Tax Penalties on Fluctuating Incomes: Estimates from Longitudinal Data

Daniel V. Gordon and Jean-François Wen
Department of Economics, University of Calgary[1]

February 18, 2017

[1]The analysis was conducted at the Prairie Regional Research Data Centre which is part of the Canadian Research Data Centre Network (CRDCN). The services and activities provided by the CRDCN are made possible by the financial or in-kind support of the SSHRC, the CIHR, the CFI, Statistics Canada and participating universities whose support is gratefully acknowledged.

Abstract

Progressive personal income taxes can cause individuals with fluctuating incomes to pay more taxes over time than individuals with constant incomes of the same average value. The implicit tax penalty violates principles of equity and may harm efficiency by discouraging risk-taking activities, such as entrepreneurship. This paper uses longitudinal data to estimate the tax penalties in six panels of Canadian data from 1993 and 2010. The effects of various income averaging policies for mitigating tax penalties are then examined.

1 Introduction

Under progressive marginal taxation with annual accounting periods, a person with an income that fluctuates from year to year will bear a greater total tax burden than a person with a steady income of the same average value. This occurs because positive income shocks can move the taxpayer into a higher marginal tax rate bracket. The problem confronted by taxpayers with fluctuating incomes is compounded by other features of tax systems, such as the expiration of unused basic personal amounts, imperfect loss offsets, and taxing capital gains on a realization basis. Economists have long recognized that the implicit penalty on unstable incomes violates the principle of horizontal equity. As noted by Vickrey (1947: 166), "[I]t is probable that the ability to pay of the individual with fluctuating income is likely no greater than that of the individual with steady income." He also expressed concern about discriminating against risk-taking: "[T]here are many who consider the willingness of individuals to risk their capital in this way to be a prime prerequisite to technological and economic progress" (p. 167).

To address these issues, governments over the years have adopted various income averaging methods. These are provisions in the tax code whereby the assessments of tax liabilities are modified by permitting taxpayers to smooth their incomes based on past or future income levels. However, with the reduction in the number of tax brackets in the 1980s, the tax penalty issue diminished in importance and income averaging methods were dropped, e.g., in the United States and Canada in 1986 and 1988, respectively. In Canada, there were 17 federal tax brackets with marginal tax rates ranging from 11 to 80 percent in 1971, whereas today there are but four federal tax brackets, with rates from 15 to 29 percent.[1] At the same time, however, the documented increases in income volatility during the past three decades may have aggravated the problem. Dynan *et al.* (2012) reported, for instance, that the

[1] The federal budget of June 18, 1971 introduced major forms of income averaging as part of a comprehensive tax reform in Canada.

share of households in the U.S. experiencing a 50 percent fall in income over a two-year period climbed from 7 percent in the early 1970s to over 12 percent in the early 2000s. Furthermore, Batchelder (2003) pointed to the *vertical* inequity aspect of tax penalties, arising from the fact that the incomes of disadvantaged individuals fluctuate relatively more than the incomes of affluent individuals, as well as from the high effective marginal tax rates at lower incomes due to the claw-backs on refundable tax credits. Finally, increasing numbers of individuals are leveraging the so-called sharing economy web applications, such as Airbnb and Uber, to become micro-entrepreneurs. For all of these reasons, it is opportune to provide recent evidence on the interaction of tax policy and income volatility. The purpose of this paper is to quantify the magnitude of the tax penalty over intervals of six years in Canada from 1993 to 2010 and to re-examine the policy issue of income averaging.[2]

Numerous authors have illustrated the 'fluctuation penalty' using simple numerical examples of hypothetical income profiles.[3] Salyzyn (1984), for example, calculated the tax implications of a rising schedule of marginal tax rates with an arbitrary six-year stream of uneven incomes. He compared the taxpayer's total burden with the outcome that would be achieved under alternative income averaging schemes. Yet, little is known about the sizes of the tax penalties that people *actually* experience, since the magnitudes will depend on the empirical distributions of individuals' incomes. We use longitudinal data and a tax simulator to compare the income tax paid by individuals with the tax burden they would have faced had their observed average real income been equally distributed over the years.[4] We examine how

[2]The tax penalty that we shall measure is post any adjustments to the timing of income receipts that individuals might make to smooth their taxable incomes across years. In the absence of such tax planning, the tax penalties would likely be higher. Income averaging provisions reduce an inequity between taxpayers who are and are not able to manipulate the timing of their taxable income.

[3]The term 'fluctuation penalty' appears to originate with Schmalbeck (1984). We will use that expression and 'tax penalty' interchangeably.

[4]The only previous empirical study of the fluctuation penalty is by Batchelder (2003), who used the Panel Survey on Income Dynamics (PSID) for the period 1968-1992. Unlike

the tax penalties vary quantitatively over the income spectrum and across broad classifications of differentially risky occupational choices. The overall average size of the tax penalty is small, but it can be substantial for some individuals. Hence, we also show the size distribution of the tax penalty for the period 2005-10. Finally, we undertake counter-factual tax simulations to evaluate the effectiveness of several previously existing or proposed income averaging methods. The results of our analysis provide factual evidence that is relevant to the policy debates on the equity and risk-taking dimensions of progressive taxation and income averaging. Calls for reinstating income averaging in the federal tax code include Batchelder (2010) in the United States and Mintz and Wilson (2002) in Canada. The lessons are also applicable elsewhere, as only very limited forms of income averaging exist in various OECD countries. In particular, the UK, France, Netherlands, and Germany, among others, allow block averaging for the royalties received by artists and other specific incomes.

The data consists of five overlapping panels of large samples of Canadian workers spanning from 1993 to 2010. As the federal statutory personal income tax rates were unchanged between 2005 and 2015 and the tax brackets were fully indexed with inflation as of 2000, the fluctuation penalties that we estimate from the last available panel provide a fairly accurate picture of the recent state of affairs.[5] Major personal income tax reforms in the late 1990s and early 2000s provide indications as to how tax penalties respond to changes in marginal tax rates. Our calculations of tax burdens are

our study, Batchelder converted the annual family incomes to 2001 dollars and then applied the 2001 federal tax code to every year. The counterfactual case of constant income was based on a mixture of households present in the data for 10 to 25 consecutive years. Based on her analysis, Batchelder proposed a reform to the structure of the Earned Income Tax Credit in the United States, as well as a provision for carrying back basic deductions, to reduce the fluctuation penalty on low-income households.

[5]There have been some increases in provincial income tax rates since 2010 and the federal government added a new marginal tax rate on incomes above $200,000 in 2016. It is likely that these changes have exacerbated the fluctuation penalties faced by some taxpayers.

affected not only by the statutory federal and provincial personal income marginal tax rates, but also by surtaxes and the standard deductions and tax credits, as well as tax-assisted retirement savings plans. We classify individuals as employed in a wage/salary job, unincorporated self-employed, or incorporated self-employed. The focus on wage/salary employment versus self-employment is interesting because some forms of self-employment are regarded as entrepreneurial. Successful entrepreneurs often create jobs and technological advances. The question as to whether progressive marginal tax rates discourage self-employment is therefore an important policy issue, as suggested above in Vickrey's second remark. The further distinction between unincorporated and incorporated self-employed workers is motivated by the observation of Larochelle-Côté and Uppal (2011), that the cross-sectional variance of incorporated self-employment income is roughly halfway between the wage/salary group and unincorporated self-employment income. The tax treatment of capital gains is especially relevant for the incorporated self-employed, who may accumulate value in their businesses over many years before selling their equity. Indeed, the desire to moderate the impact of progressive tax rates on realized capital gains was a factor in the setting of preferentially low tax rates on capital gains (Pechman, 1977: 117).

The analysis is related to several strands of literature. The first is the recent empirical work on changes in income volatility. Even with no changes to the tax code, the tax penalty would generally rise with volatility. The second strand is the estimation of the incentive effects of progressive taxes on self-employment, since the self-employed are known to have relatively unstable incomes. A third strand addresses whether income averaging schemes are practical and justifiable on equity or efficiency grounds. We discuss these topics below.

The remainder of the paper is organized as follows. Section 2 provides a review of the related literature. Section 3 provides a conceptual framework for estimating the sizes of the tax penalties. Section 4 describes the data

and the procedures used to calculate income volatility and the tax penalties. Section 5 presents the results on income volatility, effective marginal tax rates, and the sizes of tax penalties. Section 6 discusses alternative income averaging schemes. Section 7 reports on the simulation results of income averaging. Section 8 concludes.

2 Literature Review

2.1 Rising Income Volatility

The average size of the year-to-year variation in the earnings of individuals can be measured by the transitory component of the total variance of longitudinal earnings in a population of workers. Estimates by Moffitt and Gottschalk (2012) showed a marked increase in the transitory component of the variance of male earnings in the United States during the 1970s and 1980s and its continued high level through to 2004. These results are corroborated by other studies using various empirical approaches, including Gottschalk and Moffitt (1994, 2006), Haider (2001), and Shin and Solon (2011). Hacker (2004) found that the year-to-year variation in family incomes more than doubled between 1974 and 1998. These observations have motivated renewed calls for income averaging in the United States (see, e.g., Batchelder, 2010). For Canada, Baker and Solon (2003) also found increases in the transitory variance of earnings over the period 1976-1992, while Ostrovsky (2010) found that the rising transitory variance contributed to more inequality in the 1990s and into the 2000s. Beach *et al.* (2010) examined rolling windows of data from 1982-2006 to observe a decline in the transitory variance for men and women in the late 1980s, but a resurgence in the late 1990s and early 2000s. Other things held equal, the increased fluctuation of incomes since the elimination of income averaging in the United States and Canada in the 1980s can be expected to have aggravated the tax penalty from progressive taxation.

2.2 Success Tax on Self-Employment

Gentry and Hubbard (2000, 2005) referred to the tax penalty, arising from the application of progressive marginal tax rates to the uncertain incomes of entrepreneurs, as a 'success tax' (because successful entrepreneurs face higher marginal tax rates) and they estimated that it has a substantial deterrent effect on self-employment in the United States. They used a proxy for the tax penalty, equal to the difference in marginal tax rates for a hypothetical doubling and halving of the observed income of a self-employed person in the data. Wen and Gordon (2014) estimated the tax penalty on self-employment income using the mean and variance from cross-section estimates of the earnings equation for self-employed workers in Canada. A tax simulator was used to calculate the fluctuation penalty for each individual in the sample, based on repeated draws from the fitted earnings equation, conditional on the observed characteristics of each individual. The tax penalty was found to have a statistically significant, but economically modest, negative impact on self-employment rates in Canada. In the current paper, we compute directly the fluctuation penalty of each individual using the intertemporal dimension of panel data. The previous studies suggest that the fluctuation penalty has adverse incentive effects toward risky occupations.

2.3 Income Averaging Experiences

An older literature addresses whether income averaging schemes are practical and effective. Many averaging methods have been tried by various governments and still more have been proposed. Section 6 will provide more details on the mechanics of standard income averaging methods. The general purpose of income averaging is to make the tax assessment period correspond more closely to the economic planning horizon of taxpayers, rather than an arbitrary annual period. Suggestions of three- to five-year horizons are gener-

ally believed to be adequate for this purpose.[6] The United States introduced general income averaging in 1964 and increased the amount of income that could be averaged in 1969. This was a backward-looking averaging scheme that applied to all types and sources of income, but it was restricted to apply only to taxpayers who experienced increases in income. The income averaging law was repealed in the 1986 Tax Reform Act, which also greatly flattened the tax schedule. In Canada, block averaging was available to farmers and fishermen beginning in 1950. A general income averaging scheme, very similar to the policy in the United States, was introduced in 1972, along with forward averaging by the purchase of an income-averaging annuity contract (IAAC).[7] The IAAC instrument and the general averaging provisions were replaced by a new forward income averaging mechanism in 1982. The new policy permitted taxpayers with large positive income changes in any year to reallocate the increases to future years, when they expected to be in a lower tax bracket. Forward averaging and block averaging were terminated in 1988, at the same time as the number of tax brackets was collapsed from 10 to three (but increased later to four).

Davies (1977) was critical of the general income averaging provision used in practice in Canada. Based on various hypothetical one-time increases of a taxpayer's income in the final year of the period 1971-1975, he inferred that averaging was rather ineffective at reducing tax liabilities relative to taxing five-year moving averages of income.[8] Furthermore, averaging reduced marginal tax rates by less than 1.6 percentage points in most scenarios, militating against any serious efficiency argument for the policy. Davies also re-

[6] Hacker (2004) noted that transitory income shocks tend to dissipate in three years.

[7] A taxpayer claims a tax deduction for the purchase price of an IAAC and pays tax later as future payments from the annuity are received. In effect, the IAAC enables taxpayers to spread out over a number of years the taxation of certain types of irregular incomes that might otherwise push a taxpayer into a higher tax bracket.

[8] Davies (1977: 170) found that averaging did "not provide benefits for one-time increases in income of 20 percent over constant incomes and for continuing increases in income of less than 11 percent."

garded the existing averaging provisions as being exceedingly complex, with taxpayers receiving post-filing tax rebates that they neither expected nor understood. He advocated a simple moving average of income as the base for taxation. Schmalbeck (1984) criticized the U.S. version of general income averaging because of its lack of uniformity in reducing the fluctuation penalty, and hence contributing to horizontal inequity, due to deliberate limitations imposed in the legislation. In particular, he argued that Congress made it difficult to achieve eligibility for averaging early in a person's career and disallowed averaging in years when income declines. Schmalbeck was sympathetic to an outright repeal of the income averaging provisions. Forward averaging via the IAAC in Canada was also perceived to have drawbacks. It benefited predominantly high-income taxpayers. In 1979, tax filers with incomes over $50,000 accounted for 87 per cent of all IAAC deductions made in that year (Ministry of Finance, 1981). Finally, the repeal of general forward averaging in 1988 followed criticism that the policy favored the rich and could be manipulated to serve as a tax-assisted retirement savings plan. The policy favored the rich by virtue of a withholding tax on the forwarded amount of income, since the witholding tax was charged at the top marginal tax rate. Although the taxpayer would be refunded the amount of the withholding tax in the year that the forwarded income amount was added back to taxable income, taxpayers in lower tax brackets effectively lost the time value of the excess tax they initially would have to pay.

These studies warrant further efforts at gauging the potential benefit of reintroducing less restrictive and better designed income averaging methods into the present tax code.

3 Conceptual Framework

The concept of the fluctuation penalty and its estimation can be clarified with a more formal discussion. Suppose each individual's annual income, y,

is a random variable that follows a distribution $f(y; a, b)$, where $\underline{a} < a < \overline{a}$ is an ability parameter and $\underline{b} < b < \overline{b}$ is a parameter indexing other determinants of income, such as demographic characteristics and attitudes toward risk. The ability parameter will allow us to address issues of vertical equity, while the demographics or taste parameter is relevant for issues of horizontal equity. For example, b may represent factors that influence the occupational preferences of an individual between jobs requiring the same skill.

Suppose that the conditional mean and variance of an individual's income are given by $E(y; a, b)$ and $V(y; a, b)$. An individual's personal income distribution interacts with the income tax schedule, denoted by $S(Y)$, where Y is the income of a taxfiler. The tax schedule induces a frequency distribution for the tax liability $T(y; a, b)$ of an individual, given his or her characteristics $\{a, b\}$. The conditional expected value of an individual's tax liability is $E[T(y; a, b)]$.

The concept of the fluctuation penalty $P(a, b)$ is based on the difference between the expected tax liability and the tax liability evaluated at the expected income of the individual; that is, $P(a, b) = E[T(y; a, b)] - T[E(y; a, b)]$. This difference represents the numerator of any measure of the fluctuation penalty. It will be positive for any individual with a positive income variance when the tax schedule is strictly convex, that is, with the derivatives $S'(Y) > 0$ and $S''(Y) > 0$. We report the empirical results in terms of the conventional concept of a taxpayer's average tax rate. The measure of the fluctuation penalty is then the change in a taxpayer's average tax rate, $\Delta ATR = P(a, b)/E(y; a, b)$.[9]

Horizontal equity can be interpreted in this context as requiring that the tax penalty, for a given ability level a, not vary with the characteristics b. If, at any given skill level, the choice between differentially risky occupational

[9] An alternative measure is to express the tax penalty as a proportion of disposable income, $(E(y; a, b) - T[E(y; a, b))$, which is a proxy for the level of consumption in a taxpayer's utility function, as in Wen and Gordon (2014).

choices are influenced by b, then horizontal equity requires that $P(a, b') = P(a, b'')$ for any $b' \neq b''$. In contrast, vertical equity can be interpreted as requiring that the tax penalty not be decreasing with ability, i.e., $P(a', b) \leq P(a'', b)$ for any $a' < a''$. In practice, income level is a proxy for ability.

We obtain $P(a, b)$ by estimating $E[T(y; a, b)]$ and $T[E(y; a, b)]$ with six years of income data per taxpayer. That is, $E[T(y; a, b)]$ is estimated by $\sum_{t=1}^{6} T(y_t; a, b)/6$ using the results of the tax and credit simulator when applied to an individual's observed income, y_t, in each year t that he or she is in a panel, while the mean income of an individual is estimated as $\sum_{t=1}^{6} y_t(a, b)/6$. The estimate of the numerator of any tax penalty is therefore given by $\widehat{P}(a, b) = \sum_{1}^{6} T(y_t; a, b)/6 - T\left[\sum_{1}^{6} y_t(a, b)/6\right]$. The results are reported in terms of average values of the fluctuation penalty in different income ranges and for broad occupational classifications. The size distribution of the tax penalty is presented for the last panel. We have abstracted from price inflation in describing the conceptual framework. Below we will explain how we deal with inflation.

4 Data and Procedures

4.1 Data

We use confidential files of the Survey of Labour and Income Dynamics (SLID) collected annually by Statistics Canada. Each panel is a survey of 15,000 individuals from 10 Canadian provinces, excluding Indian reserves. The individuals are interviewed for six consecutive years and every three years a new sample is surveyed, making two panels overlap for three years. The panels commenced in 1993, 1996, 1999, 2002, 2005 and 2008. The panel that began in 2008 is incomplete (covering only four years) and hence we exclude it from our study. For brevity, we will label the five panels that we use as panels 1, 2, 3, 4, and 5. Thus panel 5 spans the years 2005-2010. We restrict our sample to individuals who are in a panel for at least five years,

report never being out of the labour force (though they may have spells of unemployment), and have average annual incomes above $8,000 (in constant 2012 dollars).[10] The restriction to average incomes over $8,000 is intended to exclude individuals with marginal presences in the labour market. The $8,000 threshold is arbitrary, but roughly matches the earnings of an individual earning a legislated minimum wage for 20 hours per week for 40 weeks per year. After the restrictions are imposed, there remains about 7,250 individuals per panel. Total income is defined as the sum of labour market earnings, capital gains and investment income, alimony and other income, including social insurance benefits from the Canada/Quebec Pension Plan and Employment Insurance. Income information for the main earner's spouse and the number of dependent children is also obtained from the SLID. The spousal income and dependents variables are used to determine eligibility for various income tax credits. The designation of unincorporated self-employed workers and incorporated self-employed workers is based on a self-identification variable in the SLID.

Table 1 reports the summary statistics for the five panels (in constant 2012 dollars). Average real income is increasing with each subsequent panel and the coefficient of variation of income across the sample is significantly higher in panel 5 (2005-2010) than in panel 1 (1993-1998). The average income of the incorporated self-employed is the largest among our three categories of employment.

TABLE 1 HERE

[10]Note that the average annual income restriction does not preclude individuals from having incomes below $8,000 in some years. In the cases where an individual is in the data for only five years, we construct the fluctuation penalty over five years, instead of the usual six.

4.2 Procedures

In order to estimate the sizes of the fluctuation penalties, we first calculate the tax liabilities of every individual in the counter-factual case in which they receive a constant stream of real income. To do this, each income source of an individual, for every year in the panel, is converted to 2012 dollars using the Consumer Price Index (CPI) and then averaged. Once an individual's average real (i.e. constant dollar) income, from each source, is obtained, it is put back into nominal (i.e. current dollar) terms for each year in the panel, in order to calculate the annual nominal tax liabilities in the relevant years, using the Canadian Tax and Credit Simulator (CTaCS) (Milligan, 2012).[11] These annual amounts are then converted back into 2012 dollars and summed to obtain a hypothetical six-year total real tax liability for the individual. The tax calculations include the working income tax benefit (WITB), but exclude federal family benefit programs, that are delivered through the personal income tax system as refundable tax credits (mainly the Canada Child Tax Benefit and the Goods and Services Tax Credit).[12]

The hypothetical six-year total real tax liability on the nominal equivalent of constant real income is to be compared with the individual's total real tax liabilities, determined by CTaCS, for the individuals' observed nominal incomes over the six years of a panel.[13] The six-year total tax difference is divided by the six-year total real income of the individual, in order to arrive

[11] CTaCS is a very detailed simulator, containing an exhaustive list of federal and provincial tax rates, deductions, credits, and income thresholds, that are specific to each tax year.

[12] The WITB is a refundable tax credit, available since 2007, to provide tax relief for eligible working low-income individuals and families. In 2007, the tax credit was 20 percent of earned income in excess of $3,000, up to a maximum benefit level of $500 (e.g., for a single person); the benefit was clawed back at the rate of 15 percent, once the recipient's earnings exceeded $9,500 (for a single person). The credit rate increased to 25 percent in 2009. The WITB increases the effective marginal tax rate of low-income individuals with positive net federal tax liabilities.

[13] While the data in the SLID contains the taxes actually paid by each person, CTaCS is used nonetheless to calculate the tax liabilities for the observed incomes, so that any missing tax-relevant information for an individual will tend to have a neutral consequence for calculating the size of the tax penalty.

at the individual's tax penalty as a proportion of income, i.e., the increase in a taxpayer's average tax rate as a result of variation in income.[14]

The tax simulator takes into account the special tax treatments of capital gains and dividends. However, as the SLID data combines interest income and dividends into a single variable, called investment income, the portion of this that is attributed to dividends is approximated by an allocation rule based on aggregate Canadian data on interest income and dividends for various income bins.[15] The tax simulator does not accommodate carry-forwards (or carry-backs) of business income losses (for the self-employed) or capital losses. Consequently, the size of the tax penalty for certain individuals in a loss position would potentially be overestimated by our method. To address this issue, we examined the incomes of each individual in a panel to determine whether they could be in a situation where observed losses might be carried forward and applied to positive incomes in subsequent years that the individual is observed in the panel. There are relatively few cases in the data where there are non-trivial losses followed by positive incomes. In each panel, we identified less than a dozen potentially problematical cases. For these individuals, we replaced the tax simulator's estimate of their 'actual' tax liabilities with the tax liabilities the individual really paid according to the SLID.[16]

RRSPs A dilemma that must be confronted in estimating the size of the fluctuation penalty is the treatment of Registered Retirement Savings Plans

[14] As the panels are arbitrary 'snapshots' of six consecutive years at different points in the careers of individuals, it is appropriate to treat each year symmetrically by not applying a discount factor to the tax liabilities.

[15] The data are from Statistics Canada's *Taxable Returns: Interim Statistics* (Table 2A or 3A, various years). We aggregate the income intervals into two broad classifications: income above or below $50,000. Within each income category, we calculate the share of dividends as a proportion of the sum of dividends, interest income, and net rental income for individuals.

[16] Our results are not sensititve to using the tax simulator's estimate or the observed tax liability in the SLID for these individuals.

(RRSPs). These are registered personal savings and investment accounts that allow individuals to defer taxes by deducting the current year's contributions from taxable income and paying taxes only upon the withdrawal of the funds in the future. Although the program is intended mainly to promote saving for retirement, RRSPs also enable taxpayers to smooth their intertemporal profile of tax liabilities. This is because the Canadian system permits individuals to access their RRSP savings at any time without penalty.[17] RRSPs can thus serve as a tax planning device, particularly for self-employed individuals. The dilemma with respect to including or excluding RRSP contributions in the tax simulations is that we typically do not observe a taxpayer's corresponding withdrawal of RRSP savings in a six-year long panel. If the longitudinal dimension of the data spanned the entire lifetime of each taxpayer, it clearly would be appropriate to take into account the contributions and withdrawals, in order to determine the effect of tax-assisted savings on lifetime tax burdens. But in a short panel, such as the SLID, subtracting contributions, without necessarily observing the corresponding subsequent withdrawals, leads to an underestimate of the effective tax burden faced by RRSP contributors. Indeed, if a taxpayer's marginal tax rate in the future is the same as the tax rate at the time of contribution, then the present value of the tax paid on withdrawals is equal to the tax saving on contributions. Nevertheless, our estimates of the fluctuation penalty *includes* the tax deduction arising from RRSP contributions, as do the simulations of income averaging policies in Section 7. The SLID data has RRSP withdrawals but it does not report individual contributions to RRSPs. We have estimated each individual's RRSP contribution using a Statistics Canada study by Akyeampong (1999). It shows the average annual contribution to RRSPs by income categories, separately for self-employed and wage/salary employed workers. Using these figures, we impute an RRSP contribution for each person in the

[17] In contrast, in the United States, funds withdrawn from 401(k) plans prior to retirement are subject to penalties of up to 10 percent.

data set.

5 Estimates of the Fluctuation Penalties

The sizes of fluctuation penalties are determined by the interaction of income volatility and the shape of the effective marginal tax rate schedule. Hence, we begin by examining these factors before turning to the tax penalties themselves.

5.0.1 Income Volatility

A measure of a given individual's short-term income volatility is the coefficient of variation (CV)—i.e., the ratio of the standard deviation to the mean—of the individual's annual real income over the six (or five) years the person is in a panel. Figure 1 shows the average value of the coefficient of variation of individual real income in each panel. Volatility is highest in panel 1, though the CV is close to a value of 20 percent in every panel.

FIGURE 1 HERE

Figure 2 shows the average values of real income volatility, across all five panels, by income quintile (as well as for the top 5 percent); the cutoff (in 2012 dollars) for each quintile is also indicated. The figure shows quite strikingly that high income volatility is concentrated at both the lower and the upper tails of the income distribution. The annual real income of an individual varies about 30 percent from its average over a six-year period for individuals earning less than about $26,000 (but at least $8,000) per year (in 2012 dollars) and for individuals earning more than $99,000 per year, which is almost twice the variation in the middle income group. The top

and bottom income groups are therefore the most susceptible to potential fluctuation penalties.[18]

FIGURE 2 HERE

Figure 3 turns to occupational choices. It shows the average real income volatility across all panels, but disaggregated by type of employment: wage/salary, incorporated self-employment, and unincorporated self-employment. As expected, income is much more volatile for self-employed workers, particularly the unincorporated self-employed, than for wage/salary employees. This makes the self-employed potentially vulnerable to fluctuation penalties.

FIGURE 3 HERE

5.0.2 Marginal Tax Rates

More convex tax schedules will tend to be associated with higher tax penalties. The unit of taxation in Canada for the personal income tax is the individual, although certain tax credits are based on family income. The statutory federal personal income tax rates are progressive over four brackets. We summarize the rate structure for 2010, which is the final year of the last complete panel in the SLID. The lowest federal personal income tax rate in 2010 was 15 percent on taxable income below $40,970; the marginal tax rates were 22 and 26 percent on the next $40,971 and $45,080 portions of taxable income, respectively; the highest rate was 29 percent on income over $127,022. Each province imposes tax on personal income at varying rates. The average combined federal and provincial statutory personal income tax

[18] Based on a decomposition of the total longitudinal variance of family incomes into permanent and transitory income components, Garcia-Medina and Wen (2017) found that income volatility for families headed by individuals with less than high school education is about twice that for families with university-educated heads.

rate was 45.08 percent in 2010 (Kerr et al., 2012: Table 1.7). Tax relief is provided through non-refundable tax credits for health costs, charitable donations, and for basic amounts for the taxpayer, dependent spouse, and dependent children.

We calculate the effective marginal tax rate, faced by a given individual, by hypothetically adding $100 to the person's labour market income and recalculating the personal income tax liability using CTaCS. The effective marginal tax rate is then the change in tax liability divided by incremental income of $100. An effective marginal tax rate schedule is constructed by taking the average value of the effective marginal tax rate across individuals and across years in a given panel, income bin by income bin.

Figure 4 shows the average effective marginal tax rate schedule across income groups for the panels 1 (1993-1998) and 5 (2005-2010). The overall average of the effective marginal tax rate (across all income levels) declines from 53 percent in 1993-1998 to 40 percent in 2005-2010.[19] As Figure 4 illustrates, the tax schedule is progressive across the income bins in each panel. In the period 1993-98, the effective marginal tax rate rises from 28 percent for taxpayers in the lowest quintile of incomes to 64 percent for taxpayers in the top 5 percent; in the period 2005-10, the tax rate rises from 19 percent on incomes in the bottom quintile to 44 percent on incomes at the top. Thus the greatest fall in effective marginal tax rates occurred at the upper end of the income distribution.

FIGURE 4 HERE

[19] The observation is corroborated by statutory federal tax rate cuts. The 3% surtax on federal tax payable was partly eliminated in 1998 and completely abolished the following year. In 2000, the marginal tax rate in the second tax bracket was lowered from 26% to 25% and the inclusion rate for capital gains taxation was reduced from 75% to 50%. In 2001, the tax rate for the first bracket dropped from 17% to 16% (and then to 15% in 2005), the second was lowered from 25% to 22%, and the third from 29% to 26%, while a new bracket was established with 29%. There were also numerous reductions in provincial tax rates in 1997, 1998, and 1999.

5.0.3 Fluctuation Penalties

We now come to the main results: the sizes of the fluctuation penalties. Recall that the fluctuation penalties provide a comparison between the six-year (or five-year) total tax liabilities paid by individuals, when they are taxed on the basis of their annual income, and what they would have paid in total, if they had been taxed on their average income, expressed as a proportion of their total before-tax income over the period. Hence, a penalty represents the change in the taxpayer's so-called average tax rate—i.e. an individual's tax liability divided by his or her income. As reference points, the personal income average tax rate, evaluated at the average industrial wage in Canada in 2010, was 15.1 percent, while for individuals earning three times the average industrial wage the average tax rate was approximately 30 percent (Torres et al., 2012).

Figures 5, 6, and 7 present the sample average values of the fluctuation penalty for various classifications of individuals and for different panels. The average values are quite small, because large segments of the working population have incomes that fluctuate little. However, examining the average values is a simple way to ascertain whether the penalty is generally greater for certain groups of individuals or in certain years of the data. After presenting the average values, we will turn to the distribution of the fluctuation penalties.

Average Fluctuation Penalty Across Panels Figure 5 shows the average value of the fluctuation penalty in each panel. The penalty was distinctly highest in panel 1, which is consistent with the previous observation about the relatively higher effective marginal tax rates in panel 1 (1993-98).[20] In

[20]Isolating the effects of changes in the tax code on the fluctuation penalty across panels could be analyzed more systematically using the transplant-and-compare method of Dardanoni and Lambert (2002) and Lambert and Thoresen (2009). Their approach generates a base-independent comparison of different tax schedules, when the pre-tax income distributions in different years are isoelastic transformations of one another. We do not

panel 1, the average fluctuation penalty over the six-year period is 0.34 percentage points of before-tax income, whereas it is 0.26 in panel 5 (2005-10). There is a slight upward trend in the average tax penalty from panels 2 to 5, which likely reflects the additions of a fourth federal marginal tax rate bracket in 2001 and the Working Income Tax Benefit in 2007.

FIGURE 5 HERE

Average Fluctuation Penalty by Income Figure 6 shows how the fluctuation penalty varies across the income spectrum. Only the results for panel 1 and panel 5 are depicted. The fluctuation penalty is highest for poorer individuals. On average, individuals in the first income quintile faced, in effect, a surtax of 0.79 percentage points in the period 1993-98 and 0.63 percentage points in the period 2005-10. This is likely due to the inability to carry forward the basic deduction for taxpayers and their dependents. In contrast, the average penalty on the top 5 percent of incomes was much lower in both panels 1 and 5. These findings suggest that the fluctuation penalty is a source of vertical inequity.

FIGURE 6 HERE

Average Fluctuation Penalty Across Occupational Status Figure 7 provides the average size of the fluctuation penalty in panels 1 and 5, separately for wage/salary employed workers, the incorporated self-employed, and the unincorporated self-employed. It shows that the fluctuation penalty imposes substantially greater burden on self-employed individuals than wage/salary

pursue this, as our interest is in the 'actual' tax penalty, regardless of cause, and because our focus is the most recent panel, which is the relevant one for considering the policy option of reintroduction of income averaging provisions.

workers. In panel 5, for example, the fluctuation penalty is about 0.17 percentage points for wage/salary workers, but 0.65 and 0.89 percentage points for incorporated and unincorporated self-employed individuals, respectively. This observation raises efficiency concerns. If individuals make an occupational choice between relatively risky self-employment and regular employment partly on the basis of the expected pecuniary rewards, then the fluctuation penalty has the potential of discouraging some self-employment. Furthermore, self-employed taxpayers may waste resources by spending time and effort to change the natural timing of their income receipts. Figure 7 also shows that the average fluctuation penalty for each work classification declined between panels 1 and 5.

FIGURE 7 HERE

Distribution of Fluctuation Penalty The average values of the fluctuation penalties are quite small, even if for some groups, such as lower earners and the self-employed, the average tax penalties approach 1 percentage point. However, average values mask the much higher penalties faced by some households. The size of the fluctuation penalty at each percentile of the penalty is shown in Figure 8 (up to the 99th percentile) for panel 5.[21] The 100th percentile is graphed separately, because of the scale. Specifically, Figure 9 shows the average value of the fluctuation penalty in six equal-size ordered groups of individuals comprising the top percentile.

As Figure 8 shows, more than half the population of individuals face a tax penalty very close to zero in the period 2005-10. However, there is also a substantial proportion of individuals facing non-negligible positive tax penalties. The penalty is 0.75 at the 90th percentile and 1.50 at the 95th percentile. At the 99th percentile, the fluctuation penalty rises to over 4 percentage points.

[21] The size of the fluctuation penalty, x, at the nth percentile is defined as the value at which the proportion of the population with a smaller penalty than x is n.

This implies that these individuals paid at least four percent of their average annual income more in taxes per year, than they would have if their real incomes had been constant or they had been able to perfectly average their real incomes over the six-year period.[22] For the six subgroups of individuals in the highest percentile of the fluctuation penalty, shown in Figure 9, the fluctuation penalty ranges from an average of 4 percentage points to an average of 14 percentage points at the top. The highest percentile is composed largely of the self-employed or individuals receiving large capital gains.[23] Figure 10 extends the analysis by showing the proportion of individuals from each income quintile, at various percentile ranges of the fluctuation penalty. For example, 57 percent of taxpayers located between the 95th and 100th percentiles are from the bottom income quintile. The preponderance of low-income individuals facing high tax penalties is vertically inequitable. Figure 10 also suggests horizontal inequity, since it shows that there is a substantial proportion of individuals from each income quintile at every percentile range of the fluctuation penalty.

Rising Income Versus Income Fluctuations One issue that arises in discussions of the potential remedies for fluctuation penalties is the degree to which an individual's additional tax burden arises from income fluctuations *per se* versus sustained increases in income over time (David *et al.*, 1970). The

[22]It is clear from Figure 8 that there are also individuals facing negative penalties, or in other words, fluctuation bonuses. This appears to occur because of work-related tax credits which generate negative effective marginal tax rates for some (low) income levels in Canada (as in many other countries) (Torres et al., 2012). In addition, there have been minor changes in provincial marginal tax rates during the period of the panel. With changing tax rates, it is possible for a taxpayer realizing income in lower tax rate years to pay less tax than a taxpayer with stable income.

[23]The proportion of income from unincorporated self-employment earnings is 5.4 times greater for the individuals in the top 1 percent of the fluctuation penalty, compared to the proportion for the general population in the sample. Similarly, the share of capital gains in the incomes of the top 1 percent of the fluctuation penalty is 4.5 times the share of capital gains for the sample population as a whole. However, even for the top 1 percent of the fluctuation penalty, wage/salary earnings accounts for the largest share of income, at 48 percent.

point is that, if a taxpayer's income is growing, then the fact that the taxpayer will pay higher taxes is regarded by many observers as unproblematic; after all, that is the purpose of progressive taxation. One can still object that the principle of horizontal equity is potentially violated, but the concern is less than in the case of up and down income movements. In order to evaluate to what extent the fluctuation penalty faced by a taxpayer stems from genuine income fluctuations, rather than permanent increases in income, we regress, separately for *each* individual, the taxpayer's real income against a linear trend. Then, for each taxpayer in the panel, we use the fitted values of the simple regression to calculate the size of the 'fluctuation' penalty arising purely from the trend in the taxpayer's income. The size of this hypothetical penalty can be compared with the actual fluctuation penalty, as given earlier. The difference between the actual penalty and the penalty arising from the trend in an individual's income can be attributed to genuine instability of income. Thus, Figure 11 uses panel 5 to illustrate to what extent the tax penalty is driven by income fluctuations *per se*. Figure 11 again provides the percentile distribution of the fluctuation penalty (up to the 99th percentile). The solid curve traces the height of the actual fluctuation penalty at each percentile from Figure 8 and superimposes, as a dashed curve, the counterfactual case where the penalty arises only from the linear trend (positive or negative) in the real income of each taxpayer. The vertical gap between the solid and dashed curves represents the magnitude of the fluctuation penalties after accounting for each individual's income trend. At the 99th percentile, more than half of the tax penalty is due specifically to income volatility.

5.0.4 Summary of Fluctuation Penalties

The main empirical findings can be summarized in the following way. The tax penalty on fluctuating income in recent years is lower than it was in the mid-1990s, mainly as a result of reductions in marginal tax rates. The tax penalty is negligible for most taxpayers, but it remains non-trivial for

many. In the period 2005-2010, 10 percent of taxpayers faced annual tax penalties approaching 1 percent of their income and 1 percent of taxpayers paid an implicit income surtax of over 4 percentage points. Furthermore, the tax penalties are greatest at the lower end of the income spectrum and for the unincorporated self-employed. It must be concluded that the annual tax penalties faced by many individuals is quite large. Thus, for reasons of equity and efficiency, income averaging methods should be considered as a possible remedy. We discuss and evaluate these methods next.

6 Income Averaging Methods

Now that we have assessed the sizes of the fluctuation penalties, we turn to income averaging methods to mitigate them. We quantify the tax liability impacts of three forms of income averaging: the General Averaging Formula (GAF) and the General Forward Averaging mechanism, each essentially as practiced in Canada until 1988; and the adjusted marginal tax rate method proposed by Holt (1949), which has attractive properties. The effect of block averaging, which bases taxation on a moving average of income, is not explicitly quantified, since the tax calculation essentially replicates the procedure for calculating the fluctuation penalty. In theory, block averaging would eliminate most of the fluctuation penalty.[24] We begin with an explanation of the mechanics of the different averaging policies.

6.1 General Income Averaging

The general income averaging formula bases the current year's taxable income partly on a moving average of a given set of preceding years. In order to dispense with minor tax adjustments, an income threshold for eligibility for

[24] In practice, the benefits of block averaging are diminished by a lack of perfect foresight by the taxpayer, since once a block of years has been declared, none of the same years can be used in the next block.

averaging is first established.[25] The general income averaging formula (GAF) can be written as:

$$T(y_t, \overline{y}_{-t}) = T(k\overline{y}_{-t}) + A \times \left[T((1-\alpha)k\overline{y}_{-t} + \alpha y_t) - T(k\overline{y}_{-t})\right] \qquad (1)$$

where y_t is the current year's net income, $\overline{y}_{-t}$ denotes the average net income of the four years preceding year t. $T(y_t, \overline{y}_{-t})$ denotes the payer's tax liability in year t given current income y_t, conditional on the past average $\overline{y}_{-t}$, while $T(y)$ denotes the normal application of the tax schedule at an income level of y. In (1), $k \geq 1$ represents the threshold factor, $0 \leq \alpha \leq 1$ is the weight given to current income, and $A \geq 0$ is a scaling factor.

Let Δy denote the difference between the weighted average income, $(1-\alpha)k\overline{y}_{-t} + \alpha y_t$, and the threshold income, $k\overline{y}_{-t}$, and notice that $\Delta y = \alpha(y_t - k\overline{y}_{-t})$. If ΔT is the corresponding difference in tax liabilities, then

$$\frac{\Delta T}{\Delta y} \equiv \frac{T\left[\alpha(y_t - k\overline{y}_{-t}) + k\overline{y}_{-t}\right] - T(k\overline{y}_{-t})}{\alpha(y_t - k\overline{y}_{-t})} \qquad (2)$$

is the average tax rate for the interval between the weighted average and the threshold income levels. Thus (1) can be written as,

$$T(y_t, \overline{y}_{t-1}) = T(k\overline{y}_{-t}) + A\alpha \times \frac{\Delta T}{\Delta y} \times (y_t - k\overline{y}_{-t}) \qquad (3)$$

The product $A\alpha$ determines the degree to which the average tax rate in

[25] The threshold used in Canada until 1988 was defined as the greater of 110 per cent of net income in the previous year and 120 percent of the average net income in the previous four years. Hence, this precludes averaging in the case where the current year's income is below the previous year's. In addition, an inflation-indexed floor was placed on net income in each previous year for the purpose of calculating the average. Net income is defined as total income less deductions, including pension plan contributions, tuition fees, etc. Further standard deductions for the taxpayer and eligible dependents defined taxable income at the time that the income averaging formula was in use. These deductions have since been replaced with tax credits. For new taxpayers, the minimum past income used in the averaging was given by the sum of standard deductions. See Davies (1977) for more details.

the interval between the weighted average income and the threshold income applies to the wider interval between current income and the threshold. For example, if $A\alpha = 1$, then income averaging is advantageous whenever the payer's marginal tax rate without averaging exceeds $\Delta T/\Delta y$. See David et al. (1970) for a theoretical analysis of the taxpayer's benefits from income averaging under different configurations of the values of k and αA, for both increases and decreases in current income relative to the past. In Canada's experience with the GAF, the parameter values were $k = 1.2$, $\alpha = 0.2$, and $A = 5$.

6.2 Forward Averaging

Forward averaging permits a taxpayer with a significant rise in income to elect to exclude an amount from his or her taxable income in any year. The excluded portion may not exceed the difference between the current-year income and a threshold level that is based on the incomes for each of the previous three years, adjusted upwards by an inflation indexing factor. The threshold used previously in Canada was 110 per cent of the taxpayer's average inflation-adjusted net income over the previous three years. The taxpayer is required to pay a withholding tax on the forwarded amount of income. In any following year the individual may choose add forwarded amounts to the current year's taxable income and receive at that time a tax credit for the withholding tax previously paid. The tax credit is also adjusted for inflation. The key design issues for this method of income averaging are the marginal tax rate used for withholding purposes, and the maximum number of years that the forwarded amount of income can be kept out of taxation. Salyszyn (1984) suggested that the marginal tax rate for the withholding tax be set at the lowest marginal tax rate, and that a three-year limit be placed on a forwarded amount of income before it must be included as taxable income.

6.3 Adjusted Marginal Tax Rates

Another method of income averaging is to determine the tax rates with reference to the taxpayer's moving average of income, but applied to the current year's income. Holt (1949) proposed that a taxpayer's liability in the current year be the sum of two components. First, the normal tax calculation applies to the taxpayer's moving average income. Second, the difference between actual and averaged income is taxed at the marginal rate that would normally apply to the averaged income level. The total tax liability can be expressed as,

$$T(y_t, \overline{y}_t) = T(\overline{y}_t) + MTR(\overline{y}_t) \times (y_t - \overline{y}_t) \tag{4}$$

where $\overline{y}_t$ denotes the five-year average income (including the current year's income) and $MRT(\overline{y}_t)$ denotes the marginal tax rate at an income level equal to $\overline{y}_t$. Holt commented that by this method, "deviations of income above the average are taxed at very nearly the same rate as is used in computing the tax reductions when income deviates below the average" (Holt, 1949: 353). Thus the approach directly addresses the source of the fluctuation penalty, namely the effect of rising marginal tax rates.

6.4 Block Averaging

Block averaging allows taxpayers the option of recalculating their tax liabilities by prorating their income equally over a block of up to five consecutive previous years. At the end of the block of years, any difference between actual taxes paid on unaveraged incomes and those due on the recalculated amount is adjusted by tax credits or refunds. Any number of years between blocks can be left unaveraged, but once a new block is chosen the taxpayer is bound to it and none of the years in it can be used in subsequent blocks. The block averaging method is simpler than the general averaging formula and allows for reductions in income. Drawbacks of the approach are that it increases the number of tax year records that must be kept and requires taxpayers to

anticipate their future incomes in order to optimally select blocks of years for averaging. The Royal Commission on Taxation (Canada, 1966: 262-263) proposed that the block averaging provision be extended from farmers and fisherman to all resident taxpayers.

7 Results of Income Averaging

Recall that income averaging provisions are always voluntary; that is, the taxpayer has the option, but not the obligation, to use income averaging. Consequently, we assume that tax filers use the income averaging provisions only when it is found to be beneficial to them. This is different from the earlier analysis of the fluctuation penalty, where we did not restrict the penalty to being positive. Figure 12 shows the results of three averaging provisions. The General Averaging Formula (GAF) and the Adjusted Marginal Tax Rate method are calculated for the tax year 2010 using panel 5 (2005-2010). In the case of the General Averaging Formula, we take the previous four years of income to form the past average. The Forward Averaging mechanism is implemented by assuming that individuals shift 20 percent of their income forward from 2007 to 2010; the tax liability is the total for the two years. Taxpayers can only invoke and benefit from the GAF if their income in 2010 is at least 15 percent higher than their average income over the previous four years and places them in a higher tax bracket than before.[26] Taxpayers will only gain from forward averaging if their marginal tax rate in 2010 is lower than in 2007, such that shifting 20 percent of income from 2007 to 2010 reduces their total tax liability. Consequently, the set of individuals benefiting from the application of these averaging provisions in a given year differs across methods.

FIGURE 12 HERE

[26] This threshold is less restrictive than the 20 percent threshold previously in force in Canada and was recommended by Salyzyn (1984).

Conditional on receiving a positive tax saving from the application of income averaging, the GAF reduces the average tax rate of individuals in the lowest income quintile by about 0.8 percentage points and by about 0.7 percentage points in the other quintiles. The corresponding reductions in the average tax rate from forward averaging are 1.6 percentage points for the bottom quintile and about 0.5 percentage points in the other quintiles. The adjusted marginal tax rate method yields the smallest average benefits for taxpayers, with average tax rate reductions of around 0.5 percentage points across the quintiles, but there are relatively more beneficiaries under this method. Overall, the tax savings from the averaging provisions are modest, although the average values mask larger benefits for some individuals. Another way to gauge how well each income averaging approach addresses the tax penalty problem is to consider the correlation between the tax penalty and the reduction in the tax liability, as a result of income averaging; a large positive correlation is desirable. We calculate the correlations for a single year, by evaluating each individual's tax penalty in *that* year (i.e., based on the deviation between the actual tax liability and the hypothetical tax liability that an individual would have incurred in that same year, upon earning the individual's six-year average real income). We find a large positive correlation of 80 percent in the case of the adjusted marginal tax rate method, and correlations of 46 percent for general averaging and 10 percent for forward averaging, conditional on receiving a positive tax saving from the averaging provision.[27] Thus, the correlations indicate that adjusted marginal rate method and the general averaging formula target quite accurately

[27] In a given year, most individuals do not benefit from income averaging. In the case of the GAF, for example, taxpayers with decreases or insufficiently large increases in income, compared to the four-year past average, cannot invoke the GAF. About 11 percent of the sample of taxpayers benefit from the GAF in 2010. If we include individuals who obtain zero benefits from the given averaging provision, the correlations decline to 48 percent for the adjusted marginal tax rate method and 43 percent for the GAF. The correlation for forward averaging in this case falls to below 2 percent, which is due to the fact that forward averaging only benefits individuals whose incomes in 2007 were significantly higher than their incomes in 2010.

the individuals who face tax penalties from fluctuating incomes. Either of these averaging provisions, with suitable modifications, can help address the tax penalty. The forward averaging method could serve as a supplemental method.

8 Conclusions

This paper has used longitudinal data to estimate how much individuals are overtaxed in six year intervals, as a result of the use of an annual accounting period for assessing tax liabilities. When marginal tax rates are progressive, individuals with irregular or fluctuating incomes often bear more tax burden than individuals with steady incomes of the same average value, because positive income shocks moves them into a higher tax bracket. It is an important policy issue, which has received little attention in the past three decades. Our results suggest that the fluctuation penalty, while comparatively small on average, poses a substantial disadvantage to some individuals. The penalty raises the average tax rate by nearly 1 percentage point for about 10 percent of individuals and by over 4 percentage points for 1 percent of individuals. The fluctuation penalty is most severe for the low income group, which exhibits relatively volatile incomes and tends to consist of young and less educated workers. Another group with incomes that often fluctuate year by year are self-employed individuals.

Reintroducing income averaging provisions into the tax code has the potential for making the personal income tax system fairer and encourage entrepreneurship. It may also assist the self-employed in saving for retirement, as suggested by Mintz and Wilson (2002). Canada, like the United States, abolished the policy of income averaging for tax purposes in the 1980s, partly because the cost of administering and complying with the provisions was deemed to be unattractive. Nevertheless, there are reasons to reconsider general income averaging provisions in Canada. It has been documented that

income volatility has risen since the 1980s. From the administrative and compliance standpoints, the General Averaging Formula is entirely mechanical, requiring no subjective interpretations of tax law or sophisticated planning.[28] Today most taxpayers file their taxes online using off-the-shelf tax software. Just as tax software stores a taxpayer's previous years' tax information, such as depreciation on the capital assets of self-employed workers, the software easily could calculate the income averaging formulas. Davies (1977) commented negatively on the averaging formula as practiced in the 1970s, as follows: "the averaging provisions are exceedingly complex and are therefore typically done by Revenue Canada after the individual files his normal return. Many taxpayers therefore receive a subsequent rebate without expecting it or knowing anything about the source of the benefit, which gives the refund a very gratuitous quality." This observation is much less pertinent in the present era of online tax filing with tax software.

Our calculations indicate that the General Averaging Formula provides an average tax saving of close to 1 percent of income for taxpayers in the lowest income quintile and slightly less for taxpayers in the other quintiles, when invoking the provision is beneficial for them; and the tax savings are reasonably correlated with the actual tax penalties faced by individuals. The benefit of the provision could be increased and better targeted by reducing the threshold factor and relaxing the requirement that the taxpayer's current income must be greater than the past year's. Alternatives, such as General Forward Averaging and Block Averaging, could also be considered, but they require taxpayers to actively plan the use of the averaging provisions, based on anticipations of their future income levels.

From a welfare perspective, evaluating the net benefits of income averaging depends on several margins. The first is the potential externality from encouraging risk-taking by mitigating the fluctuation penalty. It is theoret-

[28] Veall and Laiken (1980) demonstrate that the benefit from the General Averaging Formula can depend on tax planning in certain circumstances.

ically ambiguous as to whether the market equilibrium exhibits too little or too much entrepreneurship, even if many existing government policies appear to presume the former.[29] Second, income averaging provisions can change the marginal tax rate faced by each taxpayer, which will affect their taxable incomes.[30] Third, the welfare benefits of income averaging will depend on the social planner's aversion to inequality and to horizontal inequity. Finally, income averaging entails a revenue loss for the government and administrative costs, while taxpayers will face compliance costs. An explicit welfare calculation of the net benefit from income averaging is hardly feasible at this time.

Dual income tax systems are another way to deal with taxing volatile incomes. Finland, Denmark, Norway, and Sweden have adopted versions of dual income tax systems, partly to reduce the tax levied on the irregular incomes of small businesses, such as realized capital gains. A dual income tax imposes progressive marginal tax rates on labour income, but applies a low flat tax rate on capital income and corporate income. A challenge for dual income taxation is how to split the income from self-employment into the contributions of labour and capital, since the working hours and productivity of self-employed individuals are unobserved by the tax authorities. The allocation is done in practice by imputing a rate of return on the observed business assets, categorizing this as capital income, and then treating the residual profit as labour income (Sorensen, 2007). Income averaging can be seen as an alternative approach to mitigating the tax penalty on fluctuating and irregular incomes, with the advantage of being based on total income.

[29] See Aghion and Howitt (1991) and Garcia-Penalosa and Wen (2008).

[30] The estimated response of taxable income to an averaging provision is complicated by the fact that the provision will change each taxpayer's marginal tax rate differently, depending on the individual's income volatility.

9 References

References

[1] Aghion, Philippe and Peter Howitt (1992) A Model of Growth Through Creative Destruction, *Econometrica* 60(2): 323–351.

[2] Akyeampong, Eenest B. (1999) Saving for Retirement: RRSPs and RPPs, *Perspectives* (Summer), Statistics Canada - Catalogue no. 75-001-XPE.

[3] Baker, M. and G. Solon, Earnings Dynamics and Inequality among Canadian Men, 1976–1992: Evidence from Longitudinal Income Tax Records, *Journal of Labor Economics* 21: 289–321, 2003.

[4] Beach, Charles, Ross Finnie and David Gray (2010) Long-Run Inequality and Short-Run Instability of Men's And Women's Earnings In Canada, *Review of Income and Wealth*, 56: 572-596, 2010.

[5] Batchelder, Lily L. (2003) Taxing the Poor: Income Averaging Reconsidered, 40 *Harvard Journal on Legislation* 395, 446.

[6] Batchelder, Lily, L. (2010) Household Income Volatility and Tax policy: Helping More and Hurting Less, Testimony Before the U.S. Joint Economic Committee. New York University *Law and Economics Working Papers*, No. 223.

[7] Canada (1966) *Royal Commission on Taxation, Vol. 3* (Ottawa: Queen's Printer).

[8] David, Martin, Harold Groves, Roger F. Miller and Edward A. Wiegner (1970) Optimal Choices for an Averaging System — A Simulation Analysis of the Federal Averaging Formula of 1964, *National Tax Journal* 23(3): 275–295.

[9] Davies, Gordon W. (1977) General Income Averaging, *Canadian Public Policy* 3(2): 164–170.

[10] Dardanoni, V. and P.J. Lambert (2002) Progressivity Comparisons, *Journal of Public Economics* 86: 99–122.

[11] Dynan, Karen, Douglas Elmendorf and Daniel Sichel (2012) The Evolution of Household Income Volatility, *The B.E. Journal of Economic Analysis & Policy* (December).

[12] Garcia-Medina, Cecilia B. and Jean-François Wen (2017) Income Instability and Fiscal Progression, *Canadian Journal of Economics*, forthcoming.

[13] Garcia-Peñalosa, Cecilia and Jean-François Wen (2008) Redistribution and Entrepreneurship with Schumpeterian Growth, *Journal of Economic Growth* 13(1): 57—80.

[14] Gottschalk, P. and R. Moffitt, The Growth of Earnings Instability in the U.S. Labor Market, *Brookings Papers on Economic Activity* 25: 217–272, 1994.

[15] Hacker, Jacob (2004) Privatizing Risk without Privatizing the Welfare State: The Hidden Politics of Social Policy Retrenchment in the United States, *American Political Science Review* 98 (2): 243–260.

[16] Holt, Charles (1949) Averaging of Income for Tax Purposes: Equity and Fiscal-Policy Considerations, *National Tax Journal* 2(4): 349–362.

[17] Kerr, Heather, Ken McKenzie, and Jack Mintz (2012) *Tax Policy in Canada* (Toronto: Canadian Tax Foundation).

[18] Lambert, Peter J. and Thor O. Thorensen (2009) Base Independence in the Analysis of Tax Policy Effects: with an Application to Norway 1992-2004, *International Tax and Public Finance* 16: 219–252.

[19] Larochelle-Côté, Sébastien, and Sharanjit Uppal (2011) The Financial Well-Being of the Self-Employed, *Perspectives of Labour and Income*, Statistics Canada Catalogue no. 75-001-X.

[20] Mintz, Jack, and Thomas Wilson (2002) Saving the Future: Restoring Fairness to the Taxation of Savings, *C.D. Howe Institute Commentary* No. 176.

[21] Haider, S.J., Earnings Instability and Earnings Inequality of Males in the United States: 1967–1991, *Journal of Labour Economics* 19: 799–836, 2001.

[22] Milligan, Kevin (2012) Canadian Tax and Credit Simulator. Database, software and documentation, Version 2012-1.

[23] Ministry of Finance (1981) *Budget Papers, Supplementary Information and Notices of Ways and Means Motions on the Budget Tabled in the House of Commons by the Honourable Allan J. MacEachen Deputy Prime Minister and Minister of Finance, November 12, 1981* (Ottawa: Queens Printer*).*

[24] Moffitt, Robert A. and Peter Gottschalk (2012) Trends in the Transitory Variance of Male Earnings Methods and Evidence, *Journal of Human Resources* 47(1): 204–236.

[25] Ostrovsky, Yuri. 2010. Long-Run Earnings Inequality and Earnings Instability Among Canadian Men Revisited, 1985–2005, *The B.E. Journal of Economic Analysis and Policy* 10(1): Article 20:1–32.

[26] Pechman, Joseph A. (1977) *Federal Tax Policy*, third edition (Washington, D.C.: The Brookings Institution).

[27] Salyzyn, Vladimir (1984) *Taxation of Fluctuating Incomes in Canada*, fourth edition. (Don Mills, Ontario: CCH Canadian Ltd.)

[28] Schmalbeck, Richard (1984) Income Averaging After Twenty Years: A Failed Experiment in Horizontal Equity, *Duke Law Journal* 509: 509–580.

[29] Shin, D. and G. Solon (2011) Trends in Men's Earnings Volatility: What Does the Panel of Income Dynamics Show? *Journal of Public Economics* 95: 973–982.

[30] Sorensen, Peter Birch (2007) The Nordic Dual Income Tax: Principles, Practices, and Relevance for Canada, *Canadian Tax Journal* 55(3): 557–602.

[31] Taylor, Robert C. (1959) Some Reflections on Income Averaging and a Proposal, *Duke Law Journal*: 202–216.

[32] Torres, C., K. Mellbye and B. Brys (2012), Trends in Personal Income Tax and Employee Social Security Contribution Schedules, OECD Taxation Working Papers, No. 12, OECD Publishing. http://dx.doi.org/10.1787/5k95qw9633vf-en.

[33] Veall, M.R. and S.N. Laiken (1980) Current Action to Lower Future Taxes: General Averaging and Anticipated Income Increases, *Canadian Tax Journal* 28(5): 591-599.

[34] Vickrey, William (1947) *Agenda for Progressive Taxation*. (Clifton, N.J.: Ronald Press).

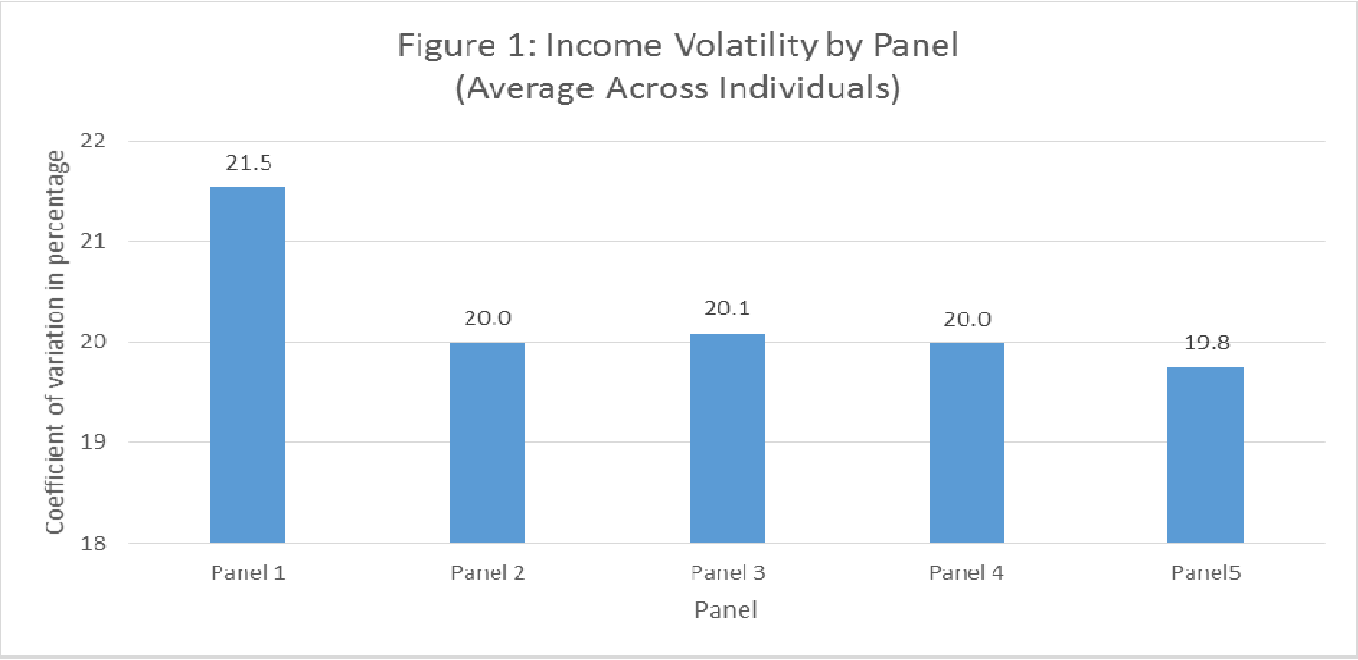
[35] Wen, Jean-François and Daniel V. Gordon (2014) An Empirical Model of Tax Convexity and Self-Employment, *The Review of Economics and Statistics* 96(3): 471–482.

Acknowledgement 1 *The analysis was conducted at the Prairie Regional Research Data Centre which is part of the Canadian Research Data Centre Network (CRDCN). The services and activities provided by the CRDCN are made possible by the financial or in-kind support of the SSHRC, the CIHR, the CFI, Statistics Canada and participating universities whose support is gratefully acknowledged.*

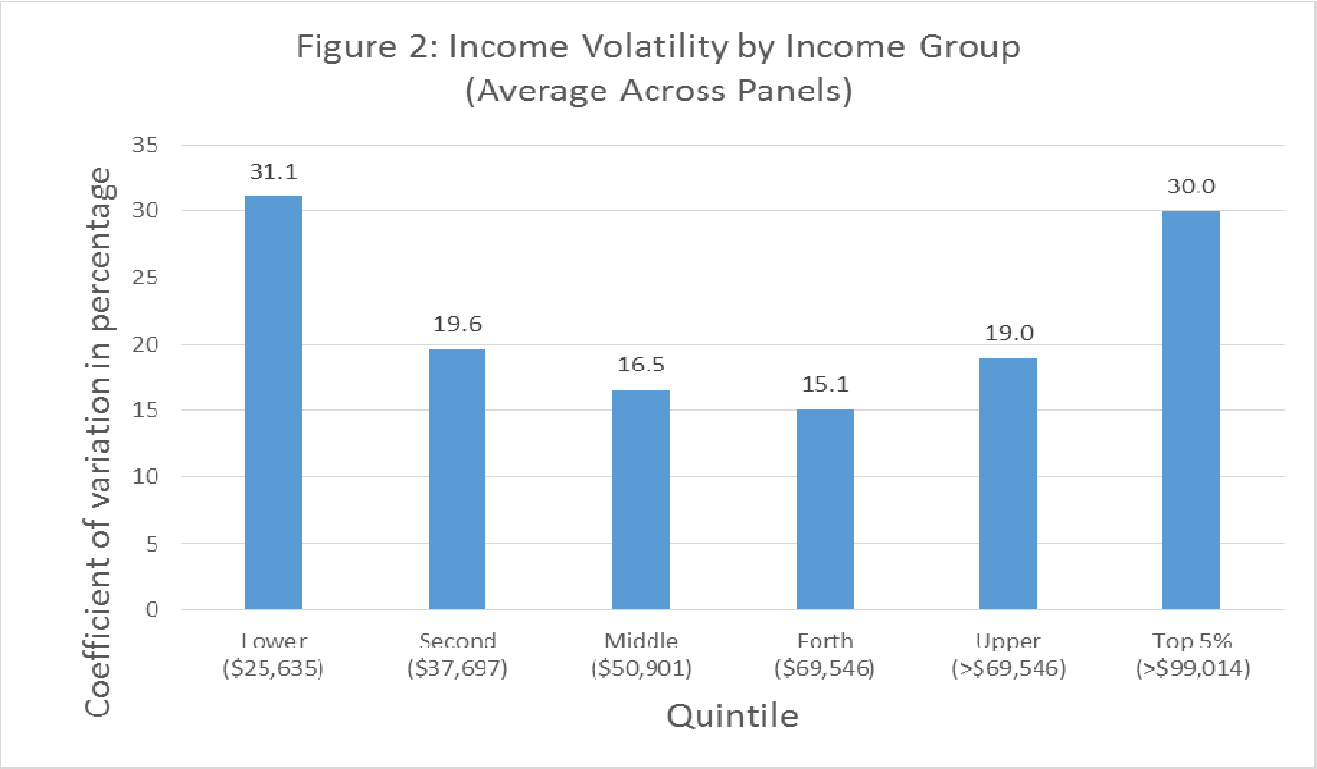
Table 1: Summary Statistics on Income and Tax by Worker Status (2012 Dollars)			
	Mean	Standard Deviation	Coefficient of Variation
Panel 1 1993-1998			
All Individuals: Income	46264.75	41086.98	0.89
All Individuals: Tax	9687.51	14589.84	1.51
Employed Worker: Income	45573.54	31804.01	0.70
Employed Worker: Tax	9479.74	10781.30	1.14
Incorporated Self-Employed: Income	61606.35	90402.97	1.47
Incorporated Self-Employed: Tax	13568.76	32371.87	2.39
Unincorporated Self-Employed: Income	44489.51	73267.75	1.65
Unincorporated Self-Employed: Tax	9631.21	28472.48	2.96
Panel 2 1996-2001			
All Individuals: Income	49588.93	49266.19	0.99
All Individuals: Tax	10430.28	18189.13	1.74
Employed Worker: Income	48936.50	37417.18	0.76
Employed Worker: Tax	10102.70	13040.74	1.29
Incorporated Self-Employed: Income	66362.79	122967.10	1.85
Incorporated Self-Employed: Tax	16314.98	48343.08	2.96
Unincorporated Self-Employed: Income	44023.20	68078.78	1.55
Unincorporated Self-Employed: Tax	9714.07	25927.95	2.67
Panel 3 1999-2004			
All Individuals: Income	51213.36	76035.16	1.48
All Individuals: Tax	10154.07	27886.02	2.75
Employed Worker: Income	50653.53	68764.94	1.36
Employed Worker: Tax	9859.703	20059.9	2.03
Incorporated Self-Employed: Income	64656.22	157957.5	2.44
Incorporated Self-Employed: Tax	15029.62	86634.57	5.76
Unincorporated Self-Employed: Income	48969.04	71677.61	1.46
Unincorporated Self-Employed: Tax	10298.06	25248.87	2.45

Panel 4 2002-2007			
All Individuals: Income	54334.83	60512.1	1.11
All Individuals: Tax	10455.14	20870.5	2.00
Employed Worker: Income	52917.64	47072.43	0.89
Employed Worker: Tax	9937.907	16692.24	1.68
Incorporated Self-Employed: Income	82439.09	146017.2	1.77
Incorporated Self-Employed: Tax	17976.34	43163.43	2.40
Unincorporated Self-Employed: Income	51890.86	88685.26	1.71
Unincorporated Self-Employed: Tax	11361.35	35097.93	3.09
Panel 5 2005-2010			
All Individuals: Income	63281.58	80474.19	1.27
All Individuals: Tax	12215.94	23881.38	1.95
Employed Worker: Income	62252.38	73019.16	1.17
Employed Worker: Tax	11841.31	21049.90	1.78
Incorporated Self-Employed: Income	82666.03	121079.60	1.46
Incorporated Self-Employed: Tax	17515.87	39654.90	2.26
Unincorporated Self-Employed: Income	56159.70	104203.60	1.86
Unincorporated Self-Employed: Tax	11293.29	31420.44	2.78

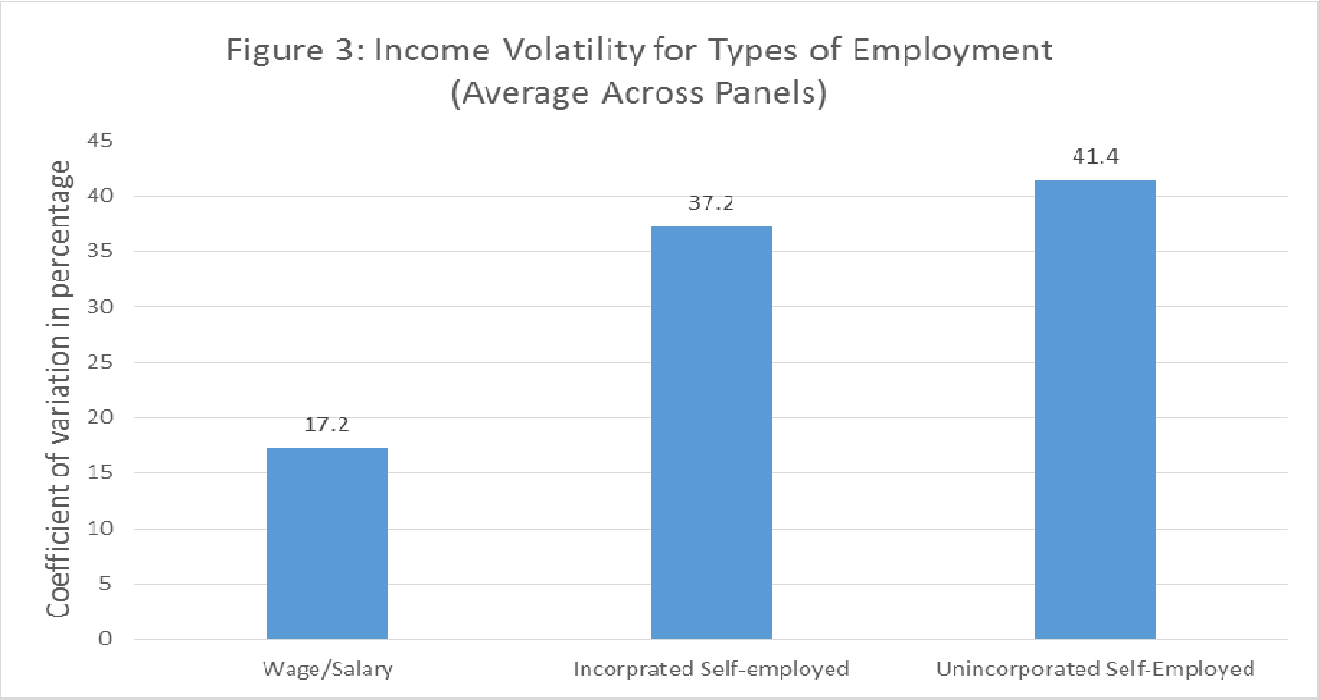
Source: Data are from the Survey of Labour and Income Dynamics, panel 1 (1993-1998) to panel 5 (2005-10). The sample is restricted to individuals who are in the labour force in every year of the panel and have an average income of at least $8,000.



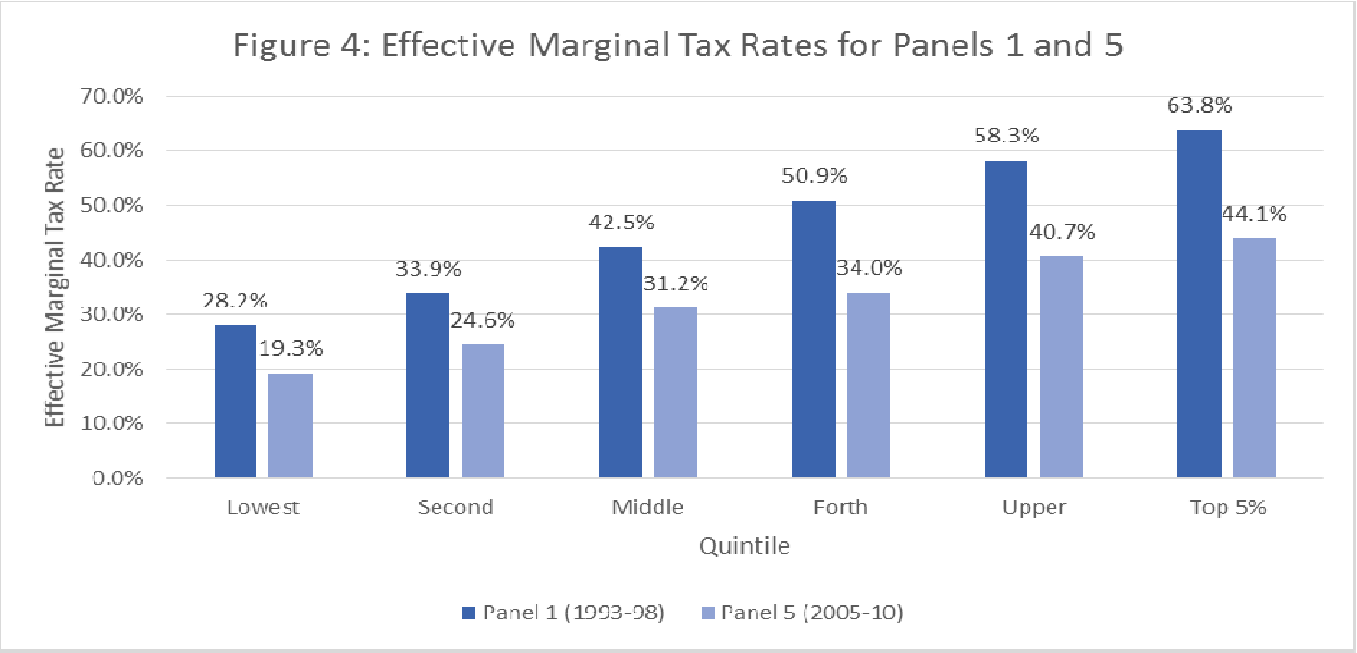
Notes: Average value of the coefficient of variation of individual incomes in panel 1 (1993-1998) to panel 5 (2005-2010) of the Survey of Labour and Income Dynamics



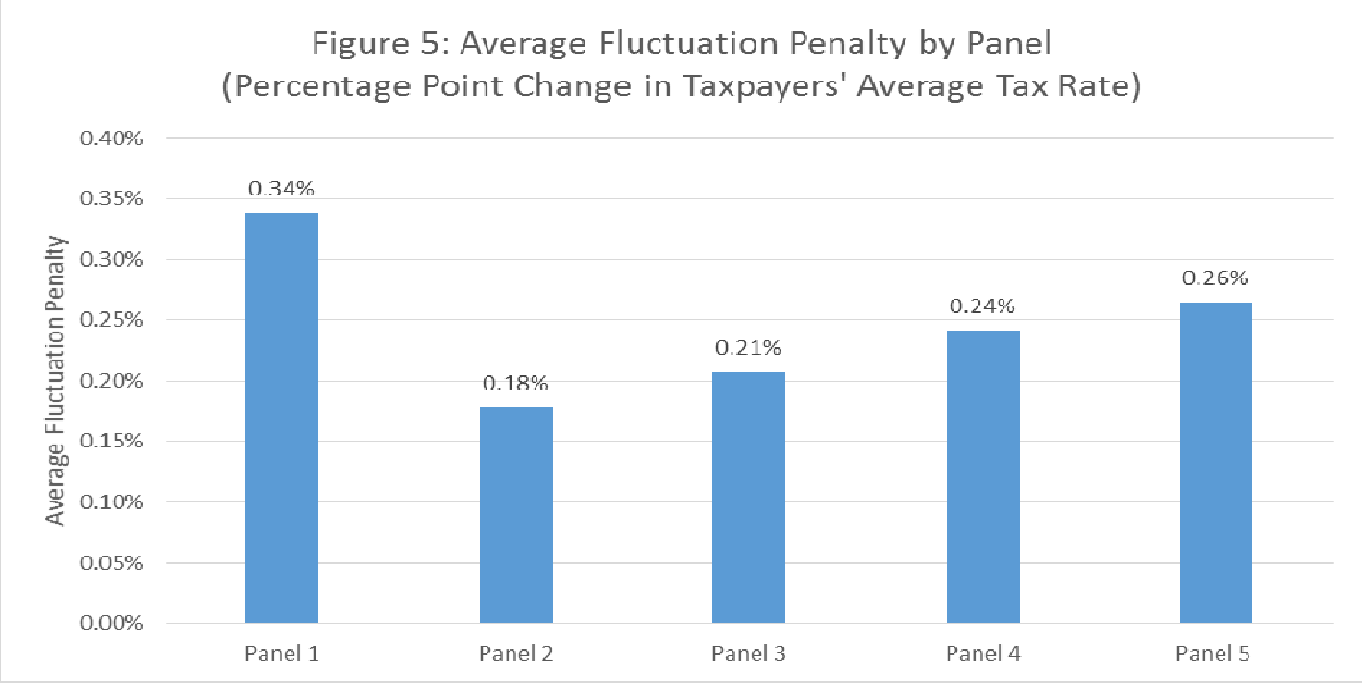
Notes: Values of the coefficient of variation of individual incomes by income quintile (and the top 5%) averaged across individuals and across panels 1 (1993-1998) to panel 5 (2005-2010) of the Survey of Labour and Income Dynamics.



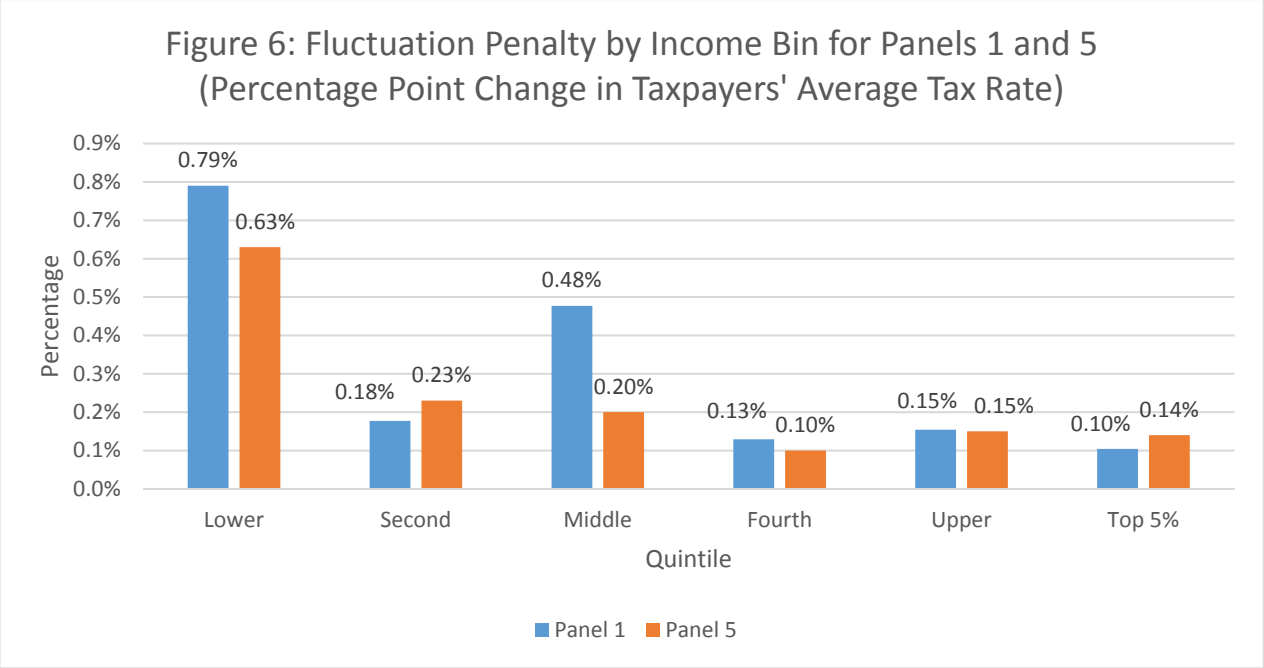
Notes: Values of the coefficient of variation of individual incomes by occupation averaged across individuals and across panels 1 (1993-1998) to panel 5 (2005-2010) of the Survey of Labour and Income Dynamics.



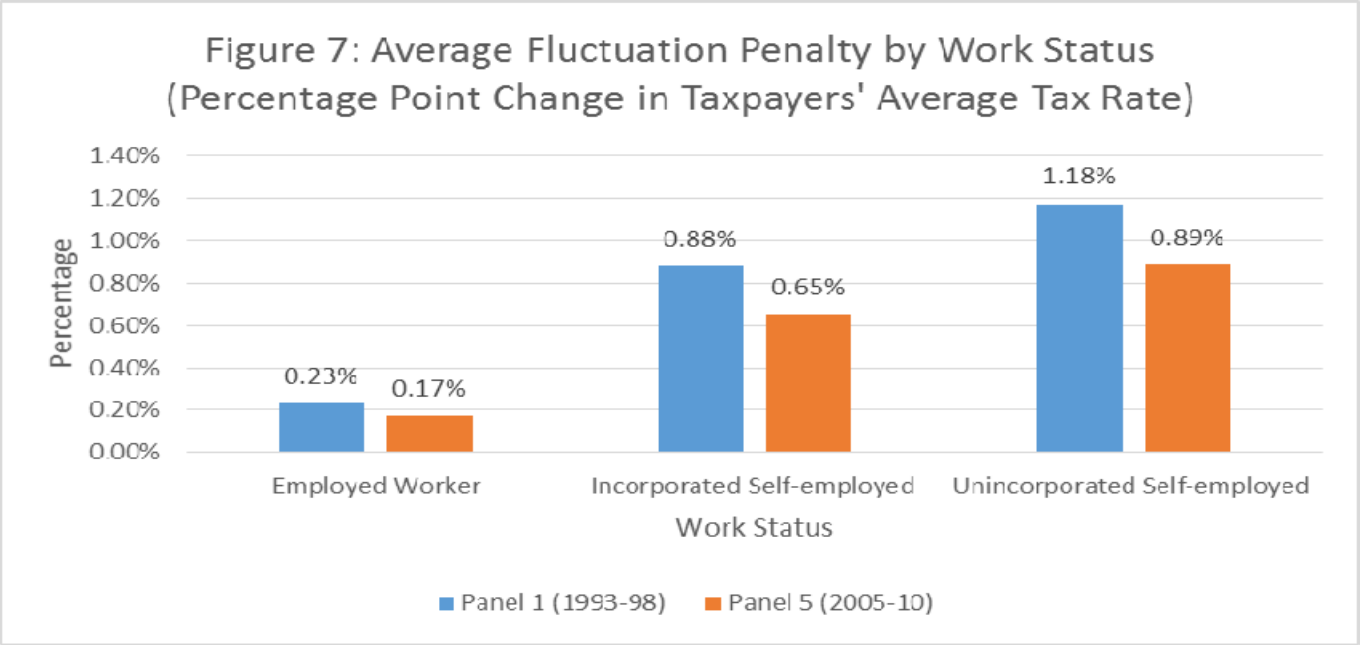
Notes: Effective marginal personal income tax rates, averaged across individuals within each income quintile, for panel 1 (1993-1998) and panel 5 (2005-2010) of the Survey of Labour and Income Dynamics. Marginal tax rates are calculated using the Canadian Tax and Credit Simulator (Milligan, 2007) by adding $100 to individuals' labour incomes and dividing their incremental tax burden by $100.



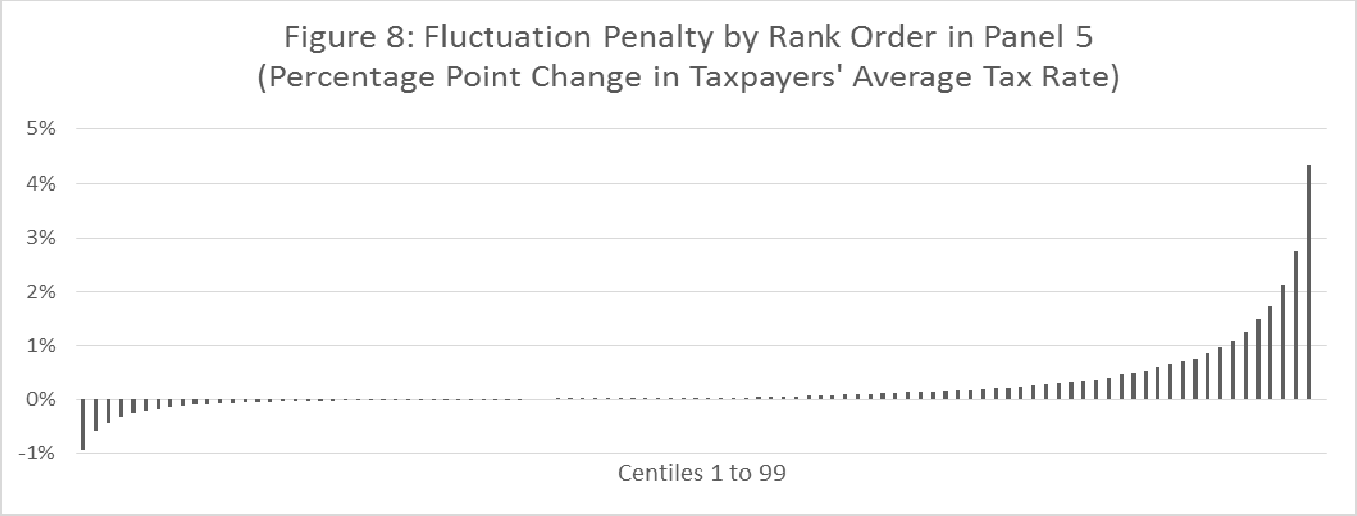
Notes: Average value of the fluctuation penalty of individual incomes in panel 1 (1993-1998) to panel 5 (2005-2010) of the Survey of Labour and Income Dynamics. An individual's fluctuation penalty is the difference between the tax burden on the individual's observed incomes over time and the tax burden for the counterfactual case of an equivalent constant real income, divided by the individuals total income, so as to express the penalty as the increase in the taxpayer's average tax rate due to income fluctuations.



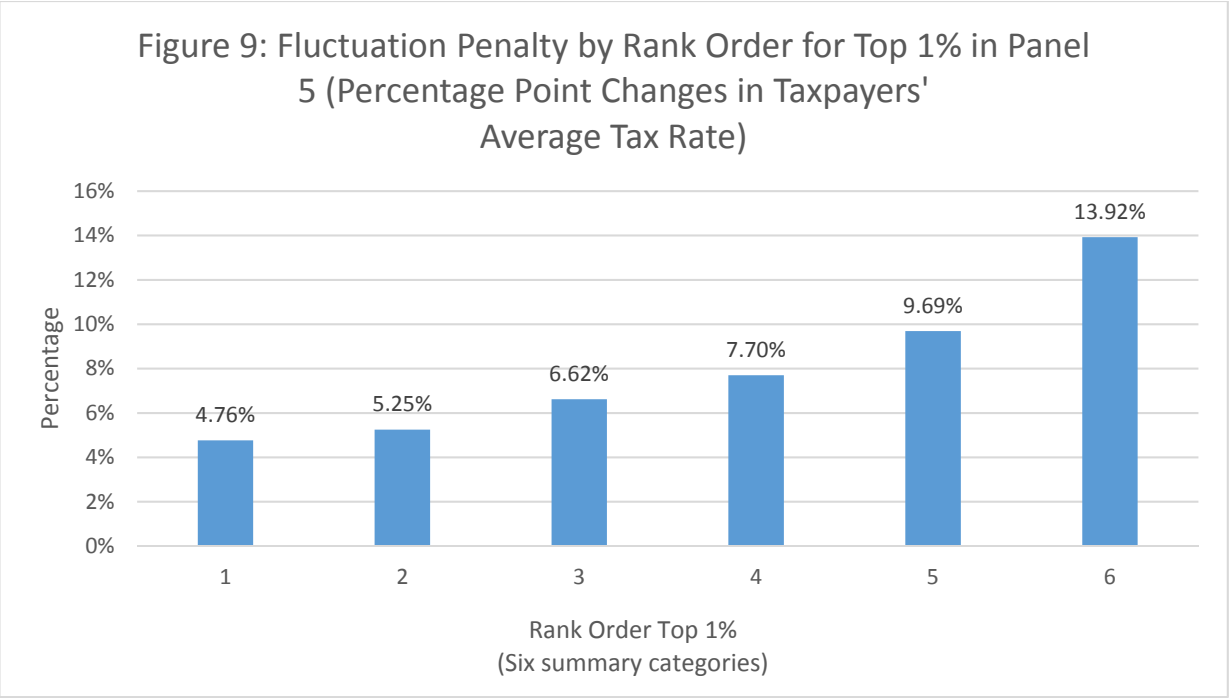
Notes: Average value of the fluctuation penalty of individual incomes in panel 1 (1993-1998) and panel 5 (2005-2010) Survey of Labour and Income Dynamics, shown by income quintile and for the top 5%. An individual's fluctuation penalty is the difference between the tax burden on the individual's observed incomes over time and the tax burden for the counterfactual case of an equivalent constant real income, divided by the individuals total income, so as to express the penalty as the increase in the taxpayer's average tax rate due to income fluctuations.



Notes: Average value of the fluctuation penalty of individual incomes in panel 1 (1993-1998) and panel 5 (2005-2010) of the Survey of Labour and Income Dynamics, shown by occupational category. An individual's fluctuation penalty is the difference between the tax burden on the individual's observed incomes over time and the tax burden for the counterfactual case of an equivalent constant real income, divided by the individuals total income, so as to express the penalty as the increase in the taxpayer's average tax rate due to income fluctuations.

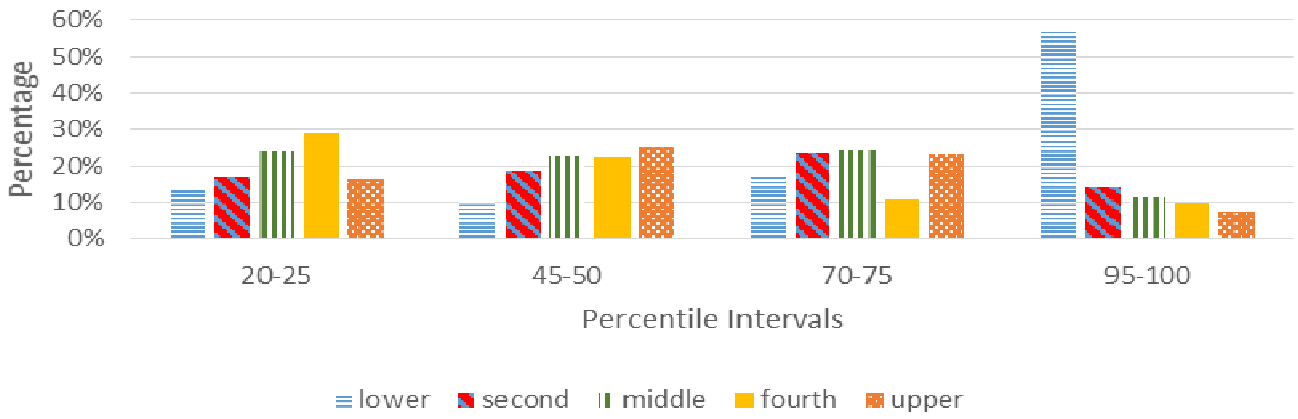


Notes: Value of the fluctuation penalty of individual incomes in panel 5 (2005-2010) of the Survey of Labour and Income Dynamics, at each percentile rank up to the 99th percentile. An individual's fluctuation penalty is the difference between the tax burden on the individual's observed incomes over time and the tax burden for the counterfactual case of an equivalent constant real income, divided by the individuals total income, so as to express the penalty as the increase in the taxpayer's average tax rate due to income fluctuations.

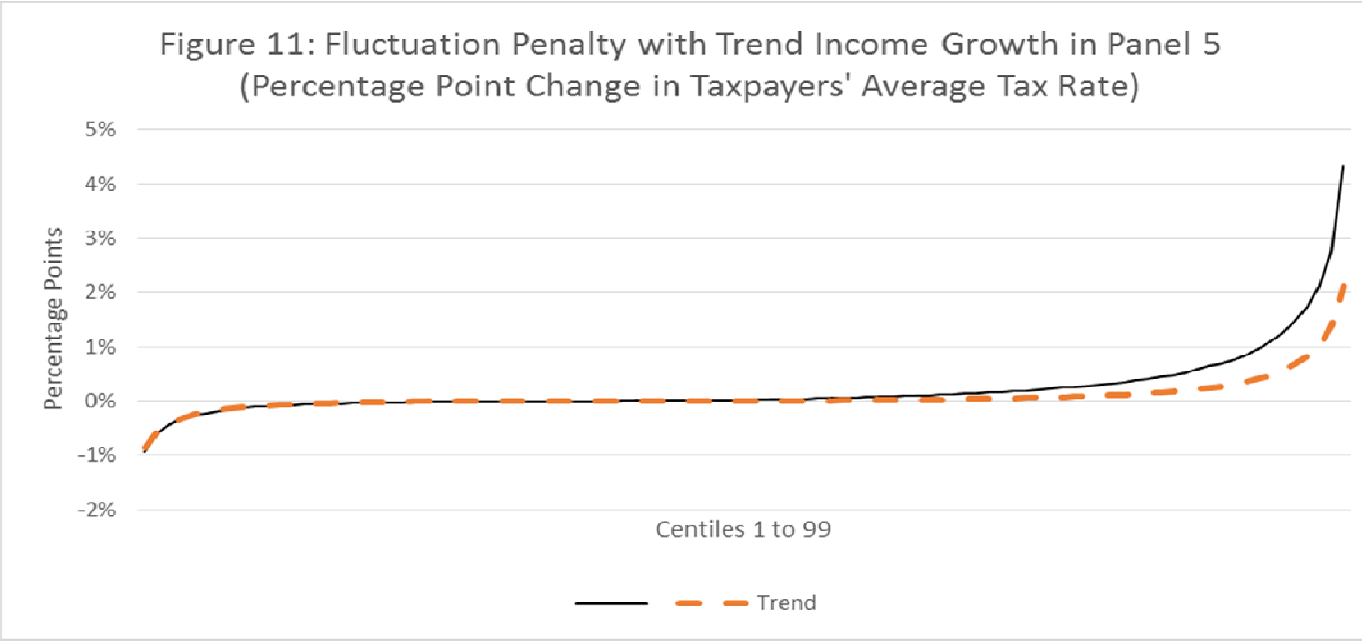


Notes: Average value of the fluctuation penalty of individual incomes in panel 5 (2005-2010) of the Survey of Labour and Income Dynamics, shown for the top percentile in six summary groupings. An individual's fluctuation penalty is the difference between the tax burden on the individual's observed incomes over time and the tax burden for the counterfactual case of an equivalent constant real income, divided by the individuals total income, so as to express the penalty as the increase in the taxpayer's average tax rate due to income fluctuations.

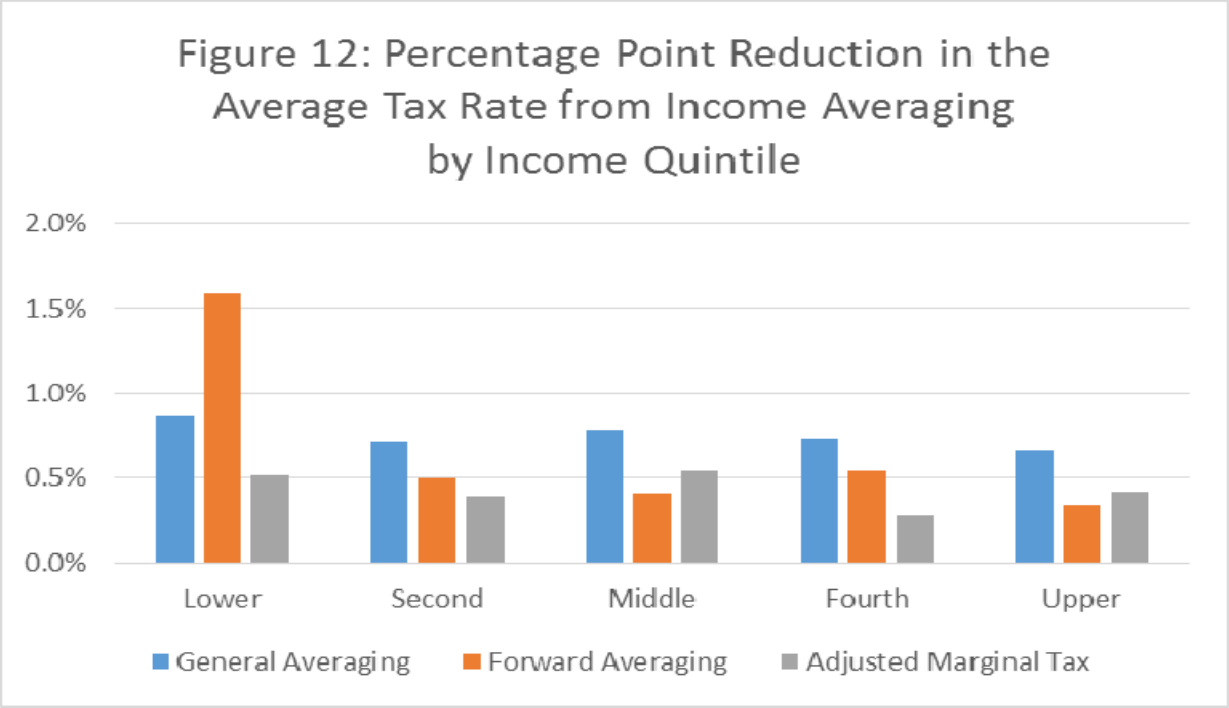
Figure 10
Proportion of Taxpayers in Each Income Quintile, at Selected Percentile Intervals of the Fluctuation Penalty



Notes: Proportion of individuals in each income quintile, at selected percentile ranges of of the fluctuation penalty, using panel 5 (2005-2010) of the Survey of Labour and Income Dynamics. An individual's fluctuation penalty is the difference between the tax burden on the individual's observed incomes over time and the tax burden for the counterfactual case of an equivalent constant real income, divided by the individuals total income, so as to express the penalty as the increase in the taxpayer's average tax rate due to income fluctuations.



Notes: Value of the fluctuation penalty of individual incomes in panel 5 (2005-2010) of the Survey of Labour and Income Dynamics, at each percentile rank up to the 99th percentile. An individual's fluctuation penalty is the difference between the tax burden on the individual's observed incomes over time and the tax burden for the counterfactual case of an equivalent constant real income, divided by the individuals total income, so as to express the penalty as the increase in the taxpayer's average tax rate due to income fluctuations. The solid curve is the actual fluctuation penalty (reproducing the curve in Figure 8), while the dashed cirve is for the hypothetical case in which income grows linearly, based on a regression of individual income against a time trend. The difference between the solid and the dashed curves is interpreted as the portion of the fluctuation penalty attributable to income volatility, rather than income growth.



Notes: Reductions in the size of the fluctuation penalty of individual incomes, for beneficiaries of income averaging methods, using panel 5 (2005-2010) of the Survey of Labour and Income Dynamics, shown by quintile. An individual's fluctuation penalty is the difference between the tax burden on the individual's observed incomes over time and the tax burden for the counterfactual case of an equivalent constant real income, divided by the individuals total income, so as to express the penalty as the increase in the taxpayer's average tax rate due to income fluctuations. Income averaging methods permit taxpayers to smooth their incomes and thereby to reduce the size of the fluctuation penalty.