Income Tax Progressivity and Self-Employment: Evidence from Canadian Provinces

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Abstract:

We examine the effects of personal income tax progressivity — in the sense of rising marginal income tax rate — on self-employment. Our simple analytical framework shows that the impacts of income tax progressivity on self-employment depend on the relative effects of taxing success and the presence of tax evasion opportunities. Empirical estimates using Canadian provincial data for the period 1979-2006 indicate that there is a negative association between income tax progressivity and self-employment. This suggests that the adverse impact of income tax on entrepreneurial risk-taking outweighs the tax evasion opportunities for the self-employed. An important implication of our results is that a reduction in income tax progressivity encourages self-employment. The empirical estimates are robust to the various sensitivity checks.

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1. Introduction

There is a growing interest in the effects of tax policies on self-employment in both academic and political circles. The self-employed are generally viewed as a key source of employment and growth in an economy (OECD, 2001). Consequently, governments often design tax policies in an attempt to promote entrepreneurial activities by the self-employed. What is the effect of personal income tax progressivity on self-employment? Can governments encourage self-employment through income tax cuts?

In most previous studies self-employment is used as a common proxy for entrepreneurship. As a result a number of studies that examine entrepreneurship focus on self-employment and use the self-employed as entrepreneurs. However, only a few studies investigate the effects of personal income tax progressivity on entrepreneurship. Gentry and Hubbard (2000) analyze the impact of tax progressivity on entrepreneurial entry. They show that under a progressive tax system, entrepreneurs pay substantial taxes when they are successful, but when entrepreneurs incur losses, their tax savings are minimal. As a result they argue that a progressive tax schedule can be viewed as a tax on "success" and discourages entrepreneurial entry even if entrepreneurs are risk-neutral. They also find supporting empirical evidence using US household panel data. Keuschnigg and Nielsen (2004) also explore the effects of progressive income tax system on entrepreneurial risk taking in the presence of moral hazard. Their analysis indicates that since the expected income from risky entrepreneurial activities is higher than wage income, progressive taxation redistributes from entrepreneurs to workers, imposes a net

tax on the risky activity, and as a result discourages entrepreneurial entry. Cullen and Gordon (2007), on the other hand, find a result contrary to conventional wisdom. They argue that firms can deduct business losses under the personal income tax system and therefore the government shares the risk taking of entrepreneurs. They show that a reduction in the personal tax rate reduces the risk sharing of governments (as this reduces the tax saving that can be obtained by deducting business losses) and discourages entrepreneurial risk taking.[1] The above studies however ignore the tax evasion opportunity by the self-employed.

A number of empirical studies have examined the effects of taxes on various proxies for self-employment. Like the theoretical analyses, the results of previous empirical studies are also mixed.[2] Robson and Wren (1999) for OECD, Folster (2002) for Sweden, Rosen (2004) for the US, Torrini (2005) for OECD countries, and Mooij and Nicodeme (2007) for European countries find taxes affect self-employment or entrepreneurship negatively. Bruce and Mohsin (2006), on the other hand, find a positive effect using US data. Although there is a vast literature on the relationship between taxation and self-employment, surprisingly there are only very few studies that focus on Canada. For example Schuetze (2002) explores the extent of tax avoidance among the self employed. While Schuetze (2000) focuses on self-employment of males, Kuhn and Schuetze (2001) examine self-employment in men and women separately. Kamhi and Leung (2005) also investigate the trends in self-employment and the various factors that influence total self-

[1] The tax system may also encourage risk taking by entrepreneurs by treating income from self-employment more favourably than wage income.

[2] Chen, Lee and Mintz (2002) and Schuetze and Bruce (2004) provide excellent surveys of the empirical literature on taxation and entrepreneurship.

employment rate in the country. However, none of these studies provides a detailed investigation of the effects of personal income tax progressivity on self-employment or entrepreneurial activity.

The principal objective of this study is to examine the effects of personal income tax progressivity on self-employment in Canada. The study also fills the gap in the literature by providing empirical evidence as to how tax progressivity influence self-employment. Using a personal income tax schedule framework similar to Feldstein (1969) and Kanbur (1982), we analyze the impact of income tax progressivity on self-employment in the presence of tax evasion opportunity. We assume that there are only two kinds of occupation: working for others and self-employment. For the self-employed, income taxation is based to a large extent on voluntary compliance to the tax laws. As a result the self-employed have a great opportunity to avoid taxes relative to wage and salary employees.[3] Thus an increase in income tax progressivity, in the sense of rising marginal income tax rate, symbolizes a greater opportunity for tax avoidance and this encourages self-employment. An increase in income tax progressivity also reduces the return of successful entrepreneurs and dents their risk-taking potentials. This ultimately discourages entrepreneurial activities. Thus our model indicates that the impact of income tax progressivity on self-employment depends on the relative effects of the adverse impact of progressivity on success and the tax evasion opportunity for the self-employed.

[3] The self-employed can also deduct personal consumption from business income (for example business use of automobiles).

We use aggregate panel data from 10 Canadian provinces over the period 1979-2006 to test the implication of the theoretical model. Our empirical findings suggest that personal income tax progressivity discourages self-employment implying that the adverse impact of higher tax progressivity on success outweighs the tax evasion opportunity that may be available to the self-employed. The empirical results are also quite robust to various sensitivity tests. The policy implication of this study is that a reduction in the marginal personal income tax rate that lowers the degree of tax progressivity encourages self-employment.

The remaining part of this paper is organized as follows. In Section 2 we present a simple theoretical model that shows the relationship between self-employment and income tax progressivity. The empirical analysis is presented in Section 3. In Section 4, we conduct robustness checks to our empirical results. Section 5 concludes.

2. Analytical framework

In this section we present a simple model that shows the effects of tax progressivity on self-employment. We assume that there are two groups of individuals: the self-employed and workers. Empirical stylized facts show that the majority of the self-employed do not hire workers (i.e. own account self-employment).[4] Thus as in Parker (1999), we assume that the self-employed (entrepreneurs) work for themselves but they do not hire workers. Entrepreneurial activity is a risky occupation. Thus as in Gentry

[4] See Kamhi and Leung (2005) for a detailed analysis of self-employment and its various components in Canada.

and Hubbard (2000) we assume that it can yield a return, Y_E, if successful or zero otherwise. Working for others, on the other hand, yields a riskless income Y_W (which is the wage rate). Thus individuals choose between a safe job and a risky one based on the return from the two occupations. Suppose we denote the probability of success in entrepreneurial activity by π, then the pre-tax expected return from self-employment would be πY_E. We assume that $Y_W < Y_E$.[5] Let v denote the proportion of the labour force that chooses self-employment.[6] Obviously the returns in the two occupations depend on the number of individuals working in the two jobs. In particular the derivative of the income levels with respect to v are given by $Y_E'(v) < 0$ and $Y_W'(v) > 0$. That is the higher the proportion of the labor force in the self-employment sector, the lower will be the return from self-employment. However as more and more people choose the self-employment sector, there will be less people in the safe job and this increases income for workers.

In Canada, as in many other countries, income from self-employment is taxed as any ordinary personal income at the applicable personal income tax rates after deductions for business expenses. As extensively discussed in the literature, there is a greater tax evasion opportunity for the self-employed than for workers. Thus as in Pestieau and Possen (1991) we assume that it is difficult to evade taxes in the safe job but there is a tax evasion opportunity in the self-employed sector. Following Feldstein (1969) and Kanbur (1982), we also assume that the tax structure is progressive and for the employees it is given as

[5] See Pestieu and Possen (1991) for a somewhat similar assumption.
[6] This is similar to the measure of entrepreneurship commonly used in the empirical literature.

$$T_W = Y_W\left[1-(1-\tau)Y_W^{\rho-1}\right], \qquad (1)$$

where $0 < \tau \leq 1$. T_W and Y_W denote the tax liability and the before-tax income level of employees, respectively. $\rho > 0$ is the coefficient of residual income progression (RIP) and it denotes the degree of tax progressivity.[7] RIP is simply the ratio of one minus the marginal tax rate (MTR) to one minus the average tax rate (ATR).[8] See Musgrave and Musgrave (1989) and Dahlby (2008) for a discussion of alternative measures of tax progressivity. The above tax structure has the following properties. If $\rho = 1$, the tax structure is proportional with a marginal tax rate τ. While $\rho > 1$ shows that the tax schedule is regressive, a lower than unity value for ρ implies a progressive tax structure. Notice that both the marginal and average tax revenue rise with income when $\rho < 1$. Thus in general the lower the value of ρ the greater is the progressivity of the tax structure. As it will be clear later, the above tax formulation is useful to investigate the impact of changes in tax progressiveness (as measured by ρ) on self-employment.

When the self-employed evade taxes there is a probability of detection through auditing. Let the probability of detection be denoted by p. Denote also the share of income that the self-employed conceal from taxation by δ where $0 \leq \delta \leq 1$. The rate of tax evasion δ is assumed to be exogenous. Thus the tax liability of successful entrepreneurs who earn the higher income Y_E and get away with the evasion is given by

$$T_E = (1-\delta)Y_E\left[1-(1-\tau)(1-\delta)^{\rho-1}Y_E^{\rho-1}\right]. \qquad (2a)$$

[7] The coefficient of residual income progression is also the elasticity of after-tax income to the before-tax income.

[8] For our tax schedule, $MTR = \left[1-\rho(1-\tau)Y_W^{\rho-1}\right]$ and $ATR = \left[1-(1-\tau)Y_W^{\rho-1}\right]$

However, if caught through auditing, tax evaders pay the full tax and a certain percent of the amount of tax evaded as penalty (see Yitzhaki, 1974). Let $\mu > 0$ denote the penalty rate. The tax liability of the self-employed that evade taxes and caught through auditing is given by

$$T_E = Y_E\left[1-(1-\tau)Y_E^{\rho-1}\right]+\mu X\ , \qquad (2b)$$

where $X = \left\{Y_E\left[1-(1-\tau)Y_E^{\rho-1}\right]-(1-\delta)Y_E\left[1-(1-\tau)(1-\delta)^{\rho-1}Y_E^{\rho-1}\right]\right\}>0.$

Note that T_E is tax liability for those who evade taxes and X is the amount of tax liability that is evaded. In the absence of tax evasion (i.e., $\delta = 0$), X will be reduced to zero.

To obtain analytically tractable results, following Gentry and Hubbard (2000) we assume that individuals are risk neutral. For risk neutral individuals, the occupational choice simply depends on the after-tax returns from the two jobs. Equilibrium in occupational choice requires that the expected after-tax income from self-employment must be equal to the after-tax return from the safe job (employment); see Evans and Jovanovic (1989). Thus in this case, for the two occupations to exist together the following condition must be satisfied:

$$\pi(1-p-p\mu)X+\pi(1-\tau)(Y_E(v))^{\rho} = (1-\tau)(Y_W(v))^{\rho}\ , \qquad (3)$$

where the variables are as defined before.

The left-hand side of Eq. (3) shows the after-tax expected return from self-employment. This includes the expected benefit from tax evasion which is the first term in the left-hand side. For tax evasion to be attractive this term should be positive. Otherwise, the self-employed would not evade taxes. In our analysis we assume that the

expected benefit from tax evasion is positive.[9] The right-hand side of the above equation on the other hand shows the after–tax return from employment. For a given τ, we are interested to know how changes in tax progressivity (ρ) affect the self-employment rate (v). [10] Thus totally differentiating Eq. (3) with respect to v and ρ and noting that the income levels depend on v one would obtain:

$$\frac{dv}{d\rho} = \frac{\Omega - \Theta}{\pi(1-p-p\mu)XY_E^{-1}Y_E'(v) + \rho\pi Y_E^{\rho-1}Y_E'(v) - (1-\tau)\rho Y_W{}^{\rho-1}Y_W'(v)}\ , \qquad (4)$$

where,

$$\Omega = \pi[1-p-p\mu]\{X\ln Y_W + (1-\tau)[Y_E^{\rho} - ((1-\delta)Y_E)^{\rho}]\ln Y_E - (1-\tau)(1-\delta)^{\rho}Y_E^{\rho}\ln(1-\delta)\} > 0,$$

$$\Theta = \pi(1-\tau)Y_E^{\rho}\ln(Y_E/Y_W) > 0,$$

While the denominator in Eq. (4) is negative, the sign of the numerator is ambiguous. Thus the effect of tax progressivity on self-employment is not clear from Eq. (4). In the absence of tax evasion opportunity (i.e. $\delta = 0$), X and Ω will reduce to zero.[11] In this case, $dv/d\rho$ will be positive implying that an increase in tax progressivity (i.e., lower ρ) discourages self-employment. That is the greater the tax progressivity, the lower the rate of self-employment. Thus, as Gentry and Hubbard (2000) explain, the progressive income tax has a detrimental effect on entrepreneurship and can be viewed as a "success tax". The reason for this is straightforward. When the tax structure becomes more progressive the government claims a higher share of the return from successful entrepreneurs (which assume the risk of earning a very low income if not successful).

[9] This implies that the exogenous penalty rate $\mu < (1-p)/p$. If $\mu = (1-p)/p$, there will be no benefit from tax evasion.
[10] For a somewhat similar exercise in a different context, see Kanbur (1982).
[11] This is also true at the prohibitively high penalty rate $\mu = (1-p)/p$.

This discourages the risk taking behaviour of the self-employed as the government shares the reward but not the loss from the risky activity.

In the presence of tax evasion opportunity, however, the relationship between tax progressivity and self-employment becomes more complicated. In fact, the sign of $dv/d\rho$ generally depends on the relative strength of the adverse impact of the "success tax" denoted by Θ and the tax evasion opportunity given by Ω.[12] Eq. (4) shows that if $\Theta > \Omega$, $dv/d\rho$ will be positive and it implies that the tax evasion opportunity is lower than the detrimental effects of the "success tax". Thus greater tax progressivity discourages self-employment. However if $\Theta < \Omega$, then it implies that the benefit of tax evasion opportunity outweighs the adverse impact of taxing success at a progressive rate. In this case self-employment becomes more attractive as tax progressivity increases. That is, greater tax progressivity encourages self-employment.[13]

In summary, the above simple model shows that in the presence of tax evasion opportunity, the impact of tax progressivity on self-employment is ambiguous. It all depends on the relative strength of the detrimental negative effects of the "success tax" and the positive effect of the tax evasion opportunity. Other things remaining constant, if the tax evasion opportunity from being a self-employed is relatively stronger than the adverse impact of taxing success at a progressive rate, an increase in tax progressivity raises self-employment rate. On the other hand, if the tax evasion opportunity is lower (say because of a high level of tax enforcement, penalty, higher frequency of auditing,

[12] Notice that Θ is equal to zero if $Y_E = Y_W$. If the self-employed succeed and earn the higher income (which we have assumed is greater than the income from the safe job) then Θ becomes positive.
[13] See also Parker (2003) on the impact of tax evasion opportunity on occupational choice.

etc.) then higher tax progressivity acts as a tax on successful entrepreneurs and discourages self-employment. Thus, the impact of tax progressivity on self-employment is generally an empirical issue. Consequently, in the following section we explore this issue empirically using aggregate panel data from 10 Canadian provinces over the period 1979 to 2006.

3. Empirical analysis

3.1. The Data

We use annual aggregate data from 10 Canadian provinces over the period 1979-2006. The main sources of our data set are Statistics Canada database (CANSIM) and *Finances of the Nation* (formerly *National Finances*) published by the Canadian Tax Foundation. The data on marginal personal income tax rates and corporate income tax rate come from various issues of *Finances of the Nation.* Data on self-employment, total employment, unemployment, implicit tax rate and relative self-employment income are from CANSIM. We provide a brief description of the data and definitions of the variables used in the empirical analysis in Appendix 1.

(Table 1 about here)

Table 1 reports the basic summary statistics for the key variables in our study.

In empirical analyses of tax policies and self-employment, one major problem that researchers often encounter is what self-employment rate to use. Consistent with our theoretical framework, we use the own-account self-employment rate (ENTER 1) —the

share of own-account self-employment rate in total employment — as our main dependent variable. However, for the sake of completeness, we also use three other measures of self-employment rate in our analysis. The second measure of self-employment (*ENTER 2*) is the share of total self-employment in total employment; see for example Folster (2002) and Torrini (2005) for a similar use of this variable as a measure of self-employment. The third measure of self-employment (*ENTER 3*) is constructed using the number of individuals with self-employment income as a share of total number of income earners. Finally, as in Rosen (2004) and Bruce and Mohsin (2006), the fourth measure (*ENTER 4*) is based on income tax returns. It is simply the number of self-employment individual income tax returns as a share of total number of income tax returns.

We measure the degree of personal income tax progression with the coefficient of Residual Income Progression (RIP); Musgrave and Musgrave (1989) and Dahlby (2008). RIP depends on the marginal and average income tax rates. Since marginal and average income tax rates vary across income tax brackets, it is difficult to come up with a single RIP value that is suitable for an empirical analysis. We would ideally like to construct RIP for each income tax bracket using the statutory marginal and average tax rates corresponding to the various tax brackets. However, there are no data on provincial average income tax rates corresponding to the various tax brackets. Thus, in order to circumvent this problem, we rely on the statutory marginal income tax rate (federal and provincial) that is applicable to the average income of single persons. See for example Van Ewijk and Tang (2007) for a similar approach. We also use the implicit average

income tax rate for single persons as a measure of an over all average tax rate. Then we use the two variables to generate RIP for all provinces. In our sensitivity analysis, we also experiment with other alternative measures of tax progressivity.

(Figure 1 about here)

Fig.1 plots the relationship between average own account self-employment rate and RIP for the 10 Canadian provinces over the period 1979-2006. There is a wide variation in the rate of entrepreneurship across provinces over the period under consideration. Over the period under consideration, the average rate of own account self-employment rate ranges from about 6.7 percent for New Brunswick to 15.8 percent for Saskatchewan[14]. There is also variation in the degree of tax progression as shown by the RIP. The average RIP ranges from 0.792 in Quebec to 0.887 in Ontario. The figure shows that there is a positive association between the self-employment rate and the coefficient of residual income progression. Note that since RIP and tax progressivity are inversely related, Fig. 1 suggests that tax progressivity and self-employment are negatively related. To explore this issue further, we estimate self-employment on the coefficient of residual income progression and other control variables.

3.2. Empirical specification

The empirical methodology we employ is consistent with our theoretical framework and similar to the ones used in Folster (2002) for Sweden, Bruce and Deskins (2006) and

[14] Complete data set on the share of the agriculture sector in the own-account self-employment rate is not available.

Georgellis and Wall (2006) for US states. The basic structural equation used to examine the effects of personal income tax progressivity on self-employment can be specified as:

$$ENTER_{it} = \alpha_0 + \alpha_1 RIP_{it} + \alpha' Z_{it} + \eta_i + \lambda_t + \varepsilon_{it}, \quad (5)$$

where $ENTER_{it}$ is self-employment rate, *RIP* is the coefficient of Residual Income Progression, *Z* denotes a vector of control variables, and ε_{it} is the error term. The time-invariant unobserved province-specific effects are captured by η_i. The λ_t, represents province-invariant time dummies. As previously explained, RIP is inversely related to income tax progression. The lower *RIP*, the higher the degree of income tax progressivity.

We are interested in the coefficient α_1. Our theoretical framework suggests that the sign of α_1 may be positive or negative, depending on the relative strength of the tax evasion opportunity in self-employment and the adverse impact of greater tax progressivity on risk-taking. If the former dominates, we expect α_1 to be positive. On the other hand, the coefficient will be negative if the latter outweighs.

There are factors other than personal income tax progressivity that may influence entrepreneurship. Our set of control variables includes the average personal income tax rate, the combined (provincial and federal) corporate income tax rate that is applicable to small businesses, the real minimum wage rate, the relative income from self-employment, and the unemployment rate. Most of these control variables are commonly used in the empirical literature; see for example Blau (1987), Kamhi and Leung (2005), Bruce and Deskins (2006) and Bruce and Mohsin (2006). The unemployment rate is included to

capture business cycle fluctuations. As in Blau (1987), we also include the real minimum wage rate to capture possible wage rigidity.

Some of the self-employed are incorporated businesses. For such kind of self-employment the corporate income tax rate may be relevant. Thus as in Mooij and Nicodeme (2007), we control for the corporate tax rate that is applicable for small businesses. Our theoretical model indicates that the relative income between self-employment and wage employment is relevant in the taxation- self-employment nexus. Thus we also control for the relative income. We expect that a higher relative income from self-employment encourages entrepreneurial activity. Note also that while the self-employment rate depends on the relative income, our simple model also shows that the relative income in turn depends on the self-employment rate. We will come to this issue later in the empirical analysis.

3.3. **Regression results**

Our regression results are reported in Table 2 below.

(Table 2 about here)

We begin with OLS estimation of the total self-employment rate on just RIP in column 1. We control for time and provincial fixed-effects in all our regressions. In this regression, the coefficient of RIP is positive and statistically significant. This indicates that greater tax progressivity (lower RIP) discourages self-employment rate. That is as the tax rate becomes more progressive, the adverse impact of income tax on entrepreneurial risk taking outweighs the tax evasion opportunity for the self-employed. The estimated quantitative effect of income tax progressivity on self-employment is also

of significant magnitude. Our basic estimation result suggests that a decrease in income tax progressivity is associated with an increase in the rate of self-employment as measured by the own-account self-employment rate.

In column 2, we control for the average personal income tax rate to capture the income tax burden. Notice that since by definition RIP involves the average income tax rate, a change in income tax progressivity in column 2 is only as a result of a change in marginal income tax rate. Thus a change in progressivity in column 2 refers to a change in the marginal income tax rate keeping the average tax burden constant. That is an increase in RIP is equivalent to a lower marginal income tax rate at a constant average tax rate. As expected, the average tax rate is negative and statistically significant indicating that higher income tax burden discourages self-employment. Our variable of interest, RIP, is still positive and statistically significant suggesting that the basic result is robust to the inclusion of the average income tax rate.

Following most of the related empirical studies in the literature, in column 3 we control for some of the factors that may influence self-employment. In particular, we include for the unemployment rate, the relative self-employment income, corporate tax rate that is applicable to small business and minimum wage rate. Kamhi and Leung (2005) also include some of these control variables in their analysis. The coefficient of RIP is still positive and statistically significant indicating that tax progressivity affects the self-employment rate after we control for other determinants of self-employment.

So far we have used ordinary least square estimation on the assumption that all the explanatory variables are exogenous. However, our theoretical model indicates that

relative self-employment income is endogenous as it depends on the self-employment rate. Furthermore, the unemployment rate can also be potentially endogenous. The Hausman test for endogeneity also suggests that these variables are endogenous. It is well known that if the right hand side variables are endogenous, results from OLS may be biased. To address this issue we use Instrumental Variable estimation method in column 4. We treat the relative income and the unemployment rate as endogenous using their corresponding one period lagged values as instruments. Column 4 shows the main results of this paper and we focus our analysis on this regression. Once again our variable of interest, RIP, is positive and highly significant. That is a higher degree of personal income tax progressivity reduces the return for successful entrepreneurs and discourages self-employment.

The control variables have their respective expected signs. A higher corporate tax rate reduces the return of businesses that are incorporated and hence discourages incorporated self-employment. On the other hand, an increase in the corporate tax rate increases the competitive advantage of the majority of the self-employed that are not incorporated (that are subject to the personal income tax rate) and raises the total self-employment rate. Our result indicates that the coefficient of the corporate tax rate is negative but it is statistically insignificant.

The coefficient of relative self-employment income is positive as expected but insignificant. The result also suggests that a reduction in the unemployment rate encourages self-employment. This implies that the self-employment rate rises as general economic condition improves. As in Blau (1987), an increase in the real minimum wage rate seems to encourage self-employment.

As explained before there is no general consensus on how to measure self-employment rate. Thus as in previous empirical studies, we use other alternative measures of self-employment rate as our dependent variable in columns 5 to 7. In column 5 we use the ratio of total self-employment to total employment (*ENTER 2*) as a dependent variable. The results are quite similar to what we find in column 4 suggesting that our results do not depend on the type of self-employment rate that we use.

In column 6, we also use a measure of self-employment rate based on the number of people with income from self-employment. That is, we use the number of individuals with self-employment income as a ratio of total number of recipients of self-employment and wage income (ENTER 3). The regression results are broadly consistent with what we find in column 4. More importantly, despite the use of a different measure of self-employment rate, the qualitative and quantitative effects of tax progressivity on self-employment do not change much.

Another measure of self-employment used in our analysis is based on the number of individual tax-filers. As in Rosen (2004) and Bruce and Mohsin (2006), we use the number of tax filers with self-employment income as a ratio of total number of tax-filers (ENTER 4). The data on tax-filers are available only for the period 1989-2006. The regression result is given in column 7. Despite a significant fall in the number of observations, the qualitative and quantitative effects of income tax progressivity on self-employment are surprisingly similar to those found previously. More importantly, the

coefficient of RIP is still positive and statistically significant albeit the numerical magnitude is smaller.

In sum, our empirical results suggest that there is a robust positive association between RIP and entrepreneurship. That is the results imply that high tax progressivity discourages self-employment rate. Thus a general reduction in the marginal personal income tax rates (which reduces tax progressivity) encourages self-employment.

4. Sensitivity analysis

In this section, we subject our empirical results to various robustness checks. The results of the various robustness checks are reported in Table 3. A common problem in regressions based on aggregate data is that the results may be driven by the presence of a few influential observations. In our case, Saskatchewan has the highest self-employment rate mainly driven by its relatively large agricultural sector. To examine the robustness of our results to the presence of influential observations, we use robust estimation method in column 1. In addition, we re-estimate the original preferred empirical model (column 4 of Table 2) excluding Saskatchewan in column 2. Our empirical results indicate that the negative association between tax progressivity and self-employment is quite robust.

Our basic specification includes time and provincial effects. Including time invariant provincial effects may remove the inter-provincial variation in tax rates. To check the sensitivity of our results to the presence of time and provincial specific fixed dummies, in column 3 we exclude these dummies and re-estimate the model over the same period.

The results again indicate that there is a strong positive association between RIP and self-employment rate.

It is well known that measuring the degree of tax progressivity is difficult. This is particularly true in analyses based on aggregate (rather than individual) data on taxation and income. The use of the RIP in our empirical analysis is consistent with our theoretical framework. However, to check the robustness of our empirical results we also use other alternative measures of tax progressivity in Table 3. More specifically, in column 4a we use a coefficient of RIP that is constructed using the marginal tax rate that is applicable to the average self-employment income and the average tax rate of unattached individuals. Furthermore, in column 4b we use a coefficient of RIP that is based on the (unweighted) average marginal tax rates of all income brackets and implicit tax rates of unattached individuals. In column 4c, the RIP measure is based on the top marginal personal income tax rate and the average tax rate of unattached individuals. In all cases the coefficient of RIP is positive and statistically significant. Thus our empirical result is robust to the use of differently constructed RIP measures.

In summary, our empirical results suggest that tax progressivity has a statistically significant negative association with self-employment. This result is quite robust to the various robustness checks. The implication of this is that the adverse impact of higher personal marginal income tax rate on self-employment outweighs the opportunity to evade taxes.

5. Conclusions

The effects of taxes on entrepreneurial activities have attracted a lot of attention recently. A number of previous studies indicate that taxes can affect self-employment in various ways. While some of the studies show that entrepreneurs' decision to invest and hire can be significantly affected by the tax system, others explain why taxes can affect entry into entrepreneurial activities. In Canada income from self-employment is subject to personal income (after deducting for business expenses). For this reason as compared to income from employment, the self-employed have a higher tax evasion opportunity. This opportunity becomes greater as the degree of tax progressivity increases. Self-employment is inherently a risky occupation. As a result, a higher degree of tax progressivity reduces the return of successful entrepreneurs and discourages risk taking. Thus it is interesting to explore the net effects of personal income tax progressivity on the rate of self-employment. The main objective of this paper has been to examine whether an increase in tax progressivity encourages or impedes self-employment.

We first build a simple theoretical framework that shows occupational choice in the presence of a progressive personal income tax system. In our model, we just consider two occupations: self-employment and working for others. We also assume that the self-employed have the opportunity to evade taxes although there is some chance that evaders may be caught through auditing and face a penalty. Occupational choice then depends on the after-tax return from the two occupations. An increase in the income tax progressivity reduces the return of successful entrepreneurs. This discourages self-

employment. On the other hand, the return from tax evasion will be higher as tax progressivity rises. This in turn encourages self-employment. Thus the simple theoretical model of this paper shows that the effect of tax progressivity on self-employment is ambiguous. It all depends on the relative strength between the positive effects of tax evasion opportunity and the adverse effects of taxing success.

In order to examine the relationship between income tax progressivity and self-employment, we employ aggregate provincial data from Canada over the period 1979-2006. Consistent with the simple model, we mainly use the own-account self-employment rate as our measure of self-employment. However, we also experimented with other related measures of self-employment. We measure the degree of tax progressivity by the coefficient of residual income progression. Our empirical analysis suggests that a reduction in marginal tax rates that lowers the degree of tax progressivity encourages self-employment rate. This implies that the negative effect of income tax progressivity on entrepreneurial risk-taking outweighs the tax evasion opportunity for the self-employed. We also conduct sensitivity analysis to check the robustness of the results. In general our empirical results are quite robust to various sensitivity checks.

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Table 1: Summary statistics, 1979-2006

	Mean	Std Dev	Minimum	Maximum	Observations
ENTER 1 [a]	0.0930	0.0289	0.0518	0.1794	280
ENTER 2 [b]	0.1601	0.0397	0.1043	0.2860	280
ENTER 3 [c]	0.1369	0.0440	0.0691	0.2615	280
ENTER 4 [d]	0.1195	0.0403	0.0694	0.2231	180
Coefficient of Residual Income Progression (RIP)	0.8505	0.0441	0.7348	0.9539	280
Average income tax rate	0.1514	0.0216	0.0620	0.1970	280
Marginal income tax rate	0.2788	0.0327	0.2105	0.3970	280
Corporate tax rate (small businesses)	0.2138	0.0311	0.1512	0.2775	280
Unemployment rate	0.1013	0.0377	0.0340	0.2020	280
Relative income	0.5846	0.1303	0.3243	0.9954	280
Real minimum wage rate ($)	6.3983	0.6869	4.2594	8.5062	280

Note:
[a] Own-account self-employment as a share of total employment *(in decimals).*
[b] Total self-employment as a share of total employment *(in decimals).*
[c] This is the ratio of the number of recipients of self-employment income to the total number of recipients of self-employment and wage income
[d] The number of self-employment individual income tax returns as a share of total number of income tax returns.

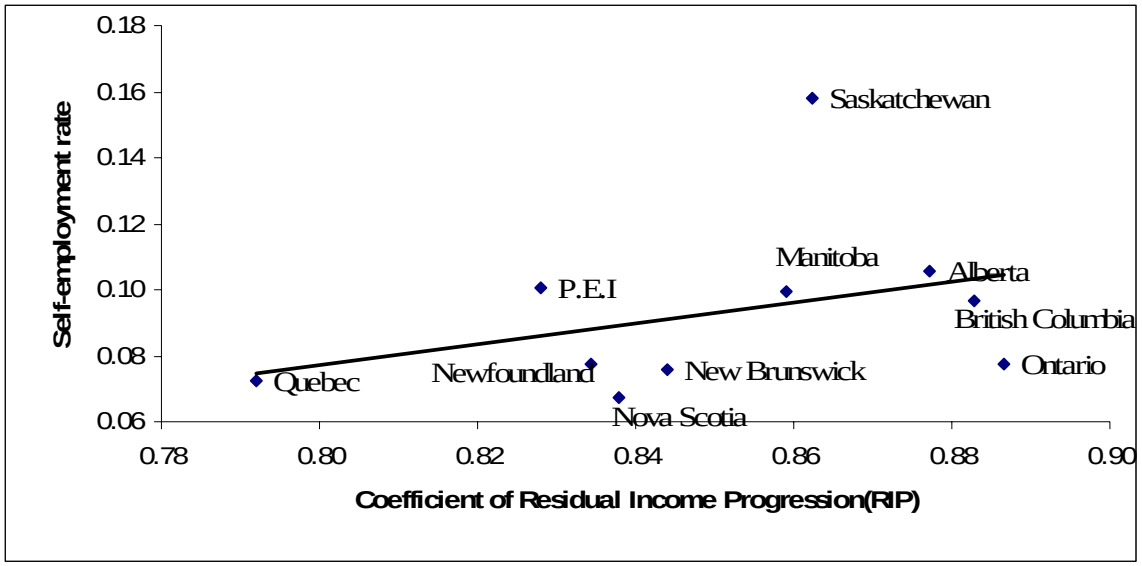

Fig. 1. Average own account self-employment rate and Coefficient of Residual Income Progression (RIP), 1979-2006.

Table 2: Self-employment Regression, 1979-2006.

Dependent Variable	ENTER 1	ENTER 1	ENTER 1	ENTER 1	ENTER 2	ENTER 3	ENTER 4
	OLS	OLS	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
RIP	0.264***	0.360***	0.324***	0.313***	0.378***	0.414***	0.252***
	(5.24)	(4.64)	(4.16)	(4.40)	(4.43)	(6.68)	(8.95)
Average personal		-0.330***	-0.351***	-0.339***	-0.489***	-0.480***	-0.217***
income tax rate		(-3.09)	(-3.76)	(-3.93)	(-4.82)	(-5.16)	(-5.73)
Corporate income			-0.011	-0.012	-0.092**	-0.073*	-0.026
tax rate			(-0.32)	(-0.33)	(-2.02)	(-1.76)	(-1.09)
Real minimum wage			0.007***	0.007***	0.009***	0.008***	0.004***
rate			(4.24)	(4.38)	(4.66)	(5.12)	(3.02)
Unemployment rate			-0.283***	-0.316***	-0.425***	-0.252***	-0.101
			(-4.46)	(-4.38)	(-4.70)	(-3.09)	(-1.02)
Relative income			0.011	0.010	0.028	-0.011	0.014*
			(1.34)	(0.52)	(1.10)	(-0.51)	(1.67)
Constant	-0.136***	-0.168***	-0.176**	-0.159***	-0.117**	-0.168***	-0.097***
	(-3.20)	(-3.11)	(-2.86)	(-3.27)	(-2.01)	(-3.77)	(-4.00)
Provincial Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	280	280	280	270	270	270	170
Adj.R-Squared	0.856	0.866	0.890	0.890	0.909	0.934	0.991

Note: t-ratios, based on robust standard errors, in parentheses. Significance levels are indicated by * for 10%, ** for 5%, and *** for 1%. See Table 1 for the definition of the dependent variables. One period lagged values of relative income and unemployment rate are used as instruments in the IV regressions.

Table 3: Robustness checks, 1979-2006.

Dependent variable: Own-account self-employment rate (in fractions)

	Robust estimation	Excluding Saskatchewan (IV)	Without time and provincial dummies (IV)	Alternative progressivity measures (IV)		
	(1)	(2)	(3)	(4a) [a]	(4b) [b]	(4c) [c]
RIP	0.466***	0.319***	0.200***	0.274***	0.305***	0.064*
	(12.24)	(4.04)	(6.18)	(5.68)	(5.64)	(1.84)
Average personal	-0.515***	-0.345***	-0.253***	-0.335***	-0.316***	-0.105
income tax rate	(-7.84)	(-3.57)	(-3.46)	(-3.90)	(-4.31)	(-1.56)
Provincial Effects	Yes	Yes	No	Yes	Yes	Yes
Time Effects	Yes	Yes	No	Yes	Yes	Yes
Observations	280	243	270	270	270	270
Adj.R-Squared	0.901	0.764	0.279	0.878	0.877	0.864

Note: t-ratios based on robust standard errors in parentheses. Significance levels are indicated by * for 10%, ** for 5%, and *** for 1%.
[a] Based on alternative measure of the degree of tax progression. The Residual Income Progression is based on a statutory marginal income tax rate (provincial and federal combined) that is applicable to the average self-employment income. The average tax rate is the implicit tax rate for a single person.
[b] RIP is based on the unweighted-average statutory MTRs of all income brackets and the average tax rate (the implicit tax rate) of unattached individuals.
[c] RIP is based on the statutory top marginal income tax rate and the average tax rate (the implicit tax rate) of unattached individuals .

Appendix 1: Definitions of variables and data sources

Variable	Description	Source
Marginal personal income tax rate (MTR)	Average provincial and federal (combined) marginal income tax rate that is applicable to average income of single individuals.	*Finances of the Nation* (formerly *National Finances*)
Average personal income tax rate (ATR)	The implicit tax rate of single persons defined as average income tax expressed as a percentage of average total income.	*CANSIM Table 202-0501*
Own-account self-employment	The number of people who are self-employed (with no paid help)	Statistics Canada (2007). Labour Force Historical Review 2006, Catalogue No. 71F0004XCB
Total Self-employment	The total number of people who are self-employed	Statistics Canada (2007). Labour Force Historical Review 2006, Catalogue No. 71F0004XCB
Total Employment	The total number of people who are employed	CANSIM Table 282-0002
ENTER 4 (Self-employment income tax-filers ratio)	The number of self-employment individuals income tax returns as a share of total number of income tax returns	Canada Revenue and Custom Agency, Income Statistics (1979-1981),Statistics Canada *Income Tax Statistics (1982-1988), Labour Income Profiles (1989-1999)* and *CANSIM Table 111-0024 (2000-2006)*
ENTER 3 (Number of self-employment income recipients ratio)	The number of recipients of self employment income relative to total number of recipients of self-employment and wage income	Statistics Canada *CANSIM* Table 202-0407.
Corporate marginal tax rate	Provincial and federal (combined) statutory marginal corporate income tax rate for eligible small businesses	*Finances of the Nation* (formerly *National Finances*)
Real minimum wage rate	The provincial minimum wage rate deflated by the CPI	Human Resources and Skills Development Canada. Available at http://srv116.services.gc.ca/dimt-wid/sm-mw/intro.aspx?lang=eng
Relative income	The ratio of average income from self-employment to average wage income	CANSIM Table 202-0407
Unemployment rate	Provincial unemployment rate	CANSIM Table 282-0002