293	−0.0974	−0.0866	−0.099
Control 8			810	0	0.0026	−0.0888	−0.067	−0.084
Treatment 9	$18,200	30/34	687	−0.0587	−0.0241	−0.0810	−0.0864	−0.0777
Control 9			900	0	−0.0016	−0.0753	−0.0560	−0.0896
Treatment 10	$23,500	34/39	384	−0.0790	−0.0373	−0.1137	−0.0856	−0.087
Control 10			234	0	0.0041	−0.093	−0.075	−0.112
Treatment 11	$28,800	39/44	177	−0.0856	−0.0515	−0.0946	−0.0633	−0.100
Control 11			91	0	−0.0170	−0.055	−0.0368	−0.0824
Treatment 12	$34,100	44/49	67	−0.0932	−0.0203	−0.210	−0.134	−0.081
Control 12			47	0	0.0375	−0.171	−0.119	−0.490
Treatment 13	$41,500	49/55	25	−0.1256	−0.0370	−0.094	−0.0615	−0.0528
Control 13			48	0	0.0390	−0.0975	−0.134	−0.108
Treatment 14	$55,300	55/63	11	−0.1960	−0.169	0.0271	0.0453	−0.049
Control 14			25	0	0.0651	−0.142	−0.099	−0.0583
Treatment 15	$81,800	63/68	3	−0.1450	0.0652	−0.304	−0.328	−0.254
Control 15			4	0	0.0565	−0.111	−0.0674	−0.416

Notes: Control N contains taxpayers whose taxable income in year 1 is between $900 and $1500. Control 0 contains all taxpayers below Treatment 1 with taxable income in year 1 above $1500.



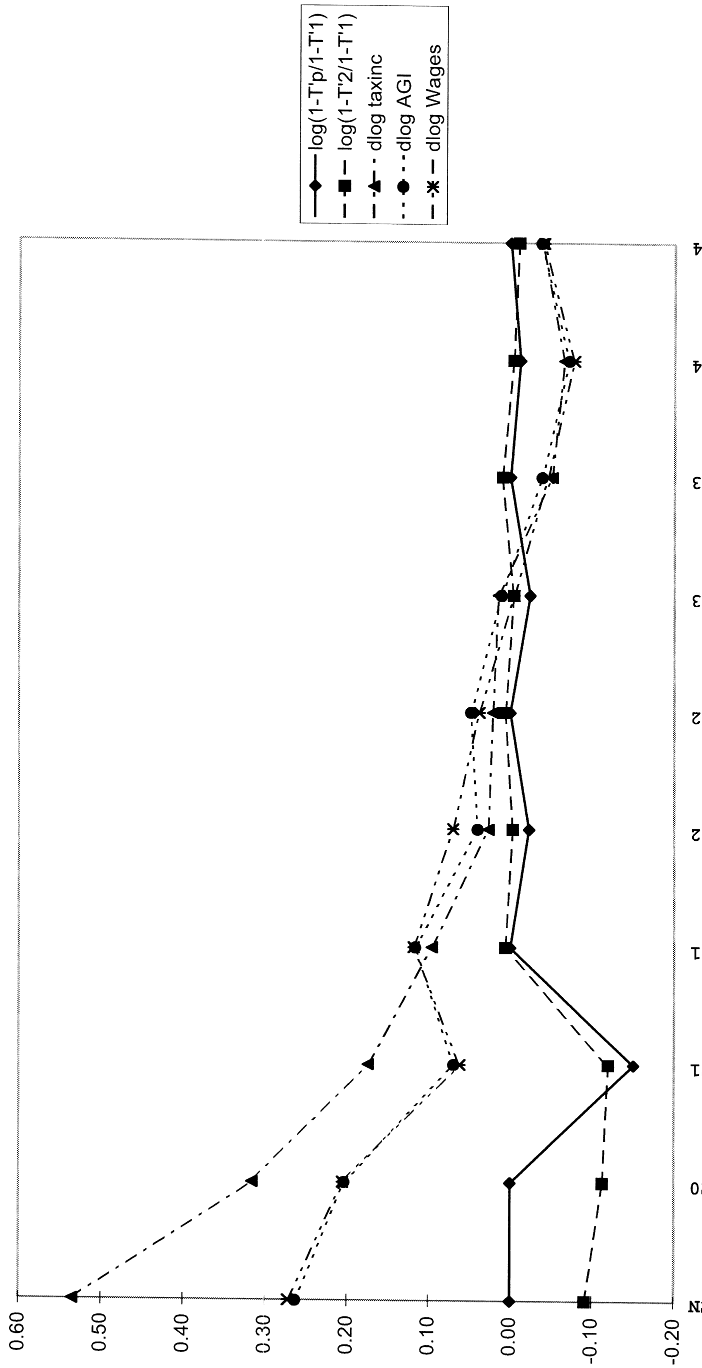
Notes: This Figure displays the log-changes in predicted net-of-tax rates (diamonds), effective net-of-tax rates (squares), taxable
income (triangles) and Ajusted Gross Income (squares) for each Control and Treatment group for Married Taxpayers.

Fig. 2. Married taxpayers.



Notes: This Figure displays the log-changes in predicted net-of-tax rates (diamonds), effective net-of-tax rates (squares), taxable income (triangles) and Ajusted Gross Income (squares) for each Control and Treatment group for Single Taxpayers.

Fig. 3. Single taxpayers.



Notes: This Figure displays the log-changes in predicted net-of-tax rates (diamonds), effective net-of-tax rates (squares), taxable income (triangles), AGI (squares) and wages (stars) for each Control and Treatment group for Low income Single Taxpayers.

Fig. 4. Singles, low income earners.

and down exactly in the same way as the curve of predicted changes in marginal rates. Therefore, predicted change in marginal rates is highly correlated with the real change in rates and therefore predicted change is a good potential instrument for real change because it generates a strong first stage correlation. We discuss below whether this instrument also satisfies the critical exclusion restriction.

In columns (7), (8) and (9), I report the means of log changes of real taxable income ($\log(taxinc_{2R}/taxinc_1)$), real adjusted gross income ($\log(AGI_{2R}/AGI_1)$), and real wages ($\log(wages_{2R}/wages_1)$). Note that there is mean reversion at both ends of the income distribution. The changes in incomes are high and positive for low incomes whereas the change in incomes becomes in general negative for high income earners. This complicates the estimation of the elasticities at very low and very high incomes.

If marginal rates matter for taxpayers, treatment groups should experience larger decreases in incomes than the surrounding control groups. To check whether this pattern is apparent in the data, I have also plotted the log changes of taxable income, AGI, and wages in Fig. 2 for married taxpayers and Figs. 3 and 4 for singles.

Fig. 2 gives striking evidence of the responsiveness of married taxpayers to tax rates. From the Treatment 5 group (kink 21/24) to the Control 10 group (kink 43/49), the log change in taxable income presents exactly the same shape as the predicted changes in marginal rates: the value for the treatment group is always smaller than for the two surrounding control values. The same is true for log changes in adjusted gross income, though the differences between treatments and controls are somewhat smaller. This is not the case for lower incomes because the jumps in marginal rates were very small (less than 3%) except at the first kink (large jump of 14%). However, around this first kink, the mean reversion phenomenon is very important (this is not presented in Fig. 2 but can be easily seen in Table 2). The pattern for wage earnings is not similar to the pattern of taxable income or adjusted gross income: even at the middle income kinks, there is no clear evidence that wages of treatments tend to be systematically smaller than wages of surrounding controls. This suggests that the response of taxpayers is probably not the consequence of reduced labor supply.

The pattern for singles in Fig. 3 is less clear, even for middle income earners. Until the Treatment 8 group, the kinks were small (except for the first one, the jumps were less than 3%) and thus no systematic response is observed. From Treatment 8 to Control 12, there is some evidence of taxpayer behavior for adjusted gross income and taxable income. As for married taxpayers, wages for singles reveal no clear evidence of behavioral responses.

However, the first kink point for singles deserves particular attention. Fig. 4 focuses more particularly on low income singles. There is a clear break in the pattern of AGI and wages around the first kink point consistent with a behavioral response to marginal rates: although the general pattern of the curves is declining (due to mean reversion), wages and AGI go up from Treatment 1 to Control 1.[12] There is no such pattern for taxable income because mean reversion in taxable income at the bottom is even larger than for AGI or wages because of deductions which mechanically magnify percentage changes. Therefore, Fig. 4 suggests that low income singles reacted to marginal rates by reducing reported labor supply, either by working less or shifting to the underground economy.

2.5. Wald estimates

From the above tables, it is easy to compute Wald estimates of the elasticity for each kink. Wald estimates relate the difference in changes in income between treatments and controls to the difference in changes in real marginal rates between treatments and controls. This gives simple estimates of the elasticity of income with respect to (one minus) the marginal tax rate. Treatments are observations in a given treatment group and controls are observations belonging to the two surrounding control groups. The Wald estimate can be written as

$$\hat{\zeta} = \frac{\hat{E}[\log(z_2/z_1)|Tr] - \hat{E}[\log(z_2/z_1)|C]}{\hat{E}[\log(1-T'_2/1-T'_1)|Tr] - \hat{E}[\log(1-T'_2/1-T'_1)|C]},$$

where $\hat{E}$ denotes the empirical mean, Tr is for treatment and C for control. z_1 is income in year 1 and z_2 is income in year 2 in terms of year 1 dollars. This estimate is equivalent to an IV regression of $\log(z_2/z_1)$ on $\log[(1-T'_2)/(1-T'_1)]$ (and a constant) using a binary instrument (1 if in treatment and 0 if in control). This method leads to consistent estimates if the difference in changes in income between treatments and controls is entirely due to the fact that treatments are more likely to experience an increase in marginal tax rate than controls. This assumption is likely to be satisfied because incomes of treatments and surrounding controls are very close and therefore treatments and controls are similar except for their treatment/control status. As a result, the instrument does not affect changes in income other than through the marginal tax channel and therefore satisfies the exclusion restriction. This assumption is much more likely to be satisfied for middle income earners where mean reversion is not an issue. As a result, I present Wald estimates only for middle income kinks. Wald estimates for middle income kinks for taxable income, Adjusted Gross Income (AGI) and wages for married taxpayers and singles are reported in Table 4. Each Wald estimate was computed using observations of the corresponding treatment and both surrounding controls.

Because taxpayers may not control their incomes perfectly, there is a concern that taxpayers close to the frontier between Control and Treatment groups might in fact face similar expected marginal tax rates. This concern can be addressed by

[12] Wages and AGI curves are very close for low income singles because most of them report only wage income.

Table 4
Wald estimates

Kink		Taxable income					AGI	Wages
Location	Jump in marginal rates	Difference treatment/control in dlog(*taxinc*)	$\text{Log}(1-T'_p/1-T'_1)$ treatment group	Difference treatment/control in $\log(1-T'_2/1-T'_1)$	Reduced form estimate ((3) divided by (4))	Wald estimate ((3) divided by (5))	Wald estimate	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(A) Married taxpayers								
$16,000	21/24	0.0006	−0.0387	−0.0200	−0.016	−0.032	−0.188	0.016
					(0.275)	(0.557)	(0.381)	(0.518)
$20,000	24/28	−0.0110	−0.0545	−0.0255	0.202	0.431	0.403	0.229
					(0.179)	(0.387)	(0.309)	(0.359)
$24,600	28/32	−0.0192	−0.0576	−0.0235	0.333*	0.817	0.464	−0.327
					(0.169)	(0.497)	(0.331)	(0.395)
$29,900	32/37	−0.0199	−0.0769	−0.0330	0.258*	0.602	0.363	0.838*
					(0.139)	(0.342)	(0.259)	(0.370)
$35,200	37/43	−0.0149	−0.0998	−0.0415	0.172	0.398	0.288	0.275
					(0.118)	(0.329)	(0.273)	(0.450)
$45,800	43/49	−0.0465	−0.1109	−0.0488	0.419*	0.987*	0.580	0.027
					(0.175)	(0.515)	(0.417)	(0.652)
$60,000	49/54	0.0083	−0.1031	−0.0633	−0.081	−0.131	−0.331	0.206
					(0.300)	(0.503)	(0.455)	(0.841)
(B) Singles taxpayers								
$10,800	21/24	0.0075	−0.0387	−0.0212	−0.194	−0.354	−0.071	1.133
					(0.485)	(0.782)	(0.764)	(1.103)
$15,000	26/30	−0.0128	−0.0555	−0.0237	0.230	0.540	0.671	0.489
					(0.317)	(0.832)	(0.815)	(0.865)
$18,200	30/34	0.0007	−0.0587	−0.0245	−0.012	−0.028	1.052	−0.327
					(0.299)	(0.669)	(0.861)	(0.659)
$23,500	34/39	−0.0347	−0.0790	−0.0369	0.440	0.942	0.661	−0.184
					(0.306)	(0.711)	(0.609)	(0.598)
$28,800	39/44	−0.0122	−0.0856	−0.0497	0.143	0.246	−0.019	−0.056
					(0.850)	(0.850)	(0.627)	(0.720)

Notes: The numbers in column (3) are calculated, using Tables 1 and 2, as the difference between income in treatment group and the average of the income in the two surrounding control groups (weighted by the number of observations). Similar calculations are performed in column (5) for the change in marginal rates. Standard errors in parentheses corrected for clustering. *For estimates significant at the 5% level.

discarding taxpayers at the frontier between control and treatment bands and recomputing the Wald estimates. The new set of estimates, though of course somewhat less precise, is very close to the set of estimates previously presented. In particular, the up and down pattern of changes in Taxable Income and AGI displayed in Fig. 2 remains present. As we saw in Table 1, different income sources do not grow on average at the same rate. As a result, the predicted taxable income, and hence the predicted marginal tax rate T'_p that we compute using uniform inflation parameters could be improved upon by using various inflation parameters for each source.[13] The important point to note, however, is that using a uniform inflation rate produces consistent estimates, because the imperfect predicted marginal tax rate T'_p is still correlated with the effective tax rate T'_2, and there is no reason to think that the exclusion assumption should be affected by this imperfect measurement.

Table 4 confirms the patterns of Figs. 2 and 3. The elasticity estimates are large for married middle income earners for taxable income and AGI. However, given the small sample size, they are rarely statistically significant. The estimates are in general larger for taxable income than for AGI. The estimates for wages are usually much smaller, often very near 0. As pointed out before, the estimates for singles are lower. The aim of the next section is to compute estimates based on larger portions of the income distribution in order to obtain more precise results.

3. Model and identification strategy

This section describes a regression framework to aggregate estimates over several kink points. A simple model will illustrate the issues at hand and show that the estimated elasticities are pure compensated elasticities. The budget constraint of a taxpayer on a linear part of the tax schedule is given by $c = z(1 - \tau) + R$, where z represents before-tax income, τ is the marginal rate and R is virtual income. From individual utility maximization, we can derive an income supply function which depends on the slope of the budget line and on virtual income $z = z(1 - \tau, R)$. From this income supply function, the uncompensated elasticity of income is defined by $\zeta^u = ((1 - \tau)/z)\partial z/\partial(1 - \tau)$, and income effects are equal to $\eta = \partial z/\partial R$. Let $z^c = z^c(1 - \tau, u)$ be the compensated income supply. $z^c(1 - \tau, u)$ is the income supply which minimizes costs to attain utility level u for a given tax rate τ. The compensated elasticity of income is defined as $\zeta^c = ((1 - \tau)/z^c)\partial z^c/\partial(1 - \tau)$.

The two elasticities and income effects are related by the Slutsky equation:

[13] It should be noted that using inflation parameters by source using the tax data is potentially problematic because growth in incomes is endogenous because of the behavioral response to tax rates. For example, it is conceivable that business income does not increase as fast as wage income because it is more responsive to 'bracket creep' than wage income.

$$\zeta^{c} = \zeta^{u} - (1-\tau)\eta. \tag{1}$$

'Bracket creep' can be seen as a change in both virtual income R and marginal rate τ. Small changes in R and τ affect income supply z as follows:

$$dz = -\frac{\partial z}{\partial(1-\tau)}\,d\tau + \frac{\partial z}{\partial R}\,dR = -\zeta^{u} z \frac{d\tau}{1-\tau} + \eta\,dR.$$

Using the Slutsky equation (1) and rearranging:

$$\frac{dz}{z} = -\zeta^{c}\frac{d\tau}{1-\tau} + \eta\frac{dR - z\,d\tau}{z}.$$

To introduce randomness in the model, I suppose that the income supply function z also shifts randomly (i.e. $dz/z = \epsilon$) from year to year for reasons unrelated to the tax change such as taste shocks or changes in work opportunities. Therefore, we have

$$\frac{dz}{z} = -\zeta^{c}\frac{d\tau}{1-\tau} + \eta\frac{dR - z\,d\tau}{z} + \epsilon. \tag{2}$$

It should be noted that this derivation ignores the issue of bunching at the kink points of the tax schedule (where marginal tax rates jump). The standard model used here predicts that we should observe bunching at the kink points. In practice, due to random shocks on income, we do not expect to find perfect bunching at kink points.[14] Related to this point, a relatively small change in behavior is needed for taxpayers at the bottom of the treatment group to return to the previous bracket. Therefore, the estimates may understate the long-run elasticity of income with respect to the marginal tax rate.

Let us first neglect the income effect term (i.e., assume that $\eta = 0$). In that case, by the Slutsky equation (1), compensated and uncompensated elasticities are the same (I note $\zeta = \zeta^{c} = \zeta^{u}$). Assuming that changes from year to year are small, we have $dz/z \simeq \log(z_2/z_1)$ and $-d\tau/(1-\tau) \simeq \log[(1-T_2')/(1-T_1')]$ (with the same notation as in the previous section). The corresponding regression framework would then be the following:

$$\log(z_2/z_1) = \zeta \log[(1-T_2')/(1-T_1')] + \epsilon. \tag{3}$$

Eq. (3) shows that the elasticity ζ can be interpreted as an intertemporal elasticity of substitution. Clearly, $\log[(1-T_2')/(1-T_1')]$ is correlated with the error term because if the random shock ϵ is positive, income goes up and thus, because marginal tax rates are increasing with income, $1-T_2'$ decreases. There-

[14] Saez (1999) examines this issue in detail using the large annual cross-sections of tax returns constructed by the IRS from 1979 to 1994, and finds evidence of bunching for some particular groups of taxpayers such as itemizers.

fore, an OLS regression leads to estimates severely biased downward. However, it is possible, using the variation in tax rates due to 'bracket creep', to construct instrumental variables. Consider the following dummy variable:

$$Z_{is} = 1(taxinc_1 \in Treatment\ for\ Kink\ i, mars = s).$$

These are binary instruments equal to 1 exactly for taxpayers whose taxable income in year 1 ($taxinc_1$) is in the treatment group for Kink i and whose marital status is s.[15] The marital status *mars* can take two values: 0 for singles and 1 for married taxpayers. The instruments Z_{is} depend only on the level of income in year 1. Therefore, in this simple model, the instruments depend only on z_1 and are uncorrelated with ϵ when ϵ is independent of z_1. In this case, the IV regression

$$\log(z_2/z_1) = \zeta \log[(1 - T'_2)/(1 - T'_1)] + \epsilon, \tag{4}$$

using Z_{is} as instruments estimates consistently the elasticity ζ. This regression specification leads exactly to the simple Wald estimates presented above where we restricted ourselves to small portions of the distribution of income so that only one instrument was used for each regression.

However, if we consider large portions of the income distribution, it is more realistic to assume that the average size of the random change in incomes ϵ varies as we move along the distribution of income. For example, mean reversion produces a negative correlation between year 1 income and the shock in income ϵ. On the other hand, if there is an underlying increase in inequalities (i.e., the rich get richer and the poor get poorer), a component of ϵ will be positively related to income in year 1. This mean reversion at the bottom and the top can be seen in Figs. 2 and 3 in the globally declining pattern of log changes in income as income increases.

Therefore if ϵ depends on z_1, the instrument, which is a function of $taxinc_1$, is likely to be correlated with the error term ϵ. However by controlling for any smooth function of $taxinc_1$ in the regression setup in both stages, it is possible to get rid of the correlation between ϵ and the instruments. The parameter of interest remains identified as long as the dependence of ϵ with respect to $taxinc_1$ does not reproduce the shape of the instruments. This dependence is due to mean reversion, macro-economic shocks and underlying trends in the income distribution and therefore is probably very smooth and certainly would not present the up and down pattern of the instruments. As a result, the system is very likely to be well identified. It is critical to note that identification is based on the discontinuity in incentives generated by 'bracket creep'. This strategy is conceptually close the

[15] Alternatively, as in Gruber and Saez (2000), it is possible to use a single instrument equal to the predicted log change in one minus the marginal tax rate: $\log[(1 - T'_p)/(1 - T'_1)]$. In the present context, this single instrument gives virtually the same estimates and standard errors as the binary instruments described above.

Regression Discontinuity Design (RDD) used in Angrist and Lavy (1999) and Van der Klaauw (1996).[16] In the regressions, we control for the taxable income level in base year by including polynomials in $taxinc_1$: $taxinc_1$, $taxinc_1^2$, etc. The estimated elasticity is very robust to the number of polynomials included (once the linear and square terms are included). Therefore, in most regressions, we include polynomials up to degree 3 or 4. Note that previous studies focusing on a single reform cannot in general control for income because the change in tax rates varies monotonically with income and thus controlling for income non-parametrically would destroy the identification.

Let us now analyze the case with income effects in Eq. (2). $dR - z\,d\tau$ is the change in after-tax income due to the tax change for a given before-tax income z. Because of 'bracket creep', this quantity is piece-wise linearly (but *continuously*) increasing in income[17] and thus affects treatments and controls in approximately the same way. Therefore, this additional income effect term can be incorporated in the error term. The dependence of this term on income will be controlled for by the functions in $taxinc_1$ included as controls in the regression. Therefore, even with income effects, the parameter ζ estimated is in fact the compensated elasticity ζ^c. Intuitively, at a given kink point, the increase in tax liability due to 'bracket creep' is approximately the same for treatments and controls but the change in tax rates is different for the two groups. As a result, the difference in behavioral responses between the two groups is due almost entirely to pure substitution effects. Thus, the 'bracket creep' experience allows the estimation of a conceptually well defined parameter. This point is important because the tax reform studies reviewed in Section 2 were only able to identify elasticity estimates which were a mix of substitution and income effects. Gruber and Saez (2000), exploiting all the federal and state income tax reforms of the 1979–1990 period, propose a methodology to estimate both income and substitution effects. The main disadvantage of their analysis is that the source of identification comes from many different tax changes and is thus much less transparent than the 'bracket creep' change used here.

The precise regression framework is the following:

$$\log(z_2/z_1) = \alpha_0 + \zeta^c \log[(1 - T'_2)/(1 - T'_1)] + \alpha_1 \log(z_1) + \alpha_2\, mars + \alpha_3\, item + \beta\, f(taxinc_1) + \epsilon. \tag{5}$$

[16]The idea in both papers is to use the fact that the treatment (class size for Angrist and Lavy, financial help decision for Van der Klauw) is assigned on the basis of a discontinuous function of a continuous variable. The strategy is to use the rule as a source of identification, controlling in the regression for smooth functions of the variables on which the selection is based.

[17]This quantity is not increasing smoothly because it is constant over Control regions and linearly increasing over Treatment regions. However, the important point here is that the quantity does not jump discontinuously.

The first stage being

$$\log[(1 - T_2')/(1 - T_1')] = \sum_{i,s} \gamma_{is} Z_{is} + \pi_0 + \pi_1 \log(z_1) + \pi_2\, mars + \pi_3\, item + \delta\, f(taxinc_1) + \nu, \quad (6)$$

where z_i is real income in year i (either taxable income, wages or AGI), T_i' is the marginal rate in year i and ζ^c is the parameter of interest: compensated elasticity of income with respect to marginal rates. *mars* is a dummy for marital status (one for married taxpayers and zero for singles). I also add a dummy *item* for being an itemizer in year 1. Being an itemizer in year 1 is *predetermined* and therefore *item* can be considered as an independent variable. The controls $f(taxinc_1)$ are smooth functions of $taxinc_1$ (polynomial terms in $taxinc_1$). Polynomial terms are added until the elasticity estimate is stabilized (three or four polynomial terms are enough in most cases).

4. Regression results

The first stage always leads to very significant coefficients for all the binary instruments.[18] Eq. (6) is estimated for three types of incomes (wages, adjusted gross income (AGI), and taxable income) and different portions of the income distribution.[19] The sample is divided according to marital status — Single taxpayers and Married taxpayers filing jointly — and into year 1 itemizers and year 1 non-itemizers.[20] The elasticity results are presented in Tables 5 and 6.[21] Table 5 presents estimates for a wide range of incomes (columns (1) to (3)) and for middle income earners (columns (4) to (6)). Table 6 focuses on high income earners (columns (1) to (3)) and on low income earners around the first kink point (columns (4) and (5)).

Column (1) of Table 5 suggests that elasticities of taxable income are smaller than those found in previous studies using tax reforms: around 0.3 for married taxpayers and singles together, around 0.4 for married taxpayers and around 0.2 for singles. The elasticities of adjusted gross income are slightly lower: around 0.2 (see column (2)). The elasticities of wages are even smaller (around 0.1). The elasticities are in general higher for married taxpayers than for singles. Note,

[18] The F-statistic is always higher than 50, confirming that instruments are significantly correlated with the endogenous regressor.

[19] All income levels are expressed in 1979 dollars; a dollar of year 1979 corresponds to \$2.5 of year 2000.

[20] As selection is made along outcomes in year 1, there is no endogeneity problem.

[21] In both tables, the list of polynomial controls in $taxinc_1$ is reported in the note. $\text{Log}(z_1)$ is always included as a covariate in the regressions.

Table 5
2SLS elasticity estimates. All income earners and middle income earners

	All income earners: taxable income (1979 \$); singles \$3000–40,000; married \$5000–70,000			Middle income earners: taxable income (1979 \$); singles: \$12,000–28,000; married: \$16,000–36,000		
	Taxable income (1)	AGI (2)	Wages (3)	Taxable income (4)	AGI (5)	Wages (6)
(A) Married and single taxpayers						
(A1) Itemizers and non-itemizers						
$\log(1-T_2')/(1-T_1')$	0.311	0.185	0.084	0.395*	0.344*	0.120
	(0.165)	(0.132)	(0.173)	(0.199)	(0.165)	(0.196)
No. obs.	49,817	50,326	44,993	21,018	21,084	19,800
(A2) Itemizers						
$\log(1-T_2')/(1-T_1')$	0.417*	0.341*	0.102	0.516*	0.380*	0.091
	(0.204)	(0.168)	(0.239)	(0.254)	(0.197)	(0.256)
No. obs.	18,852	18,906	17,210	11,549	11,590	11,003
(A3) Non-itemizers						
$\log(1-T_2')/(1-T_1')$	−0.026	−0.09	−0.003	0.007	0.182	0.184
	(0.254)	(0.206)	(0.248)	(0.297)	(0.264)	(0.310)
No. obs.	30,965	31,329	27,770	9469	9491	8797
(B) Married taxpayers						
(B1) Itemizers and non-itemizers						
$\log(1-T_2')/(1-T_1')$	0.389*	0.202	0.087	0.439	0.383*	0.272
	(0.184)	(0.138)	(0.193)	(0.235)	(0.186)	(0.242)
No. obs.	30,675	30,929	28,260	15,630	15,675	14,947
(B2) Itemizers						
$\log(1-T_2')/(1-T_1')$	0.651*	0.421*	0.231	0.705*	0.521*	0.332
	(0.230)	(0.173)	(0.254)	(0.302)	(0.233)	(0.299)
No. obs.	15,924	16,033	15,015	9964	9998	9632
(B3) Non-itemizers						
$\log(1-T_2')/(1-T_1')$	−0.091	−0.193	−0.167	−0.143	0.028	0.114
	(0.302)	(0.229)	(0.286)	(0.379)	(0.301)	(0.417)
No. obs.	14,751	14,896	13,245	5666	5677	5315
(C) Single taxpayers						
$\log(1-T_2')/(1-T_1')$	0.289	0.189	−0.067	0.277	0.475	−0.157
	(0.393)	(0.338)	(0.386)	(0.454)	(0.457)	(0.439)
No. obs.	19,142	19,397	16,733	5388	5409	4853

Notes: All regressions include $\log(z_1)$, $taxinc_1$, $taxinc_1^2$, $taxinc_1^3$ and $taxinc_1^4$ as control variables. Regressions in panel (A) control in addition for marital status. Regressions including both itemizers and non-itemizers control in addition for itemizer status. Standard errors in parentheses corrected for clustering. *For estimates significant at the 5% level.

Table 6
2SLS elasticity estimates. High income earners and low income earners

	High income taxpayers: taxable income (1979 $); singles $21,000–65,000; married $31,000–90,000 Dependent variable			Low income taxpayers: taxable income (1979 $); singles $0–$3400; married $0–5000 Dependent variable	
	Taxable income (1)	Adjusted gross income (2)	Wages (3)	Adjusted gross income (4)	Wages (5)
(A) Married and single taxpayers					
$\log(1-T'_2)/(1-T'_1)$	0.277	0.022	−0.441		
	(0.252)	(0.197)	(0.304)		
No. obs.	4618	4629	4174		
(B) Married taxpayers					
$\log(1-T'_2)/(1-T'_1)$	0.332	0.067	−0.342	−0.289	−0.052
	(0.268)	(0.235)	(0.375)	(0.237)	(0.424)
No. obs.	3466	3474	3207	3895	2733
(C) Single taxpayers					
$\log(1-T'_2)/(1-T'_1)$	0.146	−0.223	−0.587	1.082*	1.302
	(0.513)	(0.382)	(0.463)	(0.453)	(0.494)
No. obs.	1152	1155	967	8713	7622

Notes: Regressions for high incomes include $\log(z_1)$, $taxinc_1$, $taxinc_1^2$, $taxinc_1^3$ and $taxinc_1^4$ as controls. Regressions for low incomes include $\log(z_1)$, $taxinc_1$ as control variables. All regressions include itemization status as control variables. Regressions in panel (A) control in addition for marital status. Standard errors in parentheses corrected for clustering. *For estimates significant at the 5% level.

however, that the elasticities are not estimated with very high precision and therefore most of the estimates are not significantly different from 0. The estimated elasticities suggest that the labor supply response to marginal rates is small. This is consistent with the estimates of traditional labor supply literature.

The most striking fact in Table 5 is that the elasticity for non-itemizers is always much smaller (and often slightly negative) than the elasticity of itemizers. Elasticities for married itemizers are high and significant: 0.65 for taxable income and 0.4 for adjusted gross income. The difference between the elasticity estimates of itemizers and those of non-itemizers persists for adjusted gross income and wages, though it is in general smaller than the difference for taxable income. This means that itemizers react more than non-itemizers not only through an increase in their itemized deductions but also through a larger reduction in reported income.[22]

Columns (4), (5) and (6) of Table 5 report the same estimates restricted to middle income earners. The general pattern is the same as in columns (1) to (3). However, the elasticities for this group are, in general, significantly higher than for

[22] This pattern of response by itemizing status is fully consistent with the results in Gruber and Saez (2000).

the wider range of income: 0.4 for taxable income, 0.3 for adjusted gross income for married taxpayers and singles together, 0.7 for taxable income of married itemizers. The wage elasticity of married taxpayers, which is around 0.3, is also somewhat higher than before.

Table 6 focuses more specifically on high income earners (columns (1), (2) and (3)) and on low income earners around the first kink point (columns (4) and (5)). The elasticities of high income earners are smaller than those of middle income earners: around 0.3 for taxable income, around 0 for adjusted gross income and negative (though never significant) for wages. The elasticities, however, are not estimated with very high precision. This seems to indicate that high income earners did not react as much as middle income earners to 'bracket creep'. The discrepancy between the results for adjusted gross income and taxable income suggests that most of the response of high income earners was through increased itemized deductions and not through a reduction in real earnings.

Columns (4) and (5) in Table 6 report estimates around the first kink point. The estimates confirm our previous qualitative results in Section 2. The elasticity of adjusted gross income and wages is large and significant for singles: 1.1 for adjusted gross income and 1.3 for wages. These are the largest elasticities found in this study. This suggests that the elasticity of labor supply is potentially high for singles with low incomes. The decrease in reported wages might be the consequence either of reduced labor supply or of switching to non-reported work activities. Note, however, that elasticities of low income earners can be high even if the response to taxation is small in absolute levels. This is due to the fact that the elasticity measures the response relative to the size of income (which is small for low income earners).

The estimates shown in Tables 5 and 6 broadly confirm the results of Section 2 where we noticed that married middle income earners are the most responsive but that the response of low income singles was also significant. Except for this last group, the response of wages is small, therefore income response to marginal rates may be due to changes in reporting behavior rather than reduced labor supply. Most of the response comes from the population of itemizers who is more elastic and can partly decrease its tax liability through increased itemized deductions.

The elasticity estimates presented here are much lower than the estimates found by the earlier studies of Lindsey (1987) and Feldstein (1995) exploiting the large tax reforms of the 1980s. However, my estimates are well in line with the latest studies by Auten and Carroll (1999) using the Tax Reform Act of 1986, Goolsbee (2000) and Carroll (1998) using the Tax Rate increase of 1993, and Gruber and Saez (2000) exploiting all the tax changes from 1979 to 1990. As in Gruber and Saez (2000), I find that taxable income is more sensitive than gross income (measured here by AGI) due to the sensitivity of itemized deductions.[23] However,

[23] Gruber and Saez (2000) also found that married taxpayers display higher elasticities than singles.

estimates might vary from study to study for several reasons. First, the set of taxpayers affected may vary from reform to reform. For example, the high incomes benefited from the largest reductions in marginal tax rates from 1986 to 1988. If high incomes are more elastic than medium incomes,[24] we should expect larger elasticities from the TRA 1986 experiment than from bracket creep. Second, it may be the case that the response for larger tax rates cuts (such as ERTA, 1981 or TRA, 1986) cannot be directly predicted from the results presented here. In other words, responses of taxpayers may be non-linear: a small change can lead to almost no effect while a big change can have a dramatic impact on reported income.[25] Finally, as pointed out in Slemrod and Kopczuk (2000), the elasticity of taxable income is not an immutable parameter but might change when the tax law is modified, loopholes are closed, or new loopholes are introduced.

5. Conclusion

This paper has made an attempt at identifying the impact of marginal rates on various types of reported income using 'bracket creep' as a source of variation in tax rates. The particular nature of this tax change made it possible to divide the sample between treatments and controls over the whole range of income distribution. As a result, any systematic difference in changes in income between taxpayers in a treatment groups and taxpayers in the surrounding controls groups can be confidently attributed to marginal tax rate effects. Our results displayed such a systematic difference for taxable income and AGI for middle income married households which translate into significant behavioral elasticities for that group. However, the elasticities for singles and for wage income are small and insignificant in general.

Mean reversion or changes in inequality do not invalidate the results of this study. As a result, 'bracket creep' offers a more direct and perhaps more convincing evidence of responses to taxation than previous studies using tax reforms. However, three important caveats should be mentioned. First, my study captures only short-term effects of marginal rates because it compares outcomes only across consecutive years. If responses to marginal rates are slow, my estimates may be smaller than medium- or long-term elasticities. However, several studies about behavioral responses to taxation suggest that short-term responses are likely to be higher than long-term responses. Slemrod (1995) argues that the timing of economic transactions is the most responsive to tax incentives (the

[24] Gruber and Saez (2000) provide some evidence along this line.

[25] This is probably what happened after the TRA of 1986 for very rich taxpayers who have the possibility to change the way and the timing in which they report income. See Feenberg and Poterba (1993) and Slemrod (1996). This non-linear behavior is probably much less relevant for low and middle income earners.

response of real economic activities seems to be much lower). Goolsbee (2000), using panel data on corporate executive compensation, showed that the income tax increase of 1993 led to large short-term inter-temporal income shifting but that the long-term response was small. In the ‘bracket creep’ experience, as inflation was expected, there may also be an inter-temporal substitution effect. People know that taxes will be higher in the following year and therefore try to increase their income now at the expense of next year’s income. Moreover, after Reagan’s election in 1980 people knew that taxes would be cut by 1982. This gave another incentive to shift income away from years 1980 and 1981. However, this expected reduction in taxes probably affected treatments and controls in the same way and therefore my estimates are not affected by this expectation component.

Second, as ‘bracket creep’ was not a tax reform, taxpayers may not have been fully aware of the marginal tax increases and thus did not respond to the change. This seems unlikely because ‘bracket creep’ was perceived as a major income tax event which triggered what has been called the ‘tax revolt’ of the late 1970s and early 1980s.

These caveats show that one should be careful when using the estimates of the present study to predict the effects of a legislated tax reform. They also show that identifying tax response elasticities is difficult because large reforms like the TRA of 1986 might produce estimates that are sensitive to underlying changes in inequality while it is almost impossible to obtain medium- or long-term responses using small tax reforms like ‘bracket creep’.

An important task left for future research is to look in more detail at the ‘anatomy’ of the behavioral response (Slemrod, 1996) by analyzing in detail how different income sources respond in tax rates and understand which sources are responsible for the behavioral response that we observe at the level of taxable income (and to a lesser degree for Adjusted Gross Income). Unfortunately, the method used here cannot be extended in a straightforward way to analyze this issue for several reasons. First, sources of income other than wages are small and relatively few taxpayers report significant amounts of these other types of incomes. As a result, the number of observations is much smaller and estimates are very noisy. Second, because incomes from other sources are often very small, log-changes can be very large even when absolute changes are relatively small. Consequently, the log–log elasticity specification is not adequate. Last, responses along the extensive margin that are very frequent for other sources cannot be captured by the log functional form. This issue is especially important in the case of itemized deductions.

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