Taxpayers' Response to Tax Rate Changes: A Canadian Panel Study

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Abstract

Taxpayers may respond to changes in income tax rates in several manners. One way to classify them is to distinguish between behavioural changes (changes in labour supply, changes in the weights of the different types of labour income, changes in saving behaviour, etc.) and income reporting changes (timing, evasion,..). Consequently, there might not be a perfectly proportional relationship between tax rate changes and tax revenues. This paper presents a methodology for the estimation of 1) income and 2) number of taxpayer elasticities with respect to marginal income tax rates. The model considers shares of total income and number of taxpayer for three income classes: medium ($50,000-$100,000), high ($100,000-$150,000) and highest ($150,000 and more) for a panel of Canadian provinces over the 1972-1996 period and for three sub-periods (1972-1976, 1977-1987, 1988-1996). The results show significant responses to tax rate changes from taxpayers in the high and highest income classes at the end of the period under study (1988-1996). Results obtained from the number of taxpayer share model also indicate that a significant part of the response of taxpayers to tax rate changes is explained by taxpayers moving to lower income classes.

Keywords: tax rates, income elasticity, panel data.

1. Introduction

The purpose of this paper is to present estimates of personal income and number of taxpayers elasticities with respect to marginal tax rates for a panel of Canadian provinces over the 1972-1996 period in total and broken down into three sub-periods reflecting different tax regimes. Our empirical model considers shares of total income and number of taxpayers for three income classes expressed in $ of 1995: medium ($50,000-$100,000), high ($100,000-$150,000) and highest ($150,000 and more).

Our approach is of interest for two reasons. First, it uses aggregate provincial data to examine the impact of marginal tax rates: such a methodology is rarely used since authors of US studies have access to individual income taxfillers data. But in most countries, such data are not available while tabular data are. Second, Canada experienced particularly high marginal rates during that period due to the use by both the federal government and provincial ones of surtaxes to reduce their deficits. As of 2000, the federal government and most provincial jurisdictions now enjoy budget surpluses and the question on how to use these surpluses arises. It is often framed as follows: Should governments restore (at least partially) the former levels of spending in, notably, social programs such as healthcare and public education, reduce their debts or cut taxes, particularly income taxes which are amongst the highest as a share of GDP in industrialised countries? This question implicitly assumes that there is a trade-off between these apparently divergent objectives and in particular that tax reduction will reduce government revenues. In this paper, using an original methodology based on aggregate panel data, we show that this trade-off might not exist in the case of personal income tax.

The paper is organised as follows. Section 2 briefly reviews the relevant literature and the Canadian personal income tax system. Section 3 presents the empirical model and data. Section 4 discusses the regression results. It is shown that the income of high-income individuals is sensitive to a point such that government revenues would have increased following a reduction of the high-income taxpayers marginal tax rate. The results also show that a significant part of the taxpayer response takes the form of taxpayers moving out of their income class. In section 5, we discuss the implications of our results in terms of fiscal policy and conclude.

2. A Brief Review of the Literature and of the Canadian Personal Income Tax System

a) Literature

Without any response from the taxpayers to a change in marginal income tax rates, the level of income reported for tax purpose is not affected and therefore tax revenues move in the same direction and in proportion to the tax rate change. However, a change in marginal tax rates may alter the behaviour of taxpayers for many reasons that, in turn, will affect reported income and tax revenues. For instance, taxpayers may respond to an increase in marginal tax rates by reducing their work effort. The existence of this type of response has received little support from the labour supply literature (see Pencavel, 1986; MaCurdy, Green and Paarsch, 1990; Triest, 1990, 1992). For Feldstein (1995), three reasons explain this lack of support: 1) the ignorance of the income-leisure trade-off resulting from the progressivity of the tax schedule and the existence of other household income; 2) above mentioned studies were concerned with the labour supply of men, while it has been shown that women participation rate and hours are much more sensitive to net wages and tax rates than those of men (see, for instance, Rosen, 1976; Hausman, 1985; Mroz, 1987; Heckman, 1993); 3) most studies are also mainly concerned with labour force participation and hours worked, while individuals may in the short run reduce work effort but in the long run change their occupation or even move to a friendlier land (fiscally speaking). It has also been argued by Feldstein and Feenberg (1996) that an increase of marginal income tax rates may induce taxpayers to work more to offset the reduction of their disposable income. However, this argument may not be valid in the case of high-income individuals.

Beside labour supply effects, changes in marginal tax rates may affect reported income since taxpayers can affect the nature of their compensation package by replacing wages by fringe benefits (private insurance, car, corporate dining rooms, etc.). Finally, changes in marginal tax rates may induce individuals to modify their saving behaviour, seek more tax shelters (tax avoidance) and even engage in tax evasion. Once again, these types of behaviour are more likely for high-income individuals.

Broadly speaking, two approaches have been used to measure the total response of taxpayers to changes in marginal income tax rates. Lindsey (1987) used a repeated cross section of tax returns from the U.S. Internal Revenue Service (IRS) to analyse the response of taxpayers to changes in U.S. personal income tax rates following the 1981 tax reform. Lindsey performed a comparison of actual taxable income to a baseline taxable income that would have been observed in the absence of tax changes. His results indicate that between one-sixth and one-fourth of the revenue losses that would have been attributable to the tax rate reductions were recouped by changes in taxpayer behaviour.

The other approach is based on the analysis of a panel of individual tax returns observed before and after a tax reform. This line of research has been initiated by Feldstein (1995) who took advantage of the Tax Reform Act of 1986 and computed the change in taxable income between 1985 and 1988 of 4000 individual taxpayers and then derived *differences-in-differences* elasticity estimates of taxable income with respect to net-of-tax rates for three income groups: medium, high and highest. He obtained quite large estimates (between 1 and 3). The work of Feldstein has been criticised by Auten and Carroll (1994, 1995): they noted in particular the relatively few high income taxpayers in its sample. Elasticity estimates by Auten and Carroll are more conservatives (around 0.66). More recently, Auten and Carroll (1999) obtained a taxable income elasticity estimate of approximately 0.60 by giving a greater weight to lower-income taxpayers. Saez (1999), also using a panel of individual tax returns, concluded that taxpayers were responding to marginal tax rate changes but not at the levels computed by Feldstein or even Auten and Carroll. Saez's study is not associated with a particular tax reform but rather to tax changes attributable to the "bracket creep"[1].

A common feature of the above approaches is that the response to changes in tax rates is estimated by comparing tax returns of the same individuals (or identical individuals) over a relatively short period of time. These panels of individuals taxpayers are used because behavioural response to tax changes may be properly isolated from other unobservable non-tax effects affecting the income distribution such as an increasing overall level of education or

[1] Real changes in marginal tax rates due to inflation and to the fact that, between 1979 and 1981, the U.S. tax rate schedule was fixed in nominal terms.

technological change. Except for Saez (1999), tax reforms occurred during the periods under study.

b) Key features of the Canadian income tax system

In Canada, all provinces use a common definition of income, as a result of either formal tax collection agreements by which 9/10 provinces have their income tax collected by the federal government (as a % of the federal tax payable or tax on tax) while the 10th (Quebec) collects it's income tax itself but out of convenience uses a definition of income very similar to the federal one (we say similar rather than identical because slight divergences emerge from time to time but they create less than a 1% difference on average).

There was a major change implemented in the fiscal regime in 1972, which explains our choice of that year as the first year of our data with the definition of income significantly widened to implement the recommendations of the Carter Commission (inclusion of ½the capital gains, of unemployment insurance, etc.). Income tax rates were fairly stable from 1972-1976.

There was a change in the funding of federal transfers to the provinces in the areas of health and post secondary-education in 1977 with cash transfers being replaced in part by a withdrawal from the personal income tax field by the federal government and a concomitant occupation by the provinces through higher tax rates. As a result, provincial tax rates play a more important role from then on. From 1977 to 1987, rates first increase then decrease and were lower at the end than at the beginning.

There was a second major change in the fiscal regime in 1988. Following the UK and the USA, Canada broadened the definition of taxable income in part by abolishing various tax expenditures (e.g. interest income) and, at the federal level, by lowering the number of tax brackets to 3 and lowering the tax rates. Furthermore, a number of exemptions and deductions were transformed into tax credits computed at the lowest tax rate regardless of income. This last period was characterised by a drop in income tax rates from 1987 to 1988 and then by a slow but steady increase of these rates for the high ($100000-$150000) and highest ($150000 and more) income classes. The three sub-periods used in our analysis reflect these changes.

We summarise the tax system in Figures 1 and 2. The first one presents the average (Canadian) marginal income tax rate for the three income groups considered while the second presents the variation in the 10 provincial rates for each income group.

(Figures 1 and 2 here)

3. Empirical Model, Data and Variables

In this paper, we propose an original methodology based on Canadian panel aggregate data to estimate taxpayers response to changes in marginal income tax rates by income class. Because two levels of government (federal and provincial) obtain revenues from income taxes, the Canadian tax system offers an interesting amount of tax diversity: income tax schedules are specific to each province while the definition of income is the same everywhere. This feature allows for the comparison of income at a specific point in time between two tax schedules. Second, Revenue Canada reports on a yearly basis aggregate data on each component of income by province and by income class. Third, in addition to income and its components, Revenue Canada also reports the number of taxpayers within each income class. This information may be used to evaluate whether responsive taxpayers move within their income class or to another income class.

Relatively to individual data, aggregate data can give a more complete picture of the effects of a tax change on government revenues. The results are not affected by the small number of high or highest income taxpayers usually found in most samples based on individual taxpayer data. In addition, results from aggregate data may be used to infer all types of effects (increasing or decreasing tax rates) while previous studies have limited the analysis to one type of effects (e.g. tax reduction in the case of Lindsey, 1987, Feldstein, 1995, Auten and Carroll, 1994, 1995, 1999 and tax increase in the case of Saez, 1999). In fact, in our data set, marginal income tax rates move in both directions.

Of course, several factors beside marginal income tax rates may explain differences in aggregate income or number of taxpayers differential in a given income class between two provinces or between two time periods within the same province. Failure to control for this unobserved heterogeneity may lead to false conclusions regarding taxpayers' response to tax rate changes if

this heterogeneity is closely related to tax rates. Our empirical model uses three different ways to eliminate a significant proportion of this unobserved heterogeneity. First, all factors which affect income regardless of income class are eliminated by using income shares rather than income levels for a given income class. It is important to emphasise that income shares can be computed from aggregate data but not from individual tax returns data. Also, additional province-specific factors which affect income levels regardless of time are eliminated with province-specific fixed effects. Finally, effects which are affecting income levels over time regardless of the province are eliminated by time-specific fixed effects. Remaining time- and province-specific effects (beside tax rates) which affect total income levels are controlled for by observable time and province specific variables such as the overall macroeconomic conditions and the underlying income distribution. The same approach is also used for the estimation of the number of taxpayers by income class.

i) Empirical Model

The existing literature on the analysis of taxpayer response to tax rate changes mainly provides taxable income elasticity estimates with respect to marginal tax rates. This paper focuses instead on the relationship between total income (or number of taxpayers) and marginal tax rates. In Canada, taxable income is defined as total income minus exemptions and deductions such as pension fund contributions, union dues, child care expenses, capital gain deductions, etc. We assume that when marginal tax rate changes, taxpayers respond solely through total income from which taxable income may be easily calculated using the applicable legal deductions. Therefore, our results should be interpreted as lower bound effects since they are not considering the response of taxpayers in terms of deductions such as capital gains or investments in a pension fund.

Consider now the following total income (or, alternatively, number of taxpayers) functions:

$$y_{it}^{j} = exp(\alpha_{o}^{j} + \sum_{i} \alpha_{i}^{j} P_{it} + \sum_{t} \alpha_{t}^{j} T_{it} + Z_{it}^{'} \alpha_{Z}^{j} + \alpha_{t}^{j} \tau_{it}^{j} + \alpha_{tt}^{j} (\tau_{it}^{j})^{2}) exp(u_{it}^{j}), j = 1,...,3, \qquad (1)$$

where y_{it}^{j} is the total income for income class j, in province i at time t; P_{it} and T_{it} are, respectively, provincial and time dummy variables; Z_{it} is a vector of province and time specific variables reflecting the general economic conditions and the underlying income distribution in

the economy; τ_{it}^{j} is the marginal tax rate of income class j; $\alpha^{j} = (\alpha_{o}^{j}, \alpha_{i}^{j}, \alpha_{t}^{j}, \alpha_{Z}^{j}, \alpha_{t}^{j}, \alpha_{tt}^{j})$ is a vector of parameters; and u_{it}^{j} is a disturbance. The functional form in (1) only allows for strictly positive predictions of total income (or number of taxpayers). The specification takes into account of the potential non-linear response to tax rate changes by including the marginal income tax rate of the income class and its square.

The total income (or number of taxpayers) share of income-class j is given by

$$s_{it}^{j} = \frac{y_{it}^{j}}{\sum_{k} y_{it}^{k}}, j = 1,...,3. \tag{2}$$

Since shares add-up to one, the system of equations defined by (1) and (2) cannot be estimated without some normalisation. Arbitrarily choosing the lowest income class for normalisation and taking the logarithm we get, using (1) and (2), the following empirical equations:

$$\ln(s_{it}^{j}/s_{it}^{1}) = (\alpha_{o}^{j} - \alpha_{o}^{1}) + \sum_{i}(\alpha_{i}^{j} - \alpha_{i}^{1})P_{it} + \sum_{t}(\alpha_{t}^{j} - \alpha_{t}^{1})T_{it} + Z_{it}^{'}(\alpha_{Z}^{j} - \alpha_{Z}^{1}) + \tag{3}$$
$$\alpha_{t}^{j}\tau_{it}^{j} + \alpha_{tt}^{j}(\tau_{it}^{j})^{2} - \alpha_{t}^{1}\tau_{it}^{1} - \alpha_{tt}^{1}(\tau_{it}^{1})^{2} + m_{it}^{j},\ j = 2, 3,$$

where $m_{it}^{j} = u_{it}^{j} - u_{it}^{1}$. Also, given the nature of the data (panel), it is assumed that the disturbance m_{it}^{j} follows an AR(1) process, that is $m_{it}^{j} = \rho^{j} m_{it-1}^{j} + \omega_{it}^{j}$ where ω_{it}^{j} is an i.i.d. disturbance with Var(ω_{it}^{j})= σ_{j}^{2} and Cov($\omega_{it}^{j}, \omega_{it}^{k}$)= σ_{jk} for all $j \neq k$.

The system of equations defines by (3) is first estimated by the iterative version of the seemingly unrelated regression method (SURE).[2] Then, the ρ^{j} are computed from the empirical residuals of the regression. Finally, using the estimated values of the ρ^{j}, the Prais-Winsten transformation is applied to all the variables in the model and the transformed model is estimated again by iterative SURE.

Because marginal tax rates are specific to each income class, their associated parameters are identified for all classes as it is showed by equation 3. Consequently it is possible to compute for each income class the total income and number of taxpayer elasticities with respect to marginal tax rates. For the income class j, these elasticities are computed (omitting subscripts i and t) as

[2] See Zellner (1962).

$$\varepsilon^{j}_{y,t} = \alpha^{j}_{t}\tau^{j} + 2\alpha^{j}_{tt}(\tau^{j})^{2}. \quad (4)$$

The response of a taxpayer to a personal income tax rate change may take two forms: income change within the same income class or income change such that the taxpayer moves to another income class. Because aggregate data allow us to estimate both total income and number of taxpayers elasticities with respect to marginal income tax rates, we are able to identify the form of the response. Defining n^{j}_{it} as the number of taxpayers in *j*, *i*, *t* and $\bar{y}^{j}_{it}$ as the average (total) income per taxpayer in the same income class, province and time period, we can write

$$y^{j}_{it} = n^{j}_{it}\,\bar{y}^{j}_{it}, \quad (5)$$

Hence, it is straightforward to define the total income elasticity with respect to the marginal tax rate τ^{j}_{it} as

$$\varepsilon^{j}_{y,t} = \varepsilon^{j}_{n,t} + \varepsilon^{j}_{\bar{y},t}, \quad (6)$$

where $\varepsilon^{j}_{n,t}$ and $\varepsilon^{j}_{\bar{y},t}$ are, respectively, the number of taxpayers and average income elasticities with respect to the marginal tax rate in income class *j* (we omit province and time subscripts for simplicity). Our model allow us to estimate both total income and number of taxpayer elasticities. The average income elasticities within an income class may then be computed using equation (6).

ii) Data and Variables

Income and number of taxpayers variables are taken from *Tax Statistics on Individuals*, various editions, published annually by Revenue Canada.[3] Our study considers data at the provincial level (10 provinces) over the 1972 to 1996 period. These data are reported by income class defined in nominal terms. For the empirical analysis, we consider three income classes as they were defined in 1995: medium ($50,000 to $100,000), high ($100,000 to $150,000) and highest (more than $150,000). The low income class ($0 to $50,000) is not considered because it is unlikely that taxpayers in this income class respond or can respond to marginal tax rate changes. For the years before 1995 and in 1996, the income classes as they were defined in 1995 have been deflated using the implicit GDP price index. Of course fiscal data are not published according to income

[3] Provincial figures by income classes are not published but are available from Revenue Canada.

classes expressed in 1995 dollars. For instance, in 1980, the income class corresponding to the medium income class (1995 dollars) was $25,145 to $50,288. The nearest income class for which data were available in 1980 was $25,000 to $50,000. These approximation errors are similar across all provinces at a specific point in time and therefore compensated for by the inclusion of the time-specific fixed effects in the model.

The province and time-specific effects are estimated using province and time-specific dummy variables (P_{it} and T_{it}). For the estimation, the province of Quebec in 1972 is the omitted category. Since the parameters α^1 are not identified in the model (except for α_t^1 and α_{tt}^1), the results associated with a particular province-specific effect is a deviation between income class *j* and income class 1 (medium) beyond any deviation between the same income classes in Quebec. The same interpretation apply for the time-specific effect, that is deviation beyond any deviation in 1972.

The vector of variables reflecting the general economic conditions of a province in a particular year (Z_{it}) includes the growth rate of the real provincial GDP, the growth rate of the provincial unemployment rate and the provincial Gini coefficient. All three variables were obtained from Statistics Canada. The Gini coefficient is included in the model in order to take into account of the underlying income distribution in the economy. It is not computed with tax data but from a survey conducted on a regular basis by Statistics Canada. Again here, as for the dummy variables, the parameters associated with these variables are not identified for the medium income class. Parameters associated with those variables for the high and highest income classes are therefore differential effects relatively to the medium income class.

The marginal income tax rates associated with each income class are taken from the *Finances of the Nation* (various issues) published by the Canadian Tax Foundation. These tax rates combine the federal and provincial rates. They differ from the statutory tax rate schedule since they represent the effective marginal tax rates for a given income level for a single individual, taking into account the personal deduction/credit and the relevant surtaxes, if any. In order to assign to each income class its relevant marginal tax rate, we computed the average taxable income per taxpayer for a given class and then choose the appropriate marginal tax rate for this level of

taxable income in the *Finances of the Nation*. Therefore, our tax rates represent the marginal tax rate of the average taxpayer in a given income class.

4. Empirical Results

i) General Results

Tables 1 and 2 report the parameter estimates of respectively the income and number of taxpayer share models. In each case, two different specifications are considered. The first two columns of the tables present estimates obtained from the specification defined by equation (3). In this specification, the parameters associated with the marginal tax rates (α_t^j and α_{tt}^j) are the same over the entire period under study. Alternatively, columns 3 and 4 of each table present estimates obtained with a specification where the parameters associated with the marginal tax rates are specific to each fiscal regime observed during the studied period (1972-1977, 1978-1987, 1988-1996). For both models (income and number of taxpayers), a likelihood ratio (LR) test shows that the regime-specific parameter specifications dominate the no regime-specific parameter specifications.[4]

(Tables 1 and 2 here)

For all models and specifications considered, most of the province-specific effects are statistically significant in both the high and highest income classes. These effects are not reported for space reasons but may be obtained from the authors on request. The presence of significant province-specific effects is an indication that using shares rather than levels did not remove all the unobserved heterogeneity. On the other hand, the results on the time-specific effects depend on the specification considered. Without regime-specific parameters associated with the marginal tax rates, most time-specific effects are statistically significant in both income and number of taxpayer models in both high and highest income classes. When regime-specific parameters are introduced in the specification, only a few time-specific effects are still statistically significant (again here, results associated with time-specific effects are not reported but may be obtained upon request). Therefore, it seems that with a proper specification with regard to marginal tax

[4] The LR test statistics are, respectively, 23.44 for the income model and 25.75 for the number of taxpayer model. In both cases, it is greater than the critical value of a χ^2 with 12 degrees of freedom at a 5% confidence level (21.03).

rates, nearly all unobserved heterogeneity related to time has been removed from the data in all income classes. Because the definition of income is the same in a particular point in time in all provinces, time related heterogeneity was expected to be a bigger problem than heterogeneity related to provincial specificity. The quasi-absence of residual time-related heterogeneity gives a strong indication that, for instance, all changes in income and income class definitions have been properly accounted for by the model.

The results associated with macroeconomic conditions and income distribution are, when statistically significant, intuitively consistent. The parameter of GDP growth is not significant in any model (income or number of taxpayers), specification (regime-specific effects or not) and income class (high or highest). Still, GDP growth may induce some response from the taxpayers, but this response is the same in all income classes. The effect of unemployment rate growth is statistically significant only for the highest income class. In that case, the parameter associated with unemployment growth is positive which indicate that high income taxpayers are less affected than other taxpayers by the labour market conditions. Finally, the parameter associated with the Gini coefficient is statistically significant and positive in 3 out of 4 highest income class equations. Therefore, it seems that highest income taxpayers are more sensitive to the overall income distribution than other taxpayers.

The results associated with the marginal tax rates are difficult to interpret because the specifications include the non-linear term $(t^j)^2$. Without regime-specific parameters associated with marginal tax rates, the parameters associated with the marginal tax rates are all negative and significant for all income classes and in all models considered (income and number of taxpayers). Also, the parameters associated with the square of the marginal tax rates are in all cases positive and significant. Therefore, for the three income classes considered, our results indicate a significant response of taxpayers for both income level and number of taxpayers. Higher tax rates reduce income and number of taxpayer shares in a given income classes. Furthermore, it seems that the shape of the response to tax rate changes is not linear.

With regime-specific parameters associated with marginal tax rates the results are more mixed and even harder to interpret. When statistically significant, the parameters associated with the

marginal tax rates are of the expected sign. However, very few of them are statistically significant. It seems that the clear effects obtained without the regime-specific specifications have been dissipated through all fiscal regimes. Therefore, in order to obtain a more accurate picture of the responses to tax rate changes, we now turn to the elasticity estimates.

ii) Elasticity Estimates

This section presents estimates of the elasticities of both income and number of taxpayers with respect to marginal tax rates. Elasticities are computed using equation (4) and using the average marginal tax rates of each fiscal regime. In Tables 3 and 4 we present income and number of taxpayer elasticity estimates computed without regime-specific parameters. In both cases, results are reported for each fiscal regime and income class.[5] Tables 5 and 6 report the corresponding elasticities computed with regime-specific parameters.

(Tables 3, 4, 5 and 6 here)

It should be noted first that significant responses are observed mostly during the last fiscal regime (1988-1996). During the first two fiscal regimes, some significant responses are observed mainly for the high income class when the elasticities are computed with regime-specific parameters. In that case, both income and number of taxpayer elasticities are negative (but larger than –1) and of approximately the same magnitude (between –0.50 and –0.75). We do find other significant effects in the earlier fiscal regimes, but without any consistent pattern.

The most interesting results are obtained during the last fiscal regime. Over this time period, income elasticities with respect to tax rates are statistically significant regardless of the specification and income class. In both specifications considered (without and with regime-specific parameters), the income elasticity is positive for the medium income class and also not statistically different from 1 in the regime-specific specification. The same kind of results are obtained with the number of taxpayer models, even though the elasticity estimate is not statistically significant in the no regime-specific parameter specification. Since the elasticities are

[5] Even without fiscal regime-specific parameters, elasticities may be computed for each fiscal regime since tax rates differ across regimes.

roughly the same between the two models (income and number of taxpayers) we can conclude that following a tax rate change, most of the effect is due to taxpayers moving to other income classes. In the case of the medium income class, the positive elasticities indicate that this income class plays the role of a tax refuge when tax rates increase, presumably because high and perhaps also highest income taxpayers alter their income in a way that allow them to reach lower income and marginal tax rate brackets.

The case of high income taxpayers is drastically different. Elasticity estimates for this income class range between –1.41 and –0.67, all of them statistically different from 0. Furthermore, none of the elasticity estimates for this income class is statistically different from –1. Also here, very similar magnitudes are observed between the income and number of taxpayer models. These results clearly show that high income taxpayers respond to tax changes by moving other income classes. In addition, the importance of the response is such that a tax rate increase, for instance, leads to a decrease in income to a point which completely offset the effect of the tax rate increase in terms of additional revenues for the government.

Not surprisingly, similar but larger responses are obtained in the highest income class. Again here, all elasticity estimates are significant and negative, regardless of the specification and model considered. Furthermore, these elasticities are not different from –1 in the case of the no regime-specific parameter specifications but are significantly inferior to –1 in the regime-specific parameter specifications. Their range is from –3.05 to –1.08. The most striking results are obtained with the regime-specific parameter specification. In that case, we obtained an income elasticity of –3.0526 and a number of taxpayer elasticity of –1.9351. However, these two elasticities are not statistically different from each other. Therefore, the conclusion here is that taxpayers responded to tax changes such that any tax rate increase was followed by a more than proportional reduction of income leading to reduced government revenues. As it was the case for high income taxpayers, highest income taxpayers responded mostly by moving to a lower income class.

Our results are conservative in the sense that they do not consider the response of taxpayers through the use of fiscal preferences since our analysis is conducted with total income rather than

taxable income. If taxpayers also responded through fiscal preferences (for instance by seeking remuneration in the form of capital gains rather than wages) the effect on government revenues may have been even more important (see Feldstein, 1999 on induced changes in deductions and exclusions). In addition, our estimates do not consider the effect of personal income tax rate changes on the spending behaviour of the taxpayers and therefore on government revenues from other sources such as the sale tax. These additional effects may have been also quite significant. Notwithstanding these additional important effects, our results show that federal and provincial governments in Canada could have raised more tax revenues during the 1988-1996 period by decreasing the marginal income tax rates of the high and highest income taxpayers.

5. Conclusion

Our results show that the methodology put forward in this paper can be used to answer this question: what is the impact of changes in personal income tax rates on the tax base and therefore on government revenues? Our results also show that in some cases, a reduction in the marginal tax rates will increase taxable revenues. Given this finding, it is important that the federal government and the provincial ones take into account that they can both increase revenues and thus spending and reduce taxes if they choose the proper reductions. It is thus particularly encouraging that in the October 18th 2000 special budget, the Canadian federal government reduced tax rates for high income taxpayers by abolishing the 5% income tax surtax. Unfortunately, the statutory top marginal rate remains unchanged at 29%. Indeed and ironically considering our results, the creation of a fourth brackets for the $100000 and more income taxpayers means that the two groups identified in this study as the appropriate targets for tax generating tax cut (TGTC) still face the same statutory rate.

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FIGURE 1
MARGINAL TAX RATES BY INCOME CLASS, 1972-1996
CANADIAN AVERAGE

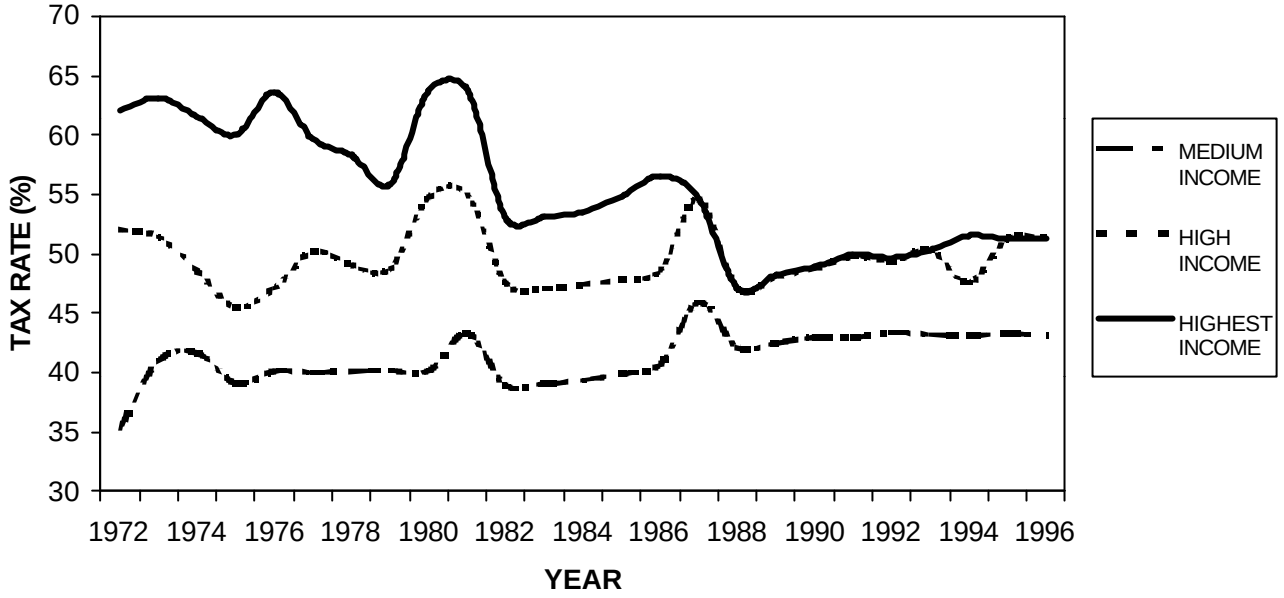

FIGURE 2
COEFFICIENT OF VARIATION OF MARGINAL TAX RATES
BY INCOME CLASS, 1972-1996

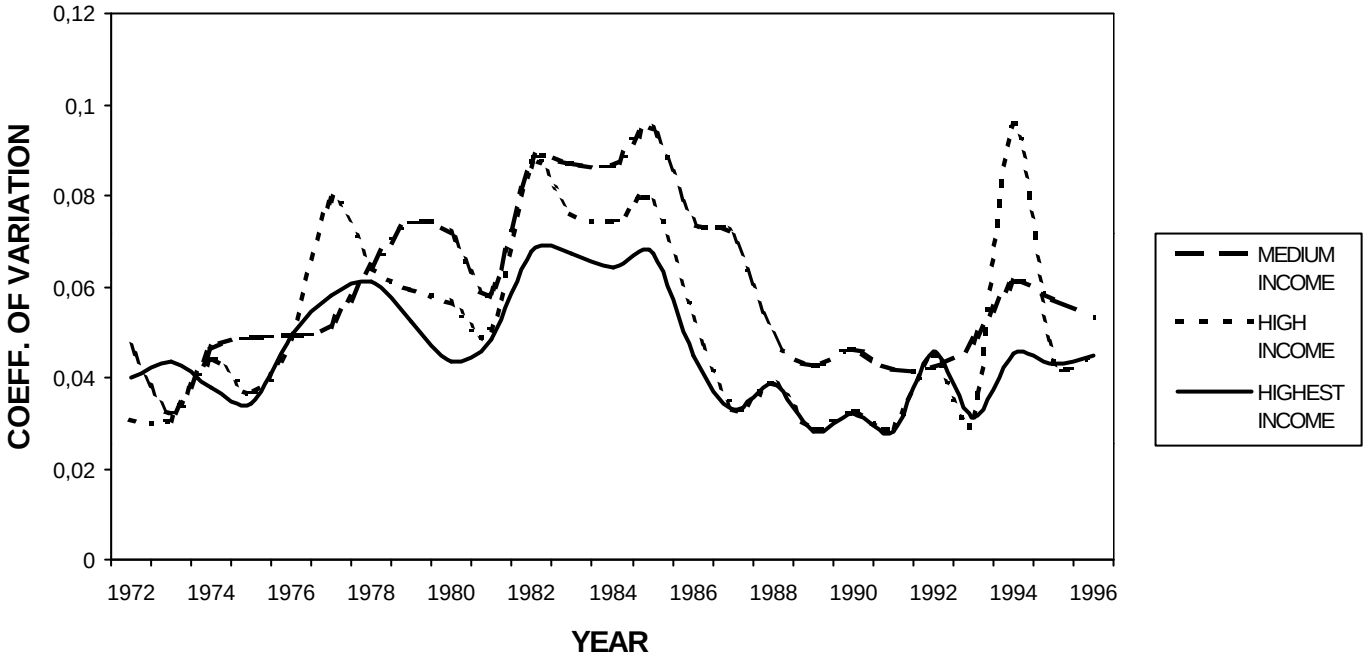

Table 1 Parameter Estimates of the Total Income Share Models
(White heteroscedastic-consistent standard errors in parentheses)

Variable	Without regime effects		With regime effects	
	High Income	Highest Income	High Income	Highest Income
Intercept	0.6633	-1.2838	1.1636	-5.6736
	(1.6063)	(1.4459)	(4.8552)	(5.6208)
GDP growth	-0.2793	-0.1269	-0.2071	-0.0857
	(0.1809)	(0.2310)	(0.1749)	(0.2326)
Unemp. Growth	-0.0331	0.0797**	-0.0267	0.0743***
	(0.0433)	(0.0371)	(0.0386)	(0.0417)
Gini	0.9517	1.6274***	0.9511	1.4169
	(0.6349)	(0.8637)	(0.6118)	(0.8750)
τ^j	-19.8490*	-14.2580*	-	-
	(5.5529)	(4.2102)		
$(\tau^j)^2$	18.7565*	11.8748*	-	-
	(5.5877)	(3.8169)		
τ^j (72-77)	-	-	2.9825	20.2389
			(13.2848)	(19.1228)
$(\tau^j)^2$ (72-77)	-	-	-3.4969	-14.4409
			(13.7725)	(15.1285)
τ^j (78-87)	-	-	-22.5063**	-34.0467**
			(9.8071)	(13.6872)
$(\tau^j)^2$ (78-87)	-	-	21.6055**	28.7790**
			(9.6368)	(12.1633)
τ^j (88-96)	-	-	-22.6823	-13.9921
			(17.5361)	(21.2468)
$(\tau^j)^2$ (88-96)	-	-	20.1618	7.8927
			(17.9614)	(21.3377)
τ^1	-11.9604**		-	
	(5.4825)			
$(\tau^1)^2$	14.9823**		-	
	(6.4687)			
τ^1 (72-77)	-		21.5664	
			(16.1284)	
$(\tau^1)^2$ (72-77)	-		-28.1919	
			(20.4523)	
τ^1 (78-87)	-		-9.2330	
			(12.6364)	
$(\tau^1)^2$ (78-87)	-		11.7212	
			(14.5679)	
τ^1 (88-96)	-		-25.2446	
			(19.9134)	
$(\tau^1)^2$ (88-96)	-		32.1838	
			(22.7224)	
ρ^j	0.2909	0.5713	0.2245	0.4820
R^2	0.986	0.958	0.987	0.956
Log-likelihood	442.478		454.196	

Table 2 Parameter Estimates of the Number of Taxpayer Share Models
(White heteroscedastic-consistent standard errors in parentheses)

Variable	Without regime effects		With regime effects	
	High Income	Highest Income	High Income	Highest Income
Intercept	-0.7516	-4.5531*	-0.4697	-4.7678
	(1.8461)	(1.4802)	(4.7672)	(5.7047)
GDP growth	-0.2065	-0.1751	-0.1238	-0.1289
	(0.1893)	(0.2731)	(0.1822)	(0.2681)
Unemp. Growth	-0.0156	0.0721***	-0.0072	0.0650
	(0.0455)	(0.0383)	(0.0406)	(0.0433)
Gini	0.8258	1.9393**	0.8163	1.7168***
	(0.6842)	(0.9098)	(0.6497)	(0.9453)
τ^j	-19.5943*	-10.7618*	-	-
	(6.9195)	(4.1113)		
$(\tau^j)^2$	18.3619*	8.6205**	-	-
	(6.9697)	(3.7223)		
τ^j (72-77)	-	-	2.4260	7.9256
			(12.7447)	(18.7519)
$(\tau^j)^2$ (72-77)	-	-	-3.0347	-5.1864
			(13.1941)	(14.8689)
τ^j (78-87)	-	-	-20.3831***	-20.0297
			(11.9291)	(13.3558)
$(\tau^j)^2$ (78-87)	-	-	19.1262	15.8814
			(11.8559)	(12.0340)
τ^j (88-96)	-	-	-21.1635	-12.9750
			(19.1120)	(19.8087)
$(\tau^j)^2$ (88-96)	-	-	18.5549	9.1220
			(19.4593)	(19.9558)
τ^1	-14.4153*		-	
	(5.5276)			
$(\tau^1)^2$	17.7579*		-	
	(6.5245)			
τ^1 (72-77)	-		16.8164	
			(16.4074)	
$(\tau^1)^2$ (72-77)	-		-22.5914	
			(20.8438)	
τ^1 (78-87)	-		-9.6385	
			(12.0299)	
$(\tau^1)^2$ (78-87)	-		11.9411	
			(13.8285)	
τ^1 (88-96)	-		-24.7976	
			(21.0147)	
$(\tau^1)^2$ (88-96)	-		32.0998	
			(23.9814)	
ρ^j	0.2575	0.4766	0.1925	0.3911
R^2	0.988	0.973	0.989	0.971
Log-likelihood	419.341		432.217	

Note to Tables 1 and 2:
Province and time specific effects are not reported here but are available from the authors upon request. *, ** and *** denote respectively statistical significance at the 1%, 5% and 10% confidence level.

Table 3 Total Income Elasticity Estimates[1]
(White heteroscedastic-consistent standard errors in parentheses)

Income class	1972-1996	1972-1977	1978-1987	1988-1996
Medium	0.1672	-0.0437	0.1041	0.3934***
($50,000-$100,000)	(0.2150)	(0.2420)	(0.2199)	(0.2230)
High	-0.6204*	-0.6936*	-0.5329*	-0.6669*
($100,000-$150,000)	(0.2030)	(0.2024)	(0.2071)	(0.2023)
Highest	-0.6041***	0.2443	-0.4435	-1.2071*
($150,000 and more)	(0.3104)	(0.4722)	(0.3284)	(0.3328)

1- Entries report elasticity estimates computed at the average marginal tax rate of the period.
* , ** and *** denote statistical significance at the 1% , 5% and 10% confidence level.

Table 4 Number of Taxpayer Elasticity Estimates[1]
(White heteroscedastic-consistent standard errors in parentheses)

Income class	1972-1996	1972-1977	1978-1987	1988-1996
Medium	0.0995	-0.1464	0.0259	0.3635
($50,000-$100,000)	(0.2201)	(0.2463)	(0.2248)	(0.2279)
High	-0.6880*	-0.7591*	-0.6033*	-0.7331*
($100,000-$150,000)	(0.2208)	(0.2205)	(0.2262)	(0.2202)
Highest	-0.6666**	-0.0764	-0.5554***	-1.0813*
($150,000 and more)	(0.2924)	(0.4541)	(0.3093)	(0.3194)

1- Entries report elasticity estimates computed at the average marginal tax rate of the period.
* , **, *** denote statistical significance at the 1%, 5% and 10% confidence level.

Table 5 Total Income Elasticity Estimates (regime specific parameters) [1]
(White heteroscedastic-consistent standard errors in parentheses)

Income class	1972-1977	1978-1987	1988-1996
Medium	-0.2892	0.1321	1.0375**
($50,000-$100,000)	(0.3686)	(0.4792)	(0.4879)
High	-0.2236	-0.4348	-1.3805*
($100,000-$150,000)	(0.3249)	(0.4448)	(0.4140)
Highest	1.4922***	-0.7866	-3.0526*
($150,000 and more)	(0.8024)	(0.8369)	(0.6741)

1- Entries report elasticity estimates computed at the average marginal tax rate of the period. *, ** and *** denote statistical significance at the 1% , 5% and 10% confidence level.

Table 6 Number of Taxpayer Elasticity Estimates (regime specific parameters) [1]
(White heteroscedastic-consistent standard errors in parentheses)

Income class	1972-1977	1978-1987	1988-1996
Medium	-0.4159	0.0398	1.1985**
($50,000-$100,000)	(0.3839)	(0.4576)	(0.4855)
High	-0.2739	-0.6150	-1.4130*
($100,000-$150,000)	(0.3368)	(0.4395)	(0.4088)
Highest	0.9412	-1.1385	-1.9351*
($150,000 and more)	(0.7980)	(0.7024)	(0.5072)

1- Entries report elasticity estimates computed at the average marginal tax rate of the period. *, **, *** denote statistical significance at the 1%, 5% and 10% confidence level.