DISCUSSION PAPERS IN ECONOMICS

Working Paper No. 98-14

Taxpayer Responses to the Tax Reform Act of 1986

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April 1998

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TAXPAYER RESPONSES TO THE TAX REFORM ACT OF 1986

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ABSTRACT

This paper examines the effects of the Tax Reform Act of 1986 on the reporting decisions of taxpayers, using microlevel information from the 1984 and 1989 Statistics of Income. Three specific questions are examined. Do the reporting decisions of individuals in response to tax reform differ across the various forms of income that individuals receive and report? Do these responses differ at different points in the distribution of income? And are these estimated responses sensitive to the specific estimation method, especially to methods that treat outliers in different ways? Our results clearly indicate that tax reform mattered in the reporting decisions of most individuals. However, there are significant differences in the reporting responses across income types, across income classes, and across estimation methods. In short, our results demonstrate that taxes matter. However, our results also show that taxes matter in different ways for individuals with different levels, in ways that depend upon the types of incomes received by taxpayers, and in ways that are sensitive to the estimation approach.

I. INTRODUCTION

A central focus of research in public economics has long been the measurement of individual responses to taxation. There is almost universal agreement among economists that, at least in theory, individual behavior should respond in some way to a change in marginal tax rates. In particular, a reduction in marginal tax rates should lead individuals to work more, to save more, to reduce tax avoidance activities, to report more income, and the like.

However, it is in the area of the magnitude of these responses where there remains enormous disagreement. Despite the best efforts of economists, estimates of the sizes of taxpayer responses in such dimensions as labor supply, saving, capital gains realizations, charitable contributions, and compensation choice are controversial and unsettled.[1]

The decade of the 1980s offers some potential for unraveling the puzzle of individual responses to tax changes. There were major tax changes throughout this decade, culminating in the Tax Reform Act of 1986 (TRA86). Many recent studies have examined various aspects of behavioral responses to TRA86, including labor supply (Eissa, 1995; Eissa and Liebman, 1996), saving (Skinner and Feenberg, 1992), housing (Poterba, 1992; Follain, Leavens, and Velz, 1993), charitable donations (Clotfelter, 1992), capital gains realizations (Burman, Clausing, and O'Hare, 1994), health insurance (Gruber and Poterba, 1994), and tax shelters (Samwick, 1996). These studies generally find that individuals respond in significant ways to federal income tax changes, although there is much debate

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[1] See, for example, the large differences in estimated behavioral responses in such areas as labor supply (e.g., Hausman (1981) and MaCurdy, Green, and Paarsch (1990)), special savings incentives (e.g., Gale and Scholz (1994) and Poterba, Venti, and Wise (1995)), and capital gains realizations (Feldstein, Slemrod, and Yitzhaki (1980) and Burman and Randolph (1994)). For a discussion of some of these controversies, see Aaron and Pechman (1981), Slemrod (1992), and, most recently, Auerbach and Slemrod (1997).

on whether these responses represent changes in real behavior or simply changes in either the timing or the financial form of transactions (Slemrod, 1995).

The responses of individuals to marginal tax rates in their reporting of income on tax returns are equally uncertain, and the magnitudes of these responses are a critical issue in a number of ongoing policy debates about the effects of income taxation, especially the impact of taxes on the level of income tax collections. As in other areas of behavior, reporting responses can be usefully analyzed in the period surrounding TRA86. In particular, TRA86 represents a "natural experiment" for the reexamination of individual reporting responses to tax changes. Recently, Feldstein (1995) and Auten and Carroll (1997) exploit this natural experiment feature of TRA86 to estimate individual reporting changes arising from TRA86, using panel data from individual tax returns. Both studies find that the individual reporting responses can be substantial.[2]

Despite the many important insights from this recent work, however, several questions remain. Do the reporting decisions of individuals in response to the dramatic tax changes in TRA86 differ across the various forms of income that individuals receive and report? Do these responses differ at different points in the distribution of income? And are these estimated responses sensitive to the specific estimation method, especially to methods that treat outliers in different ways?

In this paper we present new estimates of the responsiveness of individuals to tax changes that address these (and other) questions. We use microlevel information from the 1984 and 1989 Statistics of Income of the Internal Revenue Service to estimate the

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[2] Also, Lindsay (1987) and Navratil (1995) use information from samples of individual tax returns to estimate reporting changes from the earlier Economic Recovery Tax Act of 1981, and also find evidence of significant behavioral responses to changes in marginal tax rates.

responses of individuals in their reporting of different types of income (e.g., total or "comprehensive" income, adjusted gross income, wages and salaries, interest income, capital gains income, and dividend income), to the changes in federal and state income taxes reflected in TRA86; these years represent periods before individuals began to change their behavior in anticipation of the 1986 tax reform and after they had sufficient time to adapt to its various provisions. The simplest estimation method is ordinary least squares (OLS), applied to all observations. However, it seems likely that the responses of individuals at different income levels will differ, and we employ several methods to examine these differential responses. One method is OLS estimation for different income quintiles. Another approach is quantile regression, which allows differential responses at various quantiles (e.g., the 20, 40, 50, 60, and 80 percentiles) of the income distribution; quantile regression also limits the influence of outliers, which are present and significant in tax return data. In all cases, we apply an approach that takes advantage of the natural experiment aspect of TRA86. Unlike previous work, we therefore estimate the individual behavior responses of a wide range of tax reporting behavior, we estimate these responses at different points in the income distribution, and we employ a variety of estimation methods.

Our results clearly indicate that TRA86 mattered in the income reporting decisions of most individuals. However, there are significant differences in the reporting responses across the various types of income, across income classes, and across estimation methods. While our results demonstrate that taxes matter, our results also show that taxes matter in different ways for individuals with different levels of income, in ways that depend upon the types of incomes received by taxpayers, and in ways that are sensitive to estimation approach. These various differences have significant implications for the revenue costs associated with tax changes.

The next section briefly discusses TRA86. Data and methods are presented in section III, and results are considered in section IV. Summary and conclusions are in section V.

II. THE TAX REFORM ACT OF 1986

The Tax Reform Act of 1986 (TRA86) was arguably the most comprehensive federal income tax reform in the last fifty years. Its basic features are well-known. First, it sharply reduced marginal tax rates on nearly all taxpayers. The top individual income tax rate was reduced from 50 percent to 28 percent, and marginal tax rates for other brackets were also substantially reduced. In total, overall individual income rates fell by an average of 7 percent. Second, TRA86 changed a number of features in the definition of income, most of which had the effect of greatly expanding the tax base. For example, eligibility for tax savings from individual retirement accounts was restricted, and various itemized deductions (e.g., medical expenses, interest expenses, state and local sales taxes) were also limited. In addition, preferential tax treatment of realized capital gains was eliminated, and the ability to use passive investment losses as an offset to other forms of income was sharply curtailed. The standard deduction and personal exemptions were also increased.

In part because of changes in the federal income tax, many states also altered their state income taxes. Among states that relied heavily on the definition of the income tax base in the federal income tax, a typical state action was to reduce marginal tax rates in the state individual income tax, in order to avoid a major income tax increase on state citizens. For a similar reason, another common action was to modify in some way the federal base definition. Some states changed neither their rates nor their definition of the tax base, which led to a significant increase in state income taxes.[3]

The intent of TRA86 was, at least in part, to encourage individuals (and firms) to devote more of their efforts to productive activities. The reduction in marginal tax rates allowed individuals to keep more of each dollar of earned income, and reduced incentives to engage in activities whose only purpose is to save taxes. The expansion of the tax base reduced their ability to engage in tax shelter and arbitrage activities. However, the actual magnitudes of the individual responses to these massive federal and state changes in the income remain controversial. The next section discusses our methodology for estimating these responses.

III. DATA AND METHODS

A. Data

Our analyses are based upon the 1984 and 1989 Individual Tax Model Files (ITMFs) from the Statistics of Income of the Internal Revenue Service (IRS). These ITMFs are microlevel data sets that contain detailed information on individual observations from a stratified random sample of U.S. taxpayers.[4] The 1984 ITMF contains 79,556 individual records drawn from a population total of approximately 110 million tax return records, and the 1989 file contains 96,588 records from a population of 112 million records; in both years high-income tax returns are significantly oversampled, so that these ITMFs contain perhaps

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[3] For a detailed discussion of state and local responses to TRA86, see Bahl (1987) and Courant and Gramlich (1991).

[4] For more detailed information on these data sets, see the Internal Revenue Service (1984, 1989).

the most detailed and comprehensive information available for high-income taxpayers.[5] Each file contains roughly 200 variables that represent information coded from actual federal individual income tax returns. The taxpayer name, social security number, and other identifying information (other than the primary state of residence) are excluded from the file. We include returns filed by married couples filing jointly and separately and those filed by single individuals, and exclude returns filed by heads of households and by dependents.[6]

These ITMFs contain detailed information on taxpayer federal individual income tax reporting decisions two years prior to the enactment of TRA86 and one year after TRA86 was fully phased in. They therefore represent taxpayer behavior before individuals began to change their behavior in anticipation of the reform and after they had sufficient time to adapt to its various provisions.[7]

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[5] For example, the 1989 ITMF contains 28,042 returns for taxpayers with income above $200,000, or 29.0 percent of the total sample of 96,588 returns and 3.6 percent of the estimated high-income population of 789,803 returns.

[6] We exclude dependent returns because of the significant change in tax treatment of such returns between 1984 and 1989.

[7] In order to calculate the combined federal and state marginal tax rate for each taxpayer and each year for use in estimating reporting-marginal tax rate elasticities, we supplement this information on federal taxes with information on the state individual income tax regimes in each state (where relevant), using detailed state tax calculators for the two years. The state identifier is not available for high-income individuals (or those with AGI over $200,000). To assign state identifiers for these individuals, we first create two groups of high-income returns. One group consists of all high-income returns in the ITMF for which state and local income tax deductions are less than 15 percent of the average deduction for all high-income returns ("no income tax" group) and a second group of all other high-income returns ("other" group). We then randomly sample the appropriate group at a rate equal to the percent of high-income returns reported by the IRS in each state for that year. For example, California has 16.8 percent of the high-income returns in 1989; accordingly, we randomly sample 16.8 percent of the "other" high-income group in the 1989 ITMF, and assign these returns to California. We repeat the same procedure for each state. As a check on this procedure, we calculate the resulting total AGI by state, and then compare our estimate with that reported by the IRS. In nearly all states, the difference between our

The main advantages of the ITMFs are their incredibly rich information on items reported on the tax returns and their very large numbers of observations on individuals at all points in the income distribution, especially at higher income levels. However, there are several problems with these data. One limitation of the ITMFs is the relative lack of demographic information. Although the ITMFs contain virtually all reported tax items, the tax returns contain little information on individual characteristics. Nevertheless, we are able to extract a limited amount of demographic information from items reported on the returns. For example, we infer the age of an individual based on their use of the elderly exemption and the number of children from the child exemptions claimed on the return.

Another limitation of the ITMFs is that each is a cross-section of different individuals at a point in time, so that the same individuals are not included in each of the two years. Ideally, we would like to examine the responses of the same individuals over time, as in Feldstein (1995) and Auten and Carroll (1997), something that is not possible with separate cross-sections. Nevertheless, we have examined various aspects of the individuals in the two years, and their characteristics in such dimensions as proportions that are elderly or married are generally similar over time. In addition, the estimation approach used here can be viewed as transforming unrelated cross-sections over time into something like panel data. This estimation method is discussed in more detail later.

For each of the two years, we select from each return the levels of reported wages and salaries, interest income, dividend income, capital gains income, and adjusted gross income (AGI); as discussed later, we also calculate a measure of total, or "comprehensive", income. Our intent is to compare the levels of these various types of income that

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estimate and the IRS number is less than five percent; in those cases where the difference exceeds five percent, we resample the high-income returns until we obtain a sample high-income AGI within five percent of reported high-income AGI.

individuals report in 1984 and in 1989, holding constant as many factors as possible that might affect the amounts of reported incomes. To do this, we must consider such things as structural changes in the definition of the income tax base and secular trends in nominal per capita income, pre- and post-TRA86.

We make several adjustments in the reported information to control for these types of changes. First, for dividend and capital gains incomes we add back the portion of each that is not included in AGI so that our measure represents the true level of each income type actually received. Second, all nominal amounts in 1984 (except interest income) are adjusted to 1989 levels by the rate of growth of nominal per capita income over this period. Any remaining changes in incomes are, we believe, largely due to changes in reporting behavior as people respond to the new tax regime of TRA86.

Note that we define total income as the sum of AGI, social security income not included in AGI, dividends not reported in AGI, pension income not reported in AGI, and capital gains not reported in AGI; we also include retirement contributions and self-employed health insurance deductions. This definition of total income captures as much of an individual's income as can be measured using tax return information, and also gives a consistent definition of total income over time. Total income does not include such items as nonretirement transfer payments, fringe benefits, unrealized capital gains, and underreported income, items about which there is no information on the individual tax return; it also does not include income that is mistakenly or purposely underreported or that is not reported at all on tax returns.

Table 1 contains summary information on the distribution of income types by total income class for 1984 and 1989, where the first decile represents the poorest 10 percent of the population as measured by total income. The distribution of income changed significantly even over this short period. The shares of each income type changed somewhat erratically for many of the income deciles; however, the shares generally increased for the top decile, and the shares for the top 5 and 1 percent of the income classes also increased from 1984 to 1989. Table 1 also shows the mean levels of income types by total income class for the two years, holding prices constant at 1989 levels. Mean income levels in each income class generally rose over this period, although the increases are often larger for higher income classes. These changes in income are consistent with other evidence on distributional changes over this period.[8]

Table 1 shows the average marginal tax rates (federal plus state) by total income class, calculated as a simple arithmetic average of the marginal tax rates in each class. Overall, federal and state income tax changes resulted in a slight reduction in the average marginal tax rate, from 21.95 to 20.37 percent. The largest reductions occurred for higher total income classes. In fact, the average marginal tax rate increased for the lowest four deciles.

We use these files to estimate the responses of individuals in their reporting behavior to changes in the federal and state individual income taxation arising from TRA86. We estimate the responses of individuals in their reporting of wages and salaries, interest income, capital gains income, dividend income, AGI, and total income.

It should be emphasized that this reporting response is not the same as, say, a simple labor supply response. Although reporting behavior will certainly be influenced by any changes in hours worked or in labor force participation rates that may occur in response to tax reform, the reporting decision is a far broader decision. It is affected also by

[8] See Levy and Murname (1992), Papadimitriou and Wolff (1994), and Danziger and Gottschalk (1995) detailed discussions of studies that detail the distributional changes in the last several decades.

behavioral changes in such dimensions as employee compensation, itemized deductions, the realization of incomes, tax compliance, and the like. Our estimate of total income especially measures the entire dimensions of behavioral responses.[9]

Importantly, it should also be emphasized that this reporting response is likely to vary for individuals at different levels of income and with different forms of income. As noted above, the magnitude of the change in incentives faced by, say, higher income individuals is significantly different than that faced by lower income individuals. Also, the ability to vary the reporting of, say, wages and salaries is not likely to be the same as that for capital gains. The next subsection discusses our empirical approach to measuring these varied and differential responses.

B. Methods

We use a variety of estimation methods to identify the reporting behavior. The simplest method is OLS estimation. The basic OLS specification for each form of reporting behavior starts as:

$$Y = \beta \boldsymbol{X} + \epsilon \qquad (1)$$

where Y is some form of reported income (e.g., wages and salaries), β is a vector of parameters (including a constant), $\boldsymbol{X}$ is a vector of individual characteristics, and ϵ is an error term. By estimating separate equations for the entire sample of returns for each income type, we are able to measure differential responses across the various forms of income.

Individual characteristics include: a dummy variable for *Marital Status*, equal to 1 if

[9] Lindsay (1987), Feldstein (1995), and Auten and Carroll (1997) make a similar point.

married and 0 otherwise; the number of *Children*, as reported via dependent exemptions; a dummy variable for the receipt of *Unemployment* compensation, equal to 1 if unemployment compensation is reported and 0 otherwise; a dummy variable for *Elderly* status, equal to 1 if the elderly deduction is claimed and 0 otherwise; a dummy variable for *Itemization* status, equal to 1 if the individual itemizes deductions on the federal tax return and 0 otherwise; a dummy variable for the use of *Schedule C* (for reporting income from a business or a profession operated as a sole proprietor), equal to 1 if the individual files a Schedule C form and 0 otherwise; and a dummy variable for the use of *Schedule E* (for reporting income from rental real estate, royalties, partnerships, S corporations, estates, and trusts), equal to 1 if the individual files a Schedule E form and 0 otherwise.

It seems likely, however, that individual responses will differ at different points in the distribution of income. We use two approaches to measure differential responses. The first is estimation of equation (1) and its variants for each of the five separate quintiles of the entire sample, rather than for the entire sample itself. To do this, we rank all individuals in each year's ITMF on the basis of total income, and then estimate separate forms of equation (1) for each 20 percent subsample grouping and each income type.

A second and more novel approach to estimating differential taxpayer responses is quantile regression (Koenker and Basset, 1978). The most familiar of quantile regression is median regression, in which the median of the dependent variable is estimated rather than the mean as in OLS; median regression is also equivalent to finding a regression line that minimizes the sum of the absolute residuals, rather than the sum of the squared residuals as in OLS. With median regression, the 50th quantile is specified. Of course, other quantiles can be specified for individuals at different points in the distribution of income. Unlike OLS estimation for the entire sample, which generates a single vector of estimated coefficients, quantile regression generates a different coefficient vector for each quantile. Also unlike OLS estimation, which minimizes the sum of the squared residuals, quantile regression minimizes the sum of the absolute residuals and thereby reduces the influence of outliers. Although outliers obviously exist in any data source, in tax return data they occur frequently and they can be large.

To illustrate quantile regression, consider the following somewhat artificial example. Suppose first that we have a 20-person sample in which there are 5 individuals who receive wages and salaries and who each have zero children, 5 individuals with 1 child, 5 with 2 children, and 5 with 3 children. Suppose also that there is linear relationship between wage income and the number of children (with a constant also included).

With OLS regression, we estimate a single coefficient vector for the entire sample, and the slope coefficient on Children indicates how the mean value of wages and salaries changes with a change in the number of children. With quantile regression, we estimate a coefficient vector for each 20 percent quantile. Individuals at each level of children are ranked from poorest to richest, and the quantile regression coefficient estimate for Children at the .20 quantile indicates how the wage income of the lowest wage individual at each number of children changes with the number of children; similarly, the Children coefficient at the .80 quantile shows how the wage income of the highest wage individual at each number of children changes with the number of children. Other quantile coefficient estimates have a similar interpretation.

As a second and more realistic example, consider the sample that we actually have. Suppose that wages and salaries are a linear function of the number of children, and rank all individuals from lowest to highest in their reporting of wages and salaries. If we specify the 50th quantile, then the slope parameter for Children generated from quantile regression shows the change in the median value of wage income (conditional upon children) for a change in the number of children. More generally, the slope coefficient for any given quantile shows how the wage income of an individual in the relevant quantile position of wages for each level of children changes as the number of children changes. With other explanatory variables, the slope coefficients have a similar interpretation. Note that the quantile ranking for wages and salaries is based only upon wages and salaries, not on total income. Consequently, the same individuals are not necessarily in the same quantiles when we estimate the separate equations for wages and salaries, interest income, dividend income, capital gains income, AGI, and total income.

More precisely, define for each observation i the estimated residual e_i and the multiplier h_i as

$$e_i = Y_i - \beta \boldsymbol{X}_i \, . \tag{2}$$

$$h_i = \begin{cases} 2q \text{ if } e_i > 0 \\ 2\,(1 - q) \text{ if } e_i \leq 0 \, , \end{cases} \tag{3}$$

where Y, $\boldsymbol{X}$, and β are defined as in equation (1) and q is the quantile to be estimated (expressed as a proportion). Then quantile regression selects β in order to minimize

$$\Sigma_i \left| \; e_i \right| \; h_i \, . \tag{4}$$

Quantile regression therefore weights the absolute value of the residuals, with the weight depending upon the quantile to be estimated. Equation (4) is solved as a linear programming problem. Goodness-of-fit is measured by a pseudo-R^2, calculated as

$$R^2 = 1 - \frac{\text{(Sum of the Weighted Deviations about the Estimated Quantile)}}{\text{(Sum of the Weighted Deviations about the Raw Quantile)}} \qquad (5)$$

and standard errors are estimated using the bootstrap procedure suggested by Buchinsky (1994).

One advantage of quantile regression is the way that it deals with censored data (Powell, 1986). Recall that quantile regression ranks all individuals from lowest to highest income. However, most individuals do not have some types of income, especially capital income (e.g., interest, dividend, or capital gains income). In these cases, we only observe individuals who receive positive amounts of these incomes. Put differently, we cannot identify (or estimate) coefficient vectors for those quantiles in which individuals receive zero amounts of these incomes; only for those quantiles in which individuals receive positive amounts of incomes can we estimate the β vector. Although consistency of bootstrap estimators has not been proven theoretically, Buchinsky (1991) uses Monte-Carlo evidence to suggest the consistency of the estimates.

In OLS regressions with the full sample, the OLS subsample quintile regressions, and the quantile regressions, we apply a method of estimation that has sometimes been called the "difference-in-difference" approach.[10] TRA86 constituted a significant break from previous tax policy. If we can control for the major influences on reporting behavior that reflect such things as the growth in income over time, changes in the definition of the tax

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[10] For notable recent examples, see Gruber and Poterba (1994), Eissa (1995), and Eissa and Liebman (1996).

base, and other factors as discussed later, then any differences in reported incomes that we observe between 1984 and 1989 will be largely due to modifications in individual behavior in response to TRA86. More precisely, suppose that TRA86 affects one group of taxpayers (the treatment group) but not another group (the control group). If we measure the change over time in the response of each group (the group difference), then the difference between these responses is the "difference-in-difference" estimate of the impact of TRA86. It should be noted that the use of this approach is not without some difficulties. As emphasized by Heckman (1996) and Goolsbee (1997), the approach assumes (among other things) that the experiment affected only the treatment group and that other events over the period affected both groups equally. However, we believe that we are able to control sufficiently for these other events in our various estimations.

The crucial issue in this approach is how to determine the sources of identifying variation. We explore three potential sources of identification. The most obvious source is the time-specific factor, or pre- versus post-TRA86. The time-specific element is measured by a dummy variable *TRA*, equal to 1 for observations after TRA86 and 0 otherwise. A second source is individual-specific, for individuals who are high income versus those who are low income. We use here a dummy variable *Highincome*, equal to 1 for individuals who are in the 75th percentile or above of total income, and 0 otherwise; this variable also allows us to examine differential responses by income class. Our third source of identification is a state-specific factor, which looks for differences in behavior between those who live in high-tax states versus those in low-tax states. This variable is called *Hightax*, and equals 1 for individuals living in a state whose ratio of taxes to personal income exceeds the 75th percentile of all states, and 0 otherwise. These variables are introduced as separate variables and as interacted variables.

To illustrate the approach, consider the information on, say, wages and salaries. The simplest comparison of the effect of TRA86 on the reporting decisions of individuals is between 1984 and 1989 levels. This time-specific comparison shows that average wages and salaries reporting increased by $2,194 over this period (Table 1), controlling for nominal changes in income over time, and is one measure of the effect of tax reform on reporting behavior. When expressed as a percentage change using the difference in natural logarithms of wages and salaries (or 9.2 percent) and divided by the percentage change in marginal tax rates in Table 1 (or -7.4 percent), this "difference" (*D*) estimator is one measure (or -1.24) of the marginal tax rate elasticity of wages and salaries. These calculations are shown in the top panel of Table 2.

However, it may be necessary to allow for individual-specific factors in this estimated response, and it may also be necessary to allow for differential responses by income class. Another comparison, a "difference-in-difference" (or *DD*) estimator, introduces such individual-specific factors with the time-specific factors, and also allows us to identify the differential responsiveness of high-income individuals. This estimator is illustrated in the second panel of Table 2. Suppose it is assumed that high-income individuals (or those in the top 25 percentile of total income) behave differently than all other individuals, before and after TRA86. The difference in the average amount of wages and salaries reported by the top group between 1984 and 1989 is $3,946 (or $67,658-$63,712), while the difference for the remaining individuals is $242 (or $17,478-$17,236); these are denoted the time differences within the high and low income groups in wages and salaries between 1984 and 1989. The difference between the two income groups in 1984 is $46,476, and is $50,180 for 1989; these are denoted the individual differences at a point in time. This "difference-in-difference" in wages and salaries is therefore $3,704, equal either to ($3,946-$242) or to

($50,180-$46,476). It can be expressed as a percent, and, when divided by a similar calculation for the difference-in-difference in marginal tax rates, it can be converted to a marginal tax rate elasticity for wages and salaries; this estimator equals -0.42. A state-specific source of identification (e.g., *Hightax*) could instead be introduced with the time-specific factor; as shown in the bottom panel of Table 2, this difference-in-difference equals $1,050; the resulting DD elasticity equals -1.09. Finally, if all three sources of identification are introduced, the resulting estimator is called a "difference-in-difference-in-difference" (or *DDD*) estimator. This estimated elasticity equals -1.12.

The efficiency of the difference-in-difference approach can be increased by controlling for other factors that may affect taxpayer decisions. In a regression context, this suggests that we estimate a variant on equation (1). If the only source of identification is time-specific (or *TRA*), then we estimate

$$Y = \beta \boldsymbol{X} + \phi_1 \, TRA + \epsilon, \qquad (6)$$

where Y, $\boldsymbol{X}$, β, and ϵ are defined as in equation (1). The coefficient on *TRA*, or ϕ_1, represents the difference estimator for the effects of tax reform on reporting behavior, and measures the difference in reporting of, say, wages and salaries before versus after the enactment of TRA86. Other sources of identification are introduced in a similar way. For example, if time-, individual-, and state-specific differences are all included, we estimate

$$\begin{aligned} Y = \beta \boldsymbol{X} &+ \phi_1 \, TRA + \phi_2 \, Highincome + \phi_3 \, Hightax \\ &+ \phi_4 \, TRA * Highincome + \phi_5 \, TRA * Hightax + \phi_6 \, Highincome * Hightax \\ &+ \phi_7 \, TRA * Highincome * Hightax + \epsilon \, . \end{aligned} \qquad (7)$$

The coefficient ϕ_7 on *TRA * Highincome * Hightax* is the difference-in-difference-in-difference estimator for the effects of tax reform on reporting behavior. It equals the change in individual reporting of wages and salaries among high-income (relative to low-income) individuals in high-tax (relative to low-tax) states after (relative to before) TRA86.[11]

We apply the difference-in-difference approach to OLS estimation for the entire sample, to OLS estimation for the separate total income quintile subsamples, and to quantile regression; in the quintile subsamples estimation, we obviously do not include the *Highincome* source of identification. It should also be noted that we have estimated a very wide range of other specifications, with relatively little impact on our results. We have used the shares of the income types as the dependent variables. We have changed the basic specification (equation (1)) by excluding some variables, especially those like itemization status or Schedules C and E that might be considered endogenous. We have also estimated all specifications using both unweighted and weighted ITMF data. All of these results are available upon request.[12]

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[11] Similarly, if we introduce individual-specific variation with time-specific variation, then we estimate

$$Y = \beta \boldsymbol{X} + \phi_1 \, TRA + \phi_2 \, Highincome + \phi_3 \, TRA * Highincome + \epsilon.$$

The coefficient on *TRA * Highincome*, or ϕ_3, represents the difference-in-difference estimator for the effects of tax reform on reporting behavior, measuring whether the reporting of high-income individuals changed more after the tax reform than did the reporting of low-income individuals. If instead we introduce state-specific variation with time-specific variation, then we estimate

$$Y = \beta \boldsymbol{X} + \phi_1 \, TRA + \phi_2 \, Hightax + \phi_3 \, TRA * Hightax + \epsilon .$$

Again, the coefficient on the interaction term *TRA * Hightax*, or ϕ_3, represents the difference-in-difference estimator for the effects of tax reform on reporting behavior; that is, ϕ_3 measures the difference in reporting of wages and salaries of individuals in high-tax states relative to those in low-tax states after the enactment of TRA86, and so ϕ_3 measures whether the reporting of individuals in high-tax states changed more after the tax reform than did the reporting of those in low-tax states.

[12] In other work, we have examined the reporting responses of the very rich, defined as individuals in the top 0.5 or the top 1 percent of the total income distribution. See Alm and Wallace (forthcoming).

IV. ANALYSIS AND RESULTS

Some representative estimation results are presented in Table 3 for wages and salaries, Table 4 for AGI, and Table 5 for total income. Similar equations for the various types of capital income generally perform erratically, in part because of the concentration of capital income in a small number of taxpayers, and these results are not reported in detail.[13] For ease of comparison, only the results with *TRA* (or equation (6)) are reported in Tables 3 to 5. The elasticities of the relevant reporting decision with respect to the marginal tax rate are summarized in Table 6 for all specifications, including those for interest, dividend, and capital gains income, although these latter responses are seldom statistically identified.[14]

Consider first the results for wages and salaries, in Table 3. For the OLS full sample estimation, tax reform has a large, significant, and positive impact on the reporting decision. However, the results from the OLS subsample quintiles suggest that this result is due mainly to responsiveness at the top of the income distribution, since the coefficient on *TRA*, or ϕ_1, is small and in fact negative for most lower quintiles. The quantile regression

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[13] Note that we have also estimated the equations for capital income using Tobit maximum likelihood estimation, with similar results.

[14] The elasticity based upon equation (6), with only the *TRA* variable included, is calculated as

$$[ln(Y_{1989})-ln(Y_{1984})]/[ln(MTR_{1989})-ln(MTR_{1984})],$$

where *Y* is some type of reported income and *MTR* is the combined federal-state marginal tax rate, with both indexed by the year. Similarly, the elasticity with *TRA* and *Highincome* is calculated as

$$\frac{[(ln(Y_{1989,Highincome})-ln(Y_{1989,Lowincome}))-(ln(Y_{1984,Highincome})-ln(Y_{1984,Lowincome})]}{[(ln(MTR_{1989,Highincome})-ln(MTR_{1989,Lowincome})-(ln(MTR_{1984,Highincome})-ln(MTR_{1984,Lowincome})]},$$

where $Y_{1989,Highincome}$ is some type of reported income for highincome taxpayers in 1989, and so on. Other elasticities are calculated in a comparable manner.

estimates also suggest that higher income individuals are more responsive to tax reform, at least in absolute terms, as shown by the increase in the absolute size of ϕ_1 for higher quantiles. Recall, however, that the quantile ranking for wages and salaries is based only upon wage income, while the OLS subsample quintiles are determined by total income.

A similar, and even more striking, pattern is shown in Table 4 for AGI. As with wages and salaries, the impact of tax reform on the reporting of AGI is large, positive, and significant for the full OLS sample. However, the OLS subsample quintiles clearly indicate that the positive effect of *TRA* is due largely to the extreme responsiveness of the top quintiles. The same pattern is found in the quantile estimates, where the coefficient on *TRA* is always significant and increases in absolute size as the choice of the quantile increases from .2 to .8. The estimation results for total income (Table 5) are similar.

When all combinations of identifying variables are estimated (where appropriate) using the OLS full sample, the OLS subsample quintiles, and the quantile regressions, TRA86 is found to have a consistently positive impact on the reporting decision of most types of income. The various reporting-marginal tax rate elasticity estimates are given in Table 6 for all income types. There is a general tendency for the wage elasticities to be smaller in absolute value than those for AGI and total income, implying that individuals have somewhat less ability to change their reporting of wages than of other types of income. Also, with the exception of the quantile regression elasticities with *TRA* as the only source of identification, there is a clear tendency for the elasticities to increase in absolute value for higher income quantiles. This latter result is consistent with the notion that individuals with lower levels of income have less flexibility in their reporting decisions. Given the concentration of different forms of capital incomes in the top income classes, the different OLS elasticities for these income types are usually insignificant, and the quantile estimates for dividend and capital gains incomes are not even identified. The quantile estimates for interest income become identified at the .6 quantile, and these estimated elasticities for the .6 and .8 quantiles are negative and significant.[15] Overall, the elasticities are consistently negative for most income types, with many of them clustered roughly between -0.5 and -1.5, a range that makes them comparable in size and sign to those calculated by Feldstein (1995) and Auten and Carroll (1997).

However, there is significant variation in the elasticities, especially across estimation method. Also, it should be noted that these elasticities are quite sensitive to slight changes in the marginal tax rates used in their calculation. A change of, say, one percentage point in the relevant marginal tax rates can significantly alter the size, and even the sign, of the elasticities. For example, suppose that the marginal tax rates in 1989 are one percentage point higher than the actual rates. The quantile elasticities for wages, AGI, and total income all change from negative to positive.[16]

As noted earlier, there are good reasons for cautious interpretation of the results from the difference-in-difference method. It is also risky to attribute all of these changes in reporting directly to the changes in taxation represented by TRA86 because there are other nontax factors that may have contributed to changes in reporting behavior, such as

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[15] Feldstein (1995) and Auten and Carroll (1997) report tax price elasticities, rather than the marginal tax rate elasticities used here; that is, their elasticities equal $[\partial Y/\partial(1-MTR)][(1-MTR)/Y]$, where *Y* is some form of reported income and *MTR* is the marginal tax rate. The elasticities reported here equal $[\partial Y/\partial(MTR)][MTR/Y]$. It is straightforward to convert one elasticity to the other.

[16] To be precise, the AGI elasticities calculated from equation (8), with *TRA* and *Hightax*, for the .2 to .8 quantiles change from (-0.38, -0.52, -1.09, -1.44, -1.77) to (0.59, 0.73, 1.23, 1.36, 1.54).

technological change, international trade, the returns to education, and the like.[17] Further, TRA86 changed a number of features of the income tax, not simply marginal tax rates, and the elasticity estimates necessarily attribute all impacts of the reform to changes in marginal tax rates.

The signs on the control variables are generally consistent with expectations. With some occasional exceptions, married individuals, couples with children, and individuals who itemize tend to have higher forms of all reported incomes. In contrast, individuals who receive unemployment compensation typically have lower reported incomes of all types. Not surprisingly, the elderly dummy variable has a negative impact on the reporting of wages and salaries, an impact that does not vary much with income class in the quantile results; however, for other income types, *Elderly* sometimes has a significant and positive effect on reporting, especially for higher quintiles or quantiles and especially also for income from capital. The presence of Schedule C income has a consistently negative impact on the reporting of wages and salaries, AGI, and total income, both for the OLS and the quantile results. In contrast, the presence of Schedule E income tends to be positively correlated with nearly all forms of income. However, the impact of *Schedule E* varies somewhat with income level. The magnitude of its impact increases significantly for higher income quintiles and quantiles and also for capital income types; it is also sometimes associated with lower levels of wage, AGI, and total income reporting at lower income levels.

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[17] Again, see Levy and Murname (1992), Papadimitriou and Wolff (1994), and Danziger and Gottschalk (1995) for a discussion of these factors and their contribution to changes in income distribution.

V. CONCLUSIONS

There now seems little question that the Tax Reform Act of 1986 affected the reporting decisions of most individuals, and our estimation results point consistently to a significant increase in reported income in response to the lower marginal tax rates enacted under TRA86. However, our results also suggest that there are important differences in the reporting responses across the various types of income, across income classes, and across estimation methods. Taxpayer responses to marginal tax rates tend to be smaller for wages and salaries than for other forms of income in which individuals have more discretion in the timing of their receiving and report to be smaller for individuals with lower levels of income because these individuals also have less flexibility in their decisions. Finally, taxpayer responses tend to be sensitive to the method of estimation (as well as to slight changes in relevant parameter values). There is no doubt that taxes matter. However, disentangling the effects of taxes remains a difficult proposition.

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TABLE 1
MEAN LEVELS OF INCOME TYPES AND AVERAGE MARGINAL TAX RATES BY TOTAL INCOME CLASS, 1984 AND 1989

Total Income	Wages and Salaries		Interest Income		Dividend Income		Capital Gains Income		AGI		Total Income		Average Marginal Tax Rate	
Class	1984	1989	1984	1989	1984	1989	1984	1989	1984	1989	1984	1989	1984	1989
1	2,725	2,727	350	558	68	124	238	248	491	-1,474	701	-1,382	2.78	0.35
2	5,538	5,226	608	590	103	107	76	17	6,703	6,826	6,898	6,997	12.17	11.34
3	8,793	8,136	862	941	127	147	98	39	10,689	10,781	11,208	11,292	15.89	14.56
4	11,992	11,216	1,181	1,177	224	220	90	76	14,590	14,678	15,584	15,630	18.58	16.93
5	15,640	14,771	1,552	1,438	269	292	180	164	18,959	19,067	20,429	20,395	21.19	17.91
6	20,349	19,873	1,665	1,498	352	330	293	160	24,159	24,472	26,090	26,077	23.88	22.34
7	26,966	25,573	1,659	1,847	360	459	403	294	30,578	31,164	32,809	32,785	26.87	23.24
8	34,674	32,225	1,875	2,214	402	570	493	369	38,336	39,570	41,078	41,093	30.02	23.94
9	43,530	41,929	2,756	2,674	811	867	733	779	48,826	51,471	52,667	52,789	34.26	30.29
10	69,482	74,193	7,787	8,996	5,010	4,734	18,845	11,813	97,199	120,154	117,932	125,570	42.95	34.78
Top 5%	85,260	92,742	11,907	14,020	8,847	7,836	37,175	21,622	133,785	169,487	170,521	178,461	46.66	36.38
Top 1%	153,893	177,474	30,318	39,136	28,759	23,868	161,418	82,493	316,302	419,321	455,885	446,413	52.75	38.98
Full Sample	22,691	24,885	1,905	2,326	701	851	1,610	1,549	27,282	33,780	30,460	35,325	21.95	20.37

TABLE 2

DIFFERENCE-IN-

Wages and Salaries Difference, TRA Wages and Salaries Difference Wages, TRA and High income:

at Individual Tax Poverty Line Difference at Individual Income Poverty Line Difference

63,712

1,223,484 1984 46,476,236 1984 22,491 1984

67,658

2,253,266,359 1989 50,180,478 1989 20,885 1989

Difference-in-Difference Estimate Difference-in-Difference Estimate Difference Estimate 3,946

1,050 Time Difference 3,704,825,375 Within Individuals Time Difference 2,194 242 Time Within Individuals 2,195 Diff

TABLE 3
OLS FULL SAMPLE, OLS QUINTILES, AND QUANTILE REGRESSION RESULTS, WAGES AND SALARIES

		OLS Quintiles					Quantile Regression				
Independent Variable	OLS Full Sample	Bottom 20%	Second 20%	Third 20%	Fourth 20%	Top 20%	.2	.4	.5	.6	.8
Marital Status	11919***	1244***	119	-334*	1814***	11877***	6988***	8368***	8590***	10275***	13899***
Children	1453***	276***	226***	735***	887***	1980***	1228***	1524***	1772***	1528***	1164***
Unemployment	-4489***	725***	-76	22	-239	-8377***	179***	-1645***	-2104***	-2918***	-4617***
Elderly	-20285***	-3497***	-9834***	-17127***	-25684***	-42410***	-11747***	-15359***	-13942***	-14986***	-17862***
Schedule C	-10810***	-2024***	-4322***	-5555***	-7094***	-14646***	-10634***	-9959***	-9221***	-9101***	-7561***
Schedule E	8267***	2121***	-1210***	-1817***	-3393***	15358***	-3542***	-1407***	-228***	723***	6238***
Itemization	21632***	-826***	-339*	323*	2280***	17353***	10530***	17535***	19526***	21109***	25137***
TRA	4172***	242**	-446***	-459***	-415**	5278***	1696***	2968***	3046***	3182***	3292***
Constant	9549***	4048***	12521***	21375***	31177***	30501***	3063***	6991***	9190***	11804***	17862***
R-squared	.1564	.0554	.3964	.4823	.4674	.0548	.1466	.2458	.2725	.2938	.3066

*** : $P \leq .001$; **: $P \leq .01$; *: $P \leq .05$.

TABLE 4
OLS FULL SAMPLE, OLS QUINTILES, AND QUANTILE REGRESSION RESULTS, AGI

		OLS Quintiles					Quantile Regression				
Independent Variable	OLS Full Sample	Bottom 20%	Second 20%	Third 20%	Fourth 20%	Top 20%	.2	.4	.5	.6	.8
Marital Status	12467***	-2612***	427***	177*	540***	2300	7639***	10337***	11653***	12750***	15618***
Children	325	-339	70*	239***	385***	495	610***	529***	444***	307***	133***
Unemployment	-5722***	2150**	-117	66	-98	-14777***	-381***	-1966***	-2459***	-3148***	-4392***
Elderly	-3347***	2544***	-2171***	-5440***	-6822***	8663**	-2558***	-3661***	-3825***	-4199***	-3703***
Schedule C	-2876**	-3183***	-531***	-462***	-651***	7132*	-4389***	-4126***	-3800***	-3296***	-2670***
Schedule E	22730***	-13531***	-501***	-435***	-589***	47165***	733***	3961***	5243***	7635***	17574***
Itemization	29707***	5851***	706***	1066***	2077***	29173***	16879***	20695***	21995***	23255***	27822***
TRA	8350***	447	266***	367***	1683***	19185***	2964***	4251***	4536***	5078***	6731***
Constant	6181***	4302***	12795***	21973***	33125***	25598***	2828***	6189***	8255***	10472***	16009***
R-squared	.0291	.0401	.0830	.2288	.2110	.0099	.1785	.2338	.2500	.2590	.2571

*** : P ≤ .001; **: P ≤ .01; *: P ≤ .05.

TABLE 5
OLS FULL SAMPLE, OLS QUINTILES, AND QUANTILE REGRESSION RESULTS, TOTAL INCOME

		OLS Quintiles					Quantile Regression				
Independent Variable	OLS Full Sample	Bottom 20%	Second 20%	Third 20%	Fourth 20%	Top 20%	.2	.4	.5	.6	.8
Marital Status	13730***	-2315***	294***	767***	1673***	1744	8364***	11700***	13112***	14355***	17360***
Children	5	-372	68*	11	-34	201	377**	120***	38***	-73***	-308***
Unemployment	-6323***	2089**	-109	-92	-187	-15928***	-603***	-2208***	-2738***	-3225***	-4624***
Elderly	1086	2829***	68	-402***	130	17763***	-223***	-130***	-305***	-66***	860***
Schedule C	-1596	-3021***	-192**	-273***	-422***	12082***	-4495***	-4052***	-3604***	-3028***	-2061***
Schedule E	27715***	-12735***	55	87	290**	56794***	1746***	4916***	6492***	9315***	20325***
Itemization	31552***	5677***	822***	1069***	1910***	29655***	17829***	21390***	22765***	23996***	29016***
TRA	6669***	335	227***	113*	542***	10927***	2896*	4075***	4334***	4732***	5814***
Constant	6729***	4382***	13100***	22564***	34377***	32714***	2882***	6235***	8306***	10552***	16506***
R-squared	.0263	.0369	.0172	.0373	.0575	.0099	.1852	.2319	.2443	.2507	.2549

*** : P ≤ .001; **: P ≤ .01; *: P ≤ .05.

TABLE 6
OLS FULL SAMPLE, OLS QUINTILES, AND QUANTILE REGRESSION ELASTICITIES

		OLS Quintiles					Quantile Regression				
Income Type	OLS Full Sample	Bottom 20%	Second 20%	Third 20%	Fourth 20%	Top 20%	.2	.4	.5	.6	.8
Wages and Salaries:											
TRA	-2.26	-0.74	0.51	0.22	0.07	-0.56	-4.17	-2.45	-1.36	-0.64	-0.33
TRA,Highincome	-1.18	---	---	---	---	---	NS	-0.51	-0.67	-0.74	-0.92
TRA,Hightax	-1.80	NS	NS	NS	NS	NS	NS	-0.75	-0.76	-0.85	-1.22
TRA,Highincome,Hightax	NS	---	---	---	---	---	-0.22	-0.05	NS	-0.16	-1.16
Dividend Income											
TRA	NS	NS	NS	NS	NS	-1.14	NI	NI	NI	NI	NI
TRA,Highincome	NS	---	---	---	---	---	NI	NI	NI	NI	NI
TRA,Hightax	NS	NS	NS	NS	NS	NS	NI	NI	NI	NI	NI
TRA,Highincome,Hightax	NS	---	---	---	---	---	NI	NI	NI	NI	NI
Interest Income											
TRA	-2.49	NS	NS	NS	NS	-1.15	NI	NI	NI	-0.28	-0.18
TRA,Highincome	-3.60	---	---	---	---	---	NI	NI	NI	-0.48	-0.57
TRA,Hightax	NS	NS	NS	NS	NS	NS	NI	NI	NI	-2.87	-3.76
TRA,Highincome,Hightax	NS	---	---	---	---	---	NI	NI	NI	-1.09	-1.25
Capital Gains Income											
TRA	NS	NS	NS	NS	NS	2.86	NI	NI	NI	NI	NI
TRA,Highincome	4.36	---	---	---	---	---	NI	NI	NI	NI	NI
TRA,Hightax	NS	NS	NS	NS	NS	NS	NI	NI	NI	NI	NI
TRA,Highincome,Hightax	NS	---	---	---	---	---	NI	NI	NI	NI	NI
AGI											
TRA	-3.57	NS	-0.24	-0.15	-0.26	-1.46	-7.53	-2.83	-1.66	-0.89	-0.51
TRA,Highincome	-5.92	---	---	---	---	---	-0.25	-0.87	-1.06	-1.35	-1.58
TRA,Hightax	NS	NS	NS	NS	NS	NS	-0.38	-0.52	-1.09	-1.44	-1.77
TRA,Highincome,Hightax	NS	---	---	---	---	---	-0.11	-0.05	-1.55	-1.60	-1.59
Total Income											
TRA	-2.65	NS	-0.19	-0.24	-0.28	-0.76	-7.54	-3.15	-1.48	-0.78	-0.39
TRA,Highincome	-1.95	---	---	---	---	---	-0.25	-0.81	-0.79	-0.91	-1.12
TRA,Hightax	NS	NS	NS	NS	NS	NS	-0.32	-0.70	-0.74	-0.85	-0.91
TRA,Highincome,Hightax	NS	---	---	---	---	---	-0.17	-0.03	-0.23	-0.95	-1.07

NI: Not Identified
NS: Not Significant (at .05 or better)