The Effects on Entrepreneurship of Increasing Provincial Top Personal Income Tax Rates in Canada

Ergete Ferede

FRASER INSTITUTE
2018

Contents

Executive Summary

Entrepreneurship is a crucial source of innovation, employment, and growth in an economy. Consequently, it is a recurring theme in many academic and policy debates. While there is no single, comprehensive measure of entrepreneurship, most studies and policymakers commonly use business entry-rate—defined as the number of new businesses as a ratio of total businesses—as a key indicator of entrepreneurship. In recent years, Canada's federal and some provincial governments have raised their top marginal income tax rates and increased the progressivity of the personal income tax system. Since earnings from entrepreneurship, including capital gains, are subject to the personal income tax system in Canada, the recent increases in top income tax rates have also increased the country's capital gains taxes.

Various recent government reports indicate that the Canadian business entry rate has been declining over the past three decades. This downward trend in entrepreneurship is certainly a great concern to society as business creation is often directly related to productivity and employment growth. Considering the current state of entrepreneurship, some commentators and analysts wonder whether it is possible to increase entrepreneurship and encourage more business creation through various income tax policies. What is the impact of a progressive income tax system on entrepreneurship? Is it possible to stimulate entrepreneurship through appropriate income tax policies? This paper seeks to answer these questions empirically using Canadian provincial data over a 30-year period.

Economic models show that the personal income tax system can influence entrepreneurship in many ways. According to one strand of the literature, higher income tax discourages entrepreneurship. This is because entrepreneurial activity is inherently risky, and entrepreneurs pay significant taxes on all their incomes (labour income, capital gains, or dividends) when they are successful. However, when they incur a loss, the tax savings are quite limited. Consequently, higher personal income tax can be viewed as a tax on "success" and may discourage entrepreneurial activity. On the other hand, other studies argue that entrepreneurs have relatively more tax planning opportunities and the potential tax-saving benefits increase with the income tax rate. According to some of the theoretical models that

emphasize this issue, higher income tax rates can encourage entrepreneurship, even if it is not productive entrepreneurship. Ultimately, the effect of income tax on entrepreneurship is an empirical question.

Previous empirical studies have examined the relationship between income tax and various measures of entrepreneurship, but the results from these studies are mixed. To shed more light on this important issue, this paper investigates the effect of the top personal income tax rate on entrepreneurship using data from Canadian provinces over the period 1984–2015. In addition to the top income tax rate in each province, the empirical analysis controls for the various factors that are generally considered important determinants of entrepreneurship.

The empirical findings of this paper show that a higher provincial top income tax rate has a negative and statistically significant effect on entrepreneurship, both in the short- and long-term. The results indicate that an increase in the top marginal income tax rate discourages entrepreneurship as measured by the business entry rate. This suggests that raising the top income tax rate exacerbates the decline in business creation. Based on the empirical results, a one percentage-point increase in the top statutory marginal income tax rate is associated with a 0.06 percentage-point decrease in the business entry rate in the short-term, and a 0.21 decrease in the long-term. Considering the long-term results, a province that raises its top personal income tax rate by one percentage point can expect to have fewer new businesses enter its economy. That drop ranges from 14 (in the case of Prince Edward Island) to 696 (in the case of Ontario). Notably, in recent years, many provinces have raised their top personal income tax rates—Alberta raised its top rate by five percentage points, Ontario raised its top rate by 3.1 percentage points, and BC raised its top rate by 2.1 points. The federal government's recent four percentage point hike to its top rate will only serve to exacerbate the provincial increases.

The findings in this paper suggest that these increases in top personal income tax rates have resulted in a significant loss to the Canadian economy, which has been experiencing a decline in entrepreneurship for a long time. In sum, the empirical results show that an increase in the top marginal income tax rate discourages entrepreneurship as measured by the business entry rate. This finding suggests that the adverse effect of a higher personal income tax rate on risk-taking by entrepreneurs outweighs the potential tax planning opportunities entrepreneurs may have. The study's empirical analysis includes extensive robustness checks, which shows that in all cases, the negative effects of a higher income tax rate on entrepreneurship remain significant. The results yield an important policy implication: Canadian governments can encourage entrepreneurship with personal income tax rate cuts.

Introduction

Entrepreneurship is a vital source of innovation and a key contributor to economic growth and employment (OECD, 2001). Because it plays these crucial roles, entrepreneurship has been a recurring theme in various academic and policy debates. While there is no single and comprehensive measure of entrepreneurship, most studies and policymakers commonly use business entry and self-employment rates as good proxies. Recently, the federal government and some of the provincial governments raised their top statutory marginal income tax rates and increased the progressivity of the personal income tax system. At the same time, various reports, such as Macdonald (2014), indicate that the Canadian business entry rate has been declining. Consequently, some commentators and analysts wonder whether it is possible to raise entrepreneurship and encourage more business creation in the country through various income tax policies and other incentives. How do tax policies affect entrepreneurial activities? What are the impacts of a progressive personal income tax system on entrepreneurship? This paper seeks to answer these questions empirically using data from Canadian provinces over a 30-year period.

Various theoretical models show that the effect of income tax on entrepreneurship is ambiguous. On the one hand, Gentry and Hubbard (2000) analyze how personal income tax progressivity affects entrepreneurial entry. They argue that since entrepreneurial activities are generally risky, successful entrepreneurs who earn a high income face substantial tax liability. However, when they incur a loss, the tax savings are quite limited. Consequently, they show that a progressive income tax system discourages entrepreneurship. Keuschnigg and Nielsen (2004) also explain that income from entrepreneurship fluctuates significantly but the expected income from this risky activity is higher than wage income. Their analysis indicates that a progressive income tax system imposes a net tax on risk-taking and redistributes income from entrepreneurship to workers. On the other hand, Cullen and Gordon (2007) show that income tax has a positive effect on entrepreneurship. They argue that under a progressive income tax system, businesses can deduct their losses and take advantage of tax planning. The higher the income tax rate, the higher the benefit for entrepreneurs from tax planning efforts, which encourages entrepreneur-

ship. Given the sometimes conflicting theoretical predictions about the relationship between income tax and entrepreneurship, resolution of the total effect is largely an empirical question.

Many previous empirical studies have focused on the United States. Using state-level aggregate panel data for the US, Bruce and Deskins (2006) investigated the impact of the top marginal income tax rate on entrepreneurship as measured by the share of nonfarm employment in total employment. Their results show that the top marginal tax rate does not have a statistically significant effect on entrepreneurship. Garrett and Wall (2006) also studied the effect of the top personal income tax (PIT) rate on entrepreneurship as measured by the ratio of nonfarm employment to the working age population for the US states. They also found that the top personal income tax rate does not affect entrepreneurship. A recent study by Bruce et al. (2015) employed dynamic panel specification and used state-level data from the United States to investigate the impacts of tax policy on entrepreneurship. The study found that the top marginal income tax rate does not have a statistically significant effect on entrepreneurship.

Other empirical studies find evidence that the income tax does have a negative effect on entrepreneurship. Folster (2002) employs dynamic specification to examine the effects of the top income tax rate on the share of self-employment in total employment using panel data from Swedish counties and a sample of OECD countries. In both cases, he finds that the highest income tax rate has a statistically significant adverse effect on the self-employment rate. Using individual-based data from Sweden, Hansson (2012) investigates how income tax policies influence individuals' decision to become self-employed. He employs the probit estimation method and finds that higher income tax rates adversely affect the probability of becoming self-employed. Baliamoune-Lutz and Garello (2014) use aggregate panel data from European countries and find that income tax progressivity has adverse effects on entrepreneurship. Other prior studies such as Robson and Wren (1999), Rosen (2004), Torrini (2005), and Mooij and Nicodeme (2008) also find that there is a negative relationship between taxes and entrepreneurship.

Empirical studies that use Canadian data are quite limited. Ferede (2013) provides a theoretical framework to analyze the impact of income tax progressivity on entrepreneurship as measured by self-employment. He then uses annual aggregate panel data from Canadian provinces over the period 1979–2006 to empirically examine the effects of income tax progressivity on the self-employment rate. He finds that marginal income tax progressivity has a negative effect on the self-employment rate, suggesting that the adverse impact of higher tax progressivity on success outweighs the tax planning opportunities that may be available to the

self-employed. In the same vein, Wen and Gordon (2014), use individual-level Canadian data to estimate the effect of income tax progressivity on the probability of self-employment. They find that marginal income tax progressivity has a negative relationship with being self-employed.

Another strand of the literature focuses on the importance of capital gains taxes in influencing entrepreneurship. See for instance Poterba (1989) and Gentry (2010). Often the benefit of business start-ups is frequently captured primarily in capital gains when the start-up goes public or is sold. Entrepreneurs take a lot of risk expecting success and higher capital gains. Thus, capital gains tax can be considered as a tax on successful entrepreneurs and it may discourage business start-ups. In Canada, during the period under investigation, part of an individual's net capital gains is included as income in the personal income tax system.[1] Thus, there is not much distinction between capital gains tax and personal income taxes. The implication of this is that the personal income tax system can affect business startups through the taxation of capital gains. Of course, since only some part of the capital gains is included as income for tax purposes, entrepreneurs generally face a lower effective tax rate on this income source.

This paper investigates the effects of the personal income tax rate on entrepreneurship using aggregate panel data for Canadian provinces over the period 1984 to 2015. This paper differs from previous Canadian studies in two major ways. First, unlike previous studies, this paper employs dynamic panel specification to correctly address the potential lingering effect that taxes and tax policy may have on entrepreneurship. Such an approach enables us to estimate both the short- and long-term impacts of tax policy on entrepreneurship at the same time. Second, to the best of our knowledge, this study is the only Canadian study that investigates the effects of the top marginal income tax rate using business entry rates to measure entrepreneurship. This is important because according to the OECD, business creation is often associated with the rise of entrepreneurship.

This paper uses the General Method of Moments (GMM) estimation method as the empirical methodology for this study, which is relatively more powerful and appropriate for a dynamic panel model such as is employed in this paper. There is no comprehensive measure or definition of entrepreneurship, and for this reason various empirical studies employ dif-

[1] Since 1972, a portion of an individual's realized net capital gains have been included as income under the Canadian personal income tax system. However, the inclusion rate has varied over the years. Between 1972 and 1987, it was 50 percent, between 1988 and 1989 inclusion rate was 66.66 percent, between 1990 and 1999 it was 75 percent, and in 2000 it was about 66.66 percent. Currently, the capital gains inclusion rate is 50 percent, which it has been since 2001.

ferent entrepreneurship measures. Godin, Clemens, and Veldhuis (2008) provide a detailed discussion of the various possible alternative measures of entrepreneurship and their respective relative advantages and disadvantages. Recognizing the many measurement challenges, this paper uses business entry as a measure of entrepreneurship. The business entry rate is defined as the number of new businesses as a ratio of the average number of active total businesses in the current and previous years. As a robustness check, we also use the net change in the number of active businesses and the self-employment rate as additional measures of entrepreneurship in our sensitivity analysis. This paper considers the self-employment rate to be total self-employment in the non-agricultural sector as a share of total employment. Further, this study uses the top statutory marginal (provincial and federal combined) income tax rate as a measure of the income tax policy environment. The study also experiments with the use of various alternative measures of income tax rates.

This paper's empirical findings show that a high top income tax rate has a negative and statistically significant effect on entrepreneurship both in the short- and long-term. The results indicate that an increase in the top marginal income tax rate discourages entrepreneurship as measured by the business entry rate. This suggests that raising the top income tax rate exacerbates the decline in business creation. According to this study's chosen estimate, a one percentage-point increase in the top statutory marginal income tax rate is associated with a 0.06 percentage-point decrease in the business entry rate in the short-term and a 0.21 decrease in the long-term. Considering the long-term results, a province that raises its top personal income tax rate by one percentage point can expect to have fewer new businesses enter its economy. That drop in the number of businesses ranges from 14 (in the case of Prince Edward Island) to 696 (in the case of Ontario). This is a significant loss for an economy that has been experiencing a decline entrepreneurship for a long time. Other measures of entrepreneurship yield similar results. One important implication from the results is that provincial governments can encourage entrepreneurship through various tax incentives, including lowering the top marginal income tax rate. The empirical results are robust to various sensitivity checks.

The remaining part of this paper is organized as follows. In the next section, we specify the empirical model and discuss the estimation methodology. The following section presents and discusses the empirical results. The next section conducts various sensitivity analyses to check the robustness of the main results. The last section concludes.

Empirical Specification, Methodology, and Data

Specification

The empirical specification of this paper relies on theoretical models of the relationship between entrepreneurship and income tax that are widely discussed in previous studies. See, for instance, Parker (1999), Gentry and Hubbard (2000), and Ferede (2013). To explain the empirical section of the paper, we include below a brief description of one of such theoretical framework. Suppose there are two groups of individuals: workers and entrepreneurs the latter of which are proxied by, say, the self-employed. Comparing the two occupations, one can argue that there are more tax planning and minimization opportunities for the self-employed than for workers.[2] In general, the higher the marginal income tax rate, the higher the reward for the self-employed from tax planning activities. On the other hand, entrepreneurship is a risky occupation in the sense that income from self-employment is very uncertain and can fluctuate wildly over time. When entrepreneurs are successful, they can earn a higher income and their personal income tax liability increases with their success as measured by the higher income. In fact, if the income tax system is progressive, as is the case in Canada, the more successful an entrepreneur is, the higher is the share of the return from them that goes to the government in the form of income taxes. The government, on the other hand, does not share the downward risk of being an entrepreneur in the event of a loss. For this reason, from the entrepreneur's perspective, a higher income tax can be considered a "success tax." Thus, a higher marginal personal income tax can discourage the risk-taking behaviour of entrepreneurs and affect entrepreneurship adversely. Working for others, on the other hand, is relatively safe with a predictable level of income. Thus, in our theoretical

[2] For example, in Canada, as in many countries around the world, self-employment income is subject to the personal income tax after the self-employed deduct all their business expenses. Some argue that such an arrangement provides entrepreneurs with a greater opportunity for tax planning and avoidance.

framework, a higher income tax rate or marginal income tax progressivity has two opposite effects on entrepreneurs. All things considered, such a theoretical framework suggests that the effect of a higher marginal personal income tax on entrepreneurship is ambiguous and the issue is largely an empirical one. Consequently, in the following section, this paper uses aggregate panel data from the 10 Canadian provinces spanning three decades to investigate this issue empirically.

This paper uses an empirical specification that is consistent with the theoretical framework described above and previously employed in other similar studies such as Folster (2002), Bruce et al. (2015), Bruce and Deskins (2006), Georgellis and Wall (2006). The basic specification for the empirical analysis takes the following form:

$$ENTRP_{it} = \beta_0 + \beta_1 ENTRP_{it-1} + \beta_2 MTR_{it} + \beta' X_{it} + \mu_i + \theta_t + u_{it} \quad (1)$$

where $ENTRP_{it}$ is a measure of entrepreneurship for province i in year t. MTR is the marginal income tax rate, and X denotes a vector of other relevant control variables, and u_{it} is the error term. We also denote the time-invariant unobserved province-specific fixed effects and year effects by μ_i and Θ_t respectively.

In empirical studies that investigate the effects of tax policy on entrepreneurship, a common empirical challenge is how to measure entrepreneurship. Godin, Clemens and Veldhuis (2008) provide a detailed discussion of the various possible alternative measures of entrepreneurship and their respective relative advantages and disadvantages. In this paper, entrepreneurship is measured by the business entry rate. Statistics Canada computes the business entry rate as the ratio of new business entrants to the average number of active businesses in the current and past years. Previous studies such as Djankov et al. (2010), Mooij and Nicodeme (2008), and others also use a similar measure of entrepreneurship. For the period 2001–2015, the data for business entry rates comes from Statistics Canada's CANSIM business dynamic database. For the years prior to 2000, data come from the Longitudinal Employment Analysis Program (LEAP) database.

Previous studies such as Foster (2002), Torrini (2005), Bruce and Mohsin (2005), Kamhi and Leung (2005), and Ferede (2013), use various self-employment rates as measures of entrepreneurship. Other studies, such as Blau (1987) and Bruce et al (2015), on the other hand, argue that due to the structure of the agricultural sector, a better measure of entrepreneurship should focus on the nonfarm or non-agricultural part of self-employment. Accordingly, the ratio of total self-employment (excluding the agriculture sector) to total employment (*ENTRP3*) is used as an additional measure of entrepreneurship as part of the sensitivity analysis of this paper.

As the focus of this study is to investigate the effect of income tax on entrepreneurship, the income tax rate is the key variable of interest. Due to the progressive nature of the personal income tax system, there are different income tax rates that are applicable for the various income tax brackets. This poses a challenge in many empirical studies that rely on aggregate data. Previous studies indicate that the top income tax rate is more relevant for assessing the impact of the tax system on successful entrepreneurs. Consequently, following previous similar studies such as Foster (2002), Bruce and Deskins (2006), Bruce et al. (2015) and others, this study uses the statutory (provincial and federal combined) top marginal income tax rate as the key measure of the personal income tax system. Note that identification comes though variations in the provincial top marginal income tax rate. This is because the federal top income tax rate component is the same for all provinces except Quebec. All applicable surtaxes to the top income tax bracket are also included. Other alternative income tax rate measures are also used as part of the sensitivity analysis in the later part of the paper.

The empirical analysis focuses on the coefficient estimate of MTR (β_2) in equation (1). Theoretically, as discussed above, the sign of β_2 in equation (1) could be positive or negative. If the negative effect of higher marginal income tax on risk-taking outweighs the potential benefit that entrepreneurs may get through tax planning and avoidance opportunities, then we expect β_2 to be negative. However, if the potential benefit from tax planning and avoidance opportunities exceeds the adverse effects of higher MTR on entrepreneurs, then β_2 could be positive. The empirical results will help shed light on which of these two opposite effects dominate for Canadian provinces. It is also worth noting that since the main specification is dynamic, β_2 shows the short-term effects of changes in the marginal income tax rate on entrepreneurship. The long run effect of MTR on entrepreneurship is simply obtained as $\beta_2/(1- \beta_1)$.

In addition to the income tax rate, the empirical model controls for various variables that are generally deemed to have influences on entrepreneurship. More specifically, the study includes as control variables in the analysis neighbouring provinces' weighted average (weighted by population) marginal income tax rate, the shares of the population between 25 and 49 years of age (middle age), those above 64 years of age (over 64), the corporate income tax rate that is applicable to small businesses, that average personal income tax rate of families, the share of the resource sector in the economy, and the corporate profit-to-GDP ratio. These control variables are denoted as X in equation (1). The justifications for the inclusion of these control variables are briefly described below.

In a fiscal federation such as Canada, entrepreneurial activities in one province can be influenced by the tax policies of other provinces. This

is because labour is generally mobile across jurisdictions. Entrepreneurs can move from a high-tax province to a low-tax province in response to significant differences in tax rates and tax policy. To control for this potential effect of horizontal tax competition among provinces, the weighted average (weighed by population) MTR of neighbouring provinces is included as an additional control variable in the empirical analysis. Previous studies such as Liang et al. (2014) and Clemens, et al. (2015) indicate that entrepreneurship can be influenced by demographics. To this end, we account for demographics by including the share of the population that is between 25 and 49 years of age (middle age) and those above 64 years of age (over 64). The theoretical analysis of Liang et al. (2014) shows that an aging population reduces entrepreneurship. Thus, we expect these variables to adversely affect entrepreneurship. Similarly, to capture the potential business environment for entrepreneurs, the ratio of corporate profit before tax to GDP is used as an additional variable. A higher corporate profit-to-GDP ratio may signal a favourable environment for new entrepreneurs to enter the business world. The corporate income tax rate that is applicable to small businesses may also be relevant for entrepreneurs as our measure of entrepreneurship includes some of the incorporated self-employed. Thus, the study includes the small business corporate income tax rate as a control variable.

Methodology

As discussed before, the specification in this study explicitly includes the lagged value of the dependent variable as an explanatory variable to capture possible persistence in entrepreneurship. Including dynamics in the empirical model is an important departure from previous Canadian studies such as Ferede (2013) since it allows the history of past entrepreneurship to influence the current level of entrepreneurship. Foster (2002) and Bruce et al. (2015) also use such a dynamic specification. The control variables are like those of Ferede (2013) and other related studies. Since the specification is dynamic panel, estimating equation (1) by Ordinary Least Squares (OLS) will result in a biased estimate of coefficient estimates. An alternative estimation method is to use the Least Squares Dummy Variable model that involves the estimation of the equation by OLS after including provincial dummies. However, in a dynamic panel model setting, Nickel (1981) shows that such an approach will provide biased and inconsistent estimates of the coefficients since the lagged dependent variable is correlated with the error term.

Anderson and Hsiao (1981) suggested transforming the dynamic panel data model shown in equation (1) by first differencing as:

$$\Delta ENTRP_{it} = \beta_0 + \beta_1 \Delta ENTRP_{it-1} + \beta_2 \Delta MTR_{it} + \beta' \Delta X_{it} + \mu_i + \theta_t + \Delta u_{it} \quad (2)$$

Anderson and Hsiao (1981) argue that estimating equation (2) by the instrumental variable estimation method using two period lagged values of the level or differenced lagged dependent variable as an instrument will solve the problem. However, later studies show that, in addition to wiping out the provincial fixed effects, and with them important information, this method yields inefficient coefficient estimates.

Arellano and Bond (1991) provide an alternative method of estimating the dynamic panel data model which is more efficient than the instrumental variable method proposed by Anderson and Hsiao (1981). In the literature, their approach is often called the differenced Generalized Method of Moments (diff- GMM) method. In this method, one can estimate the dynamic panel model by first differencing (equation (2)) and using the level values of the dependent variable lagged two periods or more as valid instruments in the set of first differenced equations. The other exogenous explanatory variables in the model can be instruments of their own.

Arellano and Bover (1995) and Blundell and Bond (1998) show that the differenced GMM method has serious shortcomings. One problem of the differenced GMM estimator is that first differencing of the variables eliminates fixed provincial effects and therefore important information about time invariant provincial characteristics will be lost. Secondly, the differenced GMM estimator suffers from weak instruments and produces biases in finite samples and the estimates are asymptotically inefficient.

Arellano and Bover (1995) and Blundell and Bond (1998) attempt to solve the problems of first differenced GMM models by proposing a system GMM (sys GMM) procedure that involves the simultaneous estimation of a set of level and differenced equations. In the context of this paper, this involves estimation of equation (1) and equation (2) simultaneously. In this estimation approach, lagged variables in levels are used as instruments in the differenced equation. Lagged differences of the variables, on the other hand, can be used as instruments in level equations. In both the differenced GMM and the system GMM models, one can use Sargan test for over-identification restrictions to check the validity of the various instruments. The system GMM method is the most powerful and more commonly employed empirical methodology to estimate dynamic panel models. Consequently, the main empirical analysis is based on system GMM. However, for robustness checks this study also shows the results using other alternative estimation strategies.

Data

The empirical analysis uses annual aggregate panel data for the ten Canadian provinces over the period 1984–2015. The study period is limited by the availability of data for the key variables of interest. Data on the statutory marginal income tax rates are obtained from Milligan's (2016) Canadian Tax and Credit Simulator (CTaCS) database. For years prior to 2001, business entry rates are computed using data obtained from the Longitudinal Employment Analysis Program (LEAP) database. All other variables are obtained from the Statistics Canada database (CANSIM). Appendix table A1 reports the detailed definitions of the various variables of interest and the source of data. Table 1 below provides descriptive statistics for our main key variables of interest.

The literature on entrepreneurship shows that there is no a single comprehensive measure of entrepreneurship. Previous empirical studies use various measures of entrepreneurship or entrepreneurial activities. In this paper, entrepreneurship is measured by the business entry rate (ENTRP1). This measure captures business creation and the associated contribution of entrepreneurs and it is also more in line with the definition of entrepreneurship provided by the OECD. According to the OECD, entrepreneurship is a phenomenon related to "the enterprising human action in pursuit of the generation of value, through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets" (Ahmad and Seymour, 2008). There is a lot of variation in ENTRP1 across provinces and over time. Province-specific summary statistics for entrepreneurship and the tax rate are shown in Appendix table A2. During the period under investigation, the average business entry rate ranged from about 0.140 in Quebec to 0.219 in Newfoundland & Labrador. Similarly, the lowest business entry rate of 0.102 and the highest business entry rate of 0.338 occur in Quebec and Newfoundland & Labrador, respectively. The provincial part of the average statutory top marginal income tax rate also varies—from 0.100 in Alberta to 0.289 in Manitoba. However, for 2015, the last year of the sample period, Alberta had the lowest marginal income tax rate of 0.113, and New Brunswick had the highest marginal statutory rate of 0.258. The average combined provincial and federal statutory top income rate over the sample period ranged from 0.420 in Alberta to 0.503 in Quebec. There is also a significant variation in the combined top income tax rate over time, ranging from 0.390 in Alberta to 0.614 in Quebec in 1984.

Table 1: Summary Statistics, 1984-2015

	Definitions	Mean	Std. Dev.	Min	Max
VARIABLE					
ENTRP1	Business entry rate	0.169	0.037	0.102	0.338
ENTRP2	Net change in the number of active businesses	0.007	0.028	-0.148	0.092
Marginal tax rate (MTR)	Top statutory (provincial and federal combine) marginal income tax rate	0.472	0.037	0.39	0.614
Corporate tax rate	Statutory (provincial and federal) corporate income tax rate that is applicable to small business	0.191	0.036	0.11	0.258
Neighbours' MTR	Neighbours' population weighted average top statutory marginal income tax rate	0.474	0.04	0.39	0.606
Profit to GDP ratio	Corporate profit to GDP ratio	0.103	0.054	0.027	0.366
Over 64	The share of the population who are above 64 years of age	0.13	0.022	0.075	0.19
Median age	The share of the population who are between 25 and 49 years of age	0.368	0.026	0.302	0.413
Resource	The share of the resource sector	0.114	0.105	0.016	0.504
Average income tax rate	Implicit income tax rate for all families	0.166	0.017	0.118	0.215

Note: Total number of observations for all variables is 320

Empirical results

Table 2 reports the empirical results obtained using the different estimation methods. All the regressions include provincial fixed-effects and year dummies. The figures in parentheses are robust standard errors. The model is estimated over the period 1984–2015 for the 10 provinces. Since the first period is lost though first differencing, there are 310 observations in total for the main regression.

The empirical analysis begins by providing a basic static regression of business entry rates on just the top marginal income tax rate in column (1). This enables an easier comparison with those of previous studies that follow a similar static model. In such a regression, the coefficient estimate of MTR shows the long-term effects of the income tax rate on entrepreneurship. The results suggest that the top income tax rate has a statistically significant negative effect on entrepreneurship. More specifically, the result shows that a one percentage-point increase in the top statutory income tax rate is associated with a 0.17 percentage-point decrease in the business entry rate.

The dynamic panel data model estimation results are reported in columns (2) through (6). In column (2), the dynamic panel model is estimated with the fixed-effects estimation method, even though it includes the lagged dependent variable as an explanatory variable. The coefficients of the MTR in the estimated dynamic models show the short-run effects of the income tax rate. The long-term effects of the income tax rate are computed and shown at the bottom of table 2. The results in column (2) show that both the short-term and long-term coefficient estimates of MTR are negative and statistically significant at the five percent significance level. The results suggest that an increase in the marginal income tax rate discourages entrepreneurship as measured by the business entry rate. According to the coefficient estimates, a one percentage-point increase in the top income tax rate is associated with a reduction in the business entry rate by about 0.061 and 0.230 percentage points in the short-run and long-run, respectively.

Although the fixed-effects estimation results are reported for the sake of comparison, it is known that these estimates are biased and unreliable in the presence of a lagged dependent variable in the model. Thus, as discussed previously, it is important to address this empirical issue with the help of appropriate estimation methods. While the differenced GMM (diff-GMM) is used in columns (3) and (4), results obtained from the system GMM estimation method are reported in columns (5) and (6). The reported regression results are one-step system GMM estimates.

Table 2: Business Entry Rate Regressions 1984-2015

	Fixed Effects		Diff-GMM		System GMM	
	(1)	(2)	(3)	(4)	(5)	(6)
Marginal tax rate (MTR)	-0.169***	-0.061**	-0.067**	-0.590*	-0.451*	-0.058***
	(0.065)	(0.028)	(0.030)	(0.354)	(0.243)	(0.019)
MTR squared				0.549	0.415	
				(0.358)	(0.259)	
Average income tax		-0.122*	-0.163*	-0.169*	-0.166*	-0.162*
		(0.067)	(0.097)	(0.100)	(0.096)	(0.094)
Corporate income tax rate		-0.02	0.002	-0.006	0.018	0.023
		(0.026)	(0.031)	(0.033)	(0.025)	(0.023)
Neighbours' MTR		0.054	0.053	0.068	0.072	0.058
		(0.036)	(0.043)	(0.042)	(0.043)	(0.045)
Profit to GDP ratio		0.022	0.015	0.011	0.050*	0.050*
		(0.034)	(0.034)	(0.035)	(0.028)	(0.027)
Over 64		-0.541***	-0.623***	-0.709***	-0.488**	-0.447**
		(0.163)	(0.239)	(0.258)	(0.203)	(0.199)
Middle age		-0.456***	-0.538***	-0.611***	-0.362***	-0.324***
		(0.144)	(0.173)	(0.182)	(0.108)	(0.098)
Resource share		0.009	0.019	0.022	-0.019	-0.019
		(0.032)	(0.023)	(0.024)	(0.018)	(0.018)
Lagged dependent variable		0.734***	0.714***	0.690***	0.709***	0.723***
		(0.044)	(0.059)	(0.069)	(0.055)	(0.051)
Long-term effects of MTR		-0.230**	-0.234**	---	---	-0.210***
		(0.097)	(0.096)			(0.075)
Observations	320	310	300	300	310	310

Notes: All regressions include year and provincial fixed effects. Robust standard errors are in parentheses. Significance levels are indicated by *** for 1%, ** for 5%, and * for 10%

The differenced GMM estimation in column (3) shows that the top MTR has a statistically significant negative effect on the business entry rate. The magnitude of the estimated coefficients is slightly larger that those of column (2). Thus, the negative relationship between income tax rate and entrepreneurship persists.

Thus far, the empirical analysis assumes that there is a linear relationship between the top MTR and entrepreneurship. However, one may argue that the relationship between the two key variables can be best captured by a quadratic specification. The reason is that initially, higher MTRs might provide an incentive for highly skilled people to leave employment and set up businesses for the tax advantages. This suggests a positive relationship between MTRs and business formation. But, as the MTR increases and becomes quite high, the adverse effects of the income tax rate may have an overwhelmingly negative effect on the business entry rate. If this argument is valid, then one may find evidence of an inverted U-shaped relationship between entrepreneurship and MTR. To account for this possible non-linear relationship between the two key variables, in column (4), both the MTR and its square are included as explanatory variables and the model is estimated with difference GMM. The results indicate that the square of the MTR is statistically insignificant, suggesting that the relationship between MTR and entrepreneurship can be better captured with a linear specification.

As discussed previously, the differenced GMM estimation method has less power than the system GMM, which is arguably the most popular dynamic panel estimation method. Thus, in column (5), the system GMM estimation method is used to further check for the possible quadratic relationship between MTR and entrepreneurship. Again, the coefficient of the square of MTR is still positive and statistically insignificant, suggesting that the empirical evidence does not support the existence of a quadratic relationship between the two key variables. Consequently, the main empirically analysis is conducted using a linear specification as commonly employed in previous similar studies.

Column (6) reports the estimation results obtained from the system GMM estimation method for a linear specification. The results in column (6) indicate that the marginal income tax rate has a negative impact on entrepreneurship. The estimated regression satisfies the various specification tests, suggesting that coefficients are estimated consistently and the system GMM is appropriate for the empirical model.[3] Since column (6)

[3] The Sargan test statistics for the null hypothesis of valid instruments cannot be rejected at the conventional 5 percent level of significance supporting the validity of the instruments used in the regression. The probability values associated with the tests for the first- and second-order serial correlation in the residuals show that there is no

satisfies all the diagnostic statistical tests, and controls for various factors, this is this paper's preferred regression model and the discussion focuses on this regression result.

Column (6) shows that the coefficient of the key variable of interest rate, the marginal income tax rate, is negative and statistically significant at the one percent significance level. This key finding is consistent across various estimation methods. The results indicate that a one percentage-point increase in the marginal income tax rate is associated with a reduction in the business entry rate by about 0.058 and 0.21 percentage points in the short-term and long-term, respectively. Considering the long-term results, a province that raises its top personal income tax rate by one percentage point can expect to have fewer new businesses enter its economy, ranging from 14 (in the case of Prince Edward Island) to 696 (in the case of Ontario) (see table 3). Notably, in recent years, many provinces have raised their top personal income tax rates—Alberta raised its top rate by five percentage points, Ontario raised its top rate by 3.1 percentage points and BC raised its top rate by 2.1 points. The federal government's recent four percentage point hike to its top rate will only serve to exacerbate the provincial increases.[4] This is a significant loss for an economy that has been experiencing a decline in entrepreneurship for a long time. Note also that in column (6), the statistically significant, positive, and large coefficient of the lagged dependent variable shows that entrepreneurship is persistent and past levels of entrepreneurship have a significant effect on current levels of entrepreneurship. This confirms the appropriateness of the dynamic specification approach used in this study and suggests that ignoring the dynamic adjustment may result in biased estimates.

Regarding the other control variables in the model, most of the explanatory variables in column (6) have the expected signs. The neighbours' MTR, as expected, has positive effects on entrepreneurship, but the coefficient estimate is statistically insignificant. The coefficient estimate of the corporate profit-to-GDP ratio is, as expected, positive and statistically significant, suggesting that an improvement in the business environment as proxied by an increase in corporate profits, encourages entrepreneurship. The results also indicate that the corporate income tax rate for small

evidence of second-order serial correlation in the differenced error terms.

[4] According to the numerical estimate, a one percentage-point increase in the top personal income tax rate is associated with a 0.21 percentage-point decline in the business entry rate. The mean value of the number of total active businesses during the period under investigation is 99,110. Thus, a 0.21 percentage-point reduction in the business entry rate is translated as a reduction in the number of new businesses by 208 (i.e., 0.0021 x 99,110).

Table 3: Decrease in the Number of New Businesses Associated with a One Percentage Point Increase in the Provincial Top PIT Rate

Province	(1) Short-term Effects	(2) Long-term Effects
Newfoundland & Labrador	11	40
Prince Edward Island	4	14
Nova Scotia	17	62
New Brunswick	15	54
Quebec	129	465
Ontario	192	696
Manitoba	21	74
Saskatchewan	24	85
Alberta	76	275
British Columbia	87	315
All Provinces Average	57	208

Notes:
1) The above figures show the total number of new businesses that would not enter the economy if the top PIT rate is increased by one percentage point. The figures are computed based on the coefficient estimates of column (6) of table 2 and the average total number of active businesses for each province over the period 1984-2015.
2) This table shows that there are significant variations in the effects of income tax rate changes across provinces due to differences in the total number of active businesses in each province.

business and the share of the resource sector in the economy have statistically insignificant effects on entrepreneurship.

The average income tax rate is found to have negative and statistically significant effects. This is generally consistent with the overall result of this paper—that income tax has a negative effect on entrepreneurship. Another interesting result of this paper is that it shows that demographics does affect entrepreneurship. As in Liang et al. (2014), the results of this paper suggest that as the median age of provinces increases, the rate of new business formation falls. Furthermore, the results indicate that the aging of the population has negative effects on the business entry rate. See also Clemens et al. (2015) for a related discussion.

One may wonder how the empirical results of this paper compare to those of related previous empirical studies. Due to differences in specification and variations in entrepreneurship and income tax rate measures used, direct comparison with previous empirical studies is often difficult. In terms of specification, to the best of our knowledge, Folster (2002) for Sweden and Bruce et al. (2015) for US states are the only studies that employ dynamic panel specification. But both studies use self-employment-based measures of entrepreneurship. Folster's (2002) preferred results indicate that a 10 percentage-point increase in the highest income tax rate is associated with a reduction in the self-employment rate of about 0.6 percentage points for Sweden, which is surprisingly close to this paper's results, even when both use different measures of entrepreneurship. Bruce et al. (2015), on the other hand, finds that the top income tax rate does not have a significant effect on entrepreneurship.

In sum, regardless of the type of estimation method used, the results show that a higher marginal income tax rate is associated with a drop in entrepreneurship. The results suggest that a one percentage-point increase in the top marginal income tax rate is associated with a decrease in entrepreneurship as measured by the business entry rate by 0.058 percentage points in the short-run, and 0.21 percentage points in the long-run. The results of this paper are subjected to additional robustness checks in the following section.

Sensitivity Analysis

This section conducts a sensitivity analysis for the main empirical model to check the robustness of the key results. More specifically, the robustness of the preferred result of the paper is checked for the use of various alternative measures of income tax rates, entrepreneurship, and estimation methods. Table 4 presents the various robustness checks for the main empirical result reported in column (6) of table 2. The table below reports the coefficients of the variables of primary interest only. The other coefficient estimates are not reported for the sake of brevity.

As shown in the previous section, the empirical analysis does not support the possible non-linear relationship between MTR and entrepreneurship. However, one may still wonder whether the results of this paper would be robust if both the lowest and the highest income tax rates are included as explanatory variables. In column (1), in addition to the top MTR, the lowest income tax rate is included. The coefficient of the lowest MTR is positive but statistically insignificant. Again, the results show that the negative relationship between the top MTR and entrepreneurship persists.

One may argue that the top marginal income tax rate may not be relevant to some entrepreneurs whose income does not pass the top income tax bracket thresholds. To further check the robustness of the key result of this paper and address such a concern, in columns (2) and (3), the marginal income tax rates that are more in line with the average income of individuals is used. In columns (2) and (3) of table 4, the statutory marginal income tax rate (MTR) that is applicable to the average taxable income and the average of all income tax rates are used instead of the top MTR, respectively.[5] The average taxable income is the same for all provinces and obtained by dividing the total income assessed by total number of tax returns.[6] Note also that, as in Ferede (2013), this approach uses aggregate total income assessed and total number of tax returns for the country so that the income tax rate captures variations in only tax policy rather than income differences across the provinces. The tax rate variable includes both the applicable federal and provincial marginal income tax rates.

[5] See also Blau (1987) for the use of a somewhat similar approach.

[6] The total taxable income assessed and total number of taxable returns are aggregate data for the country. The data were obtained from Canada Revenue Agency.

Table 4: Robustness Checks

	Alternative Tax Measures				Alternative Entrepreneurship Measures		Alternative Estimation Method
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ENTRP1[a]	ENTRP1[b]	ENTRP1[c]	ENTRP1	ENTRP2	ENTRP3	2SLS
Marginal tax rate	-0.057**	-0.086***	-0.07*		-0.109**	-0.033**	-0.216***
	(0.027)	(0.028)	(0.039)		(0.051)	(0.016)	(0.071)
Coefficient of RIP				0.049***			
				(0.016)			
Lagged Dependent Variable	0.725***	0.725***	0.721***	0.723***	0.414***	0.729***	0.203
	(0.051)	(0.053)	(0.051)	(0.051)	(0.071)	(0.043)	(0.173)
Long-term effects of MTR	-0.208**	-0.313***	-0.250*	0.175***	-0.187**	-0.123**	-0.271***
	(0.102)	(0.103)	(0.129)	(0.062)	(0.084)	(0.062)	(0.052)
Observations	310	310	310	310	310	280	280

Note: All regressions include provincial fixed effects and year effects. Robust standard errors in parentheses. Significance levels are indicated by *** for 1%, ** for 5%, and * for 10%. In column (7), the lagged dependent variable is instrumented with its own one- and two-period lagged first-differenced values.

[a] In column (1), In addition to the top MTR, the statutory (provincial and federal) marginal income tax rate that is applicable to the lowest income tax bracket is also controlled for.

[b] In column (2), the statutory (provincial and federal) marginal income tax rate that is applicable to the average taxable income assessed is used.

[c] In column (3), the average of all statutory (provincial and federal) marginal income tax rates is used.

[d] In column (4), the coefficient of residual income progression (RIP) is used.

Columns (2) and (3) show that there is still a statistically significant negative association between personal income tax rates and entrepreneurship. The numerical magnitudes of the coefficient estimates indicate that a one percentage-point increase in the income tax rate is associated with about a 0.086 and 0.070 percentage-point decrease in business entry in the short-run and a 0.313 and 0.250 percentage-point reduction in the long-term. This suggests that in fact, the preferred results reported previously are at the possible lower end of the adverse effects of the income tax rate on entrepreneurship.

Ferede (2013) examines how income tax progressivity as measured by the coefficient of Relative Income Progression (RIP) affects the self-employment rate. RIP is generally defined as the ratio of one minus the marginal income tax rate to one minus the average income tax rate. Due to the way RIP is defined, an increase in income tax progressivity (say, due to an increase in the marginal income tax rate) is shown as a decline in RIP. So, a decrease in RIP is interpreted as an increase in income tax progressivity. To compare the results of this paper with those of Ferede (2013), in column (4) of table 4, the tax progressivity measure of RIP is used instead of the top marginal income tax rate. The RIP is calculated as a ratio of one minus the top statutory MTR to one minus the average income tax rate. The results suggest RIP has a statistically significant positive effect on our measure of entrepreneurship, suggesting again that income tax progressivity has a negative effect on entrepreneurship.

So far, the empirical analysis has been conducted using the business entry rate as a measure of entrepreneurship. But as indicated before, in the literature there is no generally consensus on how to measure entrepreneurship. While business entry rates capture the important aspects of business formation, it is known that some businesses also exit for various reasons. Thus, to check the robustness of the key result of this paper to such situations, an alternative measure of entrepreneurship, ENTRP2, is used in column (5). ENTRP2 is defined as the ratio of the change in the total number of active businesses as a ratio of the average of the number of active businesses in the current and previous year. In other words, ENTRP2 is constructed in the same way as ENTRP1 except that the former also considers business exits. There is a huge variation between ENTRP1 and ENTRP2 and the correlation between the two variables is only about 0.46. The results of column (5) show that the coefficient of MTR is negative and statistically significant at the five percent significance level, suggesting that there is a negative association between the income tax rate and this new measure of entrepreneurship. The numerical magnitude of the coefficient estimate is higher than the preferred result of table 2 in absolute value.

To make the results of this paper comparable with those of previous studies and check the robustness of the results to an alternative measure of entrepreneurship, a self-employment rate-based measure is employed in column (6). More specifically, in column (6), entrepreneurship is measured by the total self-employment in the non-agricultural sector as a share of total employment (ENTRP3).[7] The results confirm that there is a negative relationship between MTR and this self-employment-based measure of entrepreneurship, confirming the robustness of the key results of the paper to the use of alternative measures of entrepreneurship. However, the numerical magnitude of both the short-term and long-term effects is lower than those of the preferred result of table 2 in absolute value.

The main empirical analysis and the various robustness checks have so far been based on dynamic panel estimation results obtained from system GMM. As explained before, this helps us capture the possible persistence in entrepreneurship. In the dynamic panel model setting such as the one used in this paper, some previous studies, such as Folster (2002), employ the two-stage least square (2SLS) estimation method. Although such a method is generally considered to have less power than the system GMM, for ease of comparison with some of the previous studies, the 2SLS is used in column (7) as an additional robustness check. As before, entrepreneurship is measured by the business entry rate in this column. In column (7) the top statutory MTR is used, and the lagged dependent variable is instrumented with its own one- and two-period lagged first-differenced values. The appropriateness of the instruments is also statistically confirmed using the Hansen test of over-identification. The result again confirms that the top income tax rate is negatively associated with entrepreneurship and this result is robust to the use of various alternative estimation methods. Note that the magnitude of coefficient estimates of the lagged dependent variables in column (7) is lower than the comparable values in table 2 and it is statistically insignificant, suggesting that the 2SLS leads to a downward bias in the coefficient estimates. This obviously has implications for the long-term effects of the income tax rate on entrepreneurship.

In sum, this study's empirical analysis shows that a high personal income tax has an adverse effect on entrepreneurship both in the short-term and long-term. The coefficient of the marginal income tax rate is found to be negative and statistically significant at the five percent significance level or better in all the various scenarios analyzed in this paper. Thus, the main results are robust to the use of various measures of entrepreneurship, income tax rates, and estimation methods.

[7] The correlation between ENTRP1 and ENTRP3 is 0.09.

Conclusions

Entrepreneurship is a crucial source of innovation, employment, and growth in an economy. Thus, not surprisingly, it has been one of the most important recurring themes in many academic and policy debates. While there is no single, comprehensive measure of entrepreneurship, most studies and policymakers commonly use business entry and self-employment rates and related activities as good proxies. According to many theoretical models, the effect of the income tax on entrepreneurship is ambiguous. Empirical results from previous studies also provide mixed results about this important relationship. Thus, an important question is: Does a higher income tax rate discourage entrepreneurship? Answers to this question will provide important insights about the need for and use of tax policy incentives to encourage entrepreneurial activities.

This paper has investigated the effects of the personal income tax rate on entrepreneurship using aggregate panel data for Canadian provinces over the period from 1984 to 2015. The empirical methodology uses the system GMM estimation method which is relatively more powerful and appropriate for a dynamic panel model such as this paper employs. While entrepreneurship is defined by the business entry rate, the personal income tax system is captured by the top statutory marginal income tax rate as this is more consistent with some of the theoretical studies in the literature.

The empirical results suggest that an increase in the top statutory marginal income tax rate discourages entrepreneurship. According to this study's preferred estimate, a one percentage-point increase in the top statutory marginal income tax rate is associated with about a 0.06 and 0.21 percentage-point reduction in the business entry rate, in the short-term and long-term, respectively. Considering the long-term results, a province that raises its top personal income tax rate by one percentage point can expect to have fewer new businesses enter its economy. The decline in businesses ranges from 14 (in the case of Prince Edward Island) to 696 (in the case of Ontario). Notably, in recent years, many provinces have raised their top personal income tax rates—Alberta raised its top rate by five percentage points, Ontario raised its top rate by 3.1 percentage points and BC raised its top rate by 2.1 points. The federal government's recent four percentage point hike to its top rate will only serve to exacerbate the

provincial increases. This is a significant loss for an economy that has been experiencing a decline in entrepreneurship for a long time. The adverse effect of the income tax rate on entrepreneurship appears to be robust to various sensitivity checks. The strong evidence of the negative association between the income tax rate and entrepreneurship found in this paper suggests that the adverse effect of a higher income tax rate on risk-taking by entrepreneurs outweighs the potential tax planning opportunities entrepreneurs may have, as has been discussed in some previous theoretical studies. An important policy implication of the results of this study is that provincial governments can encourage entrepreneurship through various tax incentives such as lowering the marginal income tax rate.

Appendix Tables

Table A1: Definitions of variables and data sources

Variable	Description	Source
Business entry rate	The number of new businesses as a ratio of the average of total number of active businesses in the current and previous years.	CANSIM Table 527-0008 (2001-2015) and Statistics Canada, Longitudinal Employment Analysis Program (LEAP) database (1983-2000). and Catalogue 61F0020XCB
Net change in the number of businesses	The net change in the total number of active businesses as a ratio of the average of the total number of active business in the current and previous years	CANSIM Table 527-0008 (2001-2015) and Statistics Canada, Longitudinal Employment Analysis Program (LEAP) database (1983-2000). and Catalogue 61F0020XCB
Marginal personal income tax rate (MTR)	Provincial and federal (combined) marginal income tax rates	Canadian Tax and Credit Simulator (CTaCS) data base
Average personal income tax rate (ATR)	Average income tax rate of economic families and persons not in an economic family	CANSIM Table 206-0011
Self-employment in the agriculture sector	The number of people who are self-employed in the agriculture sector. (Note: data for Newfoundland & Labrador are obtained as the difference between the national figure and the sum of the remaining provinces)	CANSIM Table 282-0012
Total Self-employment	The total number of people who are self-employed	CANSIM Table 282-0012
Total Employment	The total number of people who are employed	CANSIM Table 282-0002

Table A1: Definitions of variables and data sources

Variable	Description	Source
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)
Over 64 years	The share of the population who are above 64 years of age	CANSIM Table 051-0001
Middle age	The share of the population who are between 25 and 49 years of age	CANSIM Table 051-0001
Corporate profit	Corporation profit before taxes	CANSIM Table 384-0001
Gross Domestic Product (GDP)	Gross domestic product at market prices	CANSIM Table 384-0037
Resource share	The share of the resource sector in the economy (Resource sector includes: mining, quarrying, oil and gas extraction, agriculture, forestry, fishing and hunting)	CANSIM Table 379-0025 (for 1984-2001) and CANSIM Table 379-0028 (for 2002-2015)

Table A2: Summary Statistics for Key Variables, 1984-2015

Province	Business Entry Rate (ENTRP1)				Statutory top marginal income tax rate (MTR)			
Province	**Mean**	**Std. dev**	**Min**	**Max**	**Mean**	**Std. dev**	**Min**	**Max**
Newfoundland & Labrador	0.219	0.059	0.137	0.338	0.481	0.036	0.423	0.544
Prince Edward Island	0.187	0.033	0.146	0.252	0.479	0.017	0.457	0.527
Nova Scotia	0.165	0.039	0.109	0.241	0.489	0.023	0.454	0.549
New Brunswick	0.169	0.039	0.119	0.267	0.479	0.031	0.417	0.548
Quebec	0.14	0.031	0.102	0.213	0.503	0.035	0.482	0.614
Ontario	0.154	0.013	0.135	0.179	0.475	0.025	0.422	0.52
Manitoba	0.156	0.018	0.124	0.198	0.467	0.037	0.429	0.56
Saskatchewan	0.156	0.014	0.129	0.187	0.461	0.029	0.44	0.534
Alberta	0.176	0.015	0.139	0.202	0.42	0.035	0.39	0.511
British Columbia	0.171	0.019	0.137	0.198	0.469	0.035	0.437	0.519

References

Ahmad, N., and R.G. Seymour (2008). *Defining Entrepreneurial Activity: Definitions Supporting Frameworks for Data Collection*. OECD Statistics Working Paper, January. OECD.

Anderson, T.W., and C. Hsiao (1981). Estimation of Dynamic Models with Error Components. *Journal of American Statistical Association* 76: 598–606.

Arellano, M., and S. Bond (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Review of Economic Studies* 58: 277–297.

Arellano, M., and O. Bover (1995). Another Look at the Instrumental Variable Estimation of Error-Component Models. *Journal of Econometrics* 68: 29–52.

Baliamoune-Lutz M., and P. Garello (2014). Tax Structure and Entrepreneurship. *Small Business Economics* 42: 165–190.

Blau, D.M. (1987). A Time-Series Analysis of Self-Employment in the United States**.** *Journal of Political Economy* 95: 445–467.

Blundell, Richard, and Stephen Bond (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics* 87: 115–143.

Bruce, D., and J. Deskins (2006). *State Tax Policy and Entrepreneurial Activity.* Small Business Research Summary No. 284. Office of Advocacy, U.S. Small Business Administration. <http://www.sba.gov/advo/research/rs284tot.pdf>, as of June 21, 2018.

Bruce, D., and M. Mohsin (2006). Tax Policy and Entrepreneurship: New Time Series Evidence. *Small Business Economics* 26: 409–425.

Bruce, D., X. Liu, and M.N. Murray (2015). State Tax Policy and Entrepreneurship. *National Tax Journal* 68: 803–838.

Clemens, Jason, Joel Emes, and Niels Veldhuis (2015). *Entrepreneurship, Demographics, and Capital Gains Tax Reform*. Research Bulletin. Fraser Institute. <https://www.fraserinstitute.org/sites/default/files/entrepreneurship-demographics-and-capital-gains-tax-reform.pdf>, as of June 21, 2018.

Cullen, J.B., and R. Gordon (2007). Taxes and Entrepreneurial Risk-Taking: Theory and Evidence for the U.S. *Journal of Public Economics* 91: 1479–1505.

Djankov, S., T. Ganser, C. McLiesh, R. Ramalho, and A. Sheleifer (2010). The Effect of Corporate Taxes on Investment and Entrepreneurship. *American Economic Journal: Macroeconomics* 2, 3: 31–64.

Ferede, Ergete (2013). Tax Progressivity and Self-Employment: Evidence from Canadian Provinces. *Small Business Economics* 40, 1: 141–153.

Folster, S. (2002). Do Lower Taxes Stimulate Self-Employment? *Small Business Economics* 19: 135–145.

Garrett, T.A., and H.J. Wall. (2006). Creating a Policy Environment for Entrepreneurs. *Cato Journal* 26, 3: 525–552.

Gentry, W.M. (2010). Capital Gains Taxation and Entrepreneurship. Williams College, mimeo.

Gentry, W.M., and R.G. Hubbard. (2000). Tax Policy and Entrepreneurial Entry. *American Economic Review* 90: 283–287.

Georgellis, Y., and H. Wall (2006). Entrepreneurship and the Policy Environment. *Federal Reserve Bank of St. Louis Review* 88: 95–111.

Godin, Keith, Jason Clemens, and Niels Veldhuis (2008). *Measuring Entrepreneurship: Conceptual Frameworks and Empirical Indicators*. Studies in Entrepreneurship and Markets, No. 7. <https://www.fraserinstitute.org/sites/default/files/MeasuringEntrepreneurship2008.pdf>, as of June 21, 2018.

Hansson, A. (2012). Tax Policy and Entrepreneurship: Empirical Evidence from Sweden. *Small Business Economics* 38: 495–513.

Kamhi, N., and D. Leung (2005). *Recent Developments in Self-Employment in Canada*. Working Paper 2005-8. Bank of Canada.

Keuschnigg, C., and S. Nielsen (2004). Progressive Taxation, Moral Hazard, and Entrepreneurship. *Journal of Public Economic Theory* 6: 471–490.

Liang, J., H. Wang, and P. Lazear (2014). *Demographics and Entrepreneurship*. NBER Working Paper 20506. National Bureau of Economic Research.

Macdonald, Ryan (2014). *Business Entry and Exit Rates in Canada: A 30-year Perspective*. Economic Insights, no. 038. Catalogue no. 11-626-X. Statistics Canada.

Milligan, Kevin (2016). *Canadian Tax and Credit Simulator*. Database, software, and documentation, Version 2016-2.

Mooij, R., and G. Nicodeme (2008). Corporate Tax Policy, Entrepreneurship and Incorporation in the EU. *International Tax and Public Finance* 15: 478–498.

Nickel, S. (1981). Biases in Dynamic Models with Fixed Effects. *Econometrica* 49: 1417–1426.

Organisation for Economic Co-operation and Development [OECD] (2001). *Science, Technology and Industry Outlook: Drivers of Growth: Information Technology, Innovation and Entrepreneurship*. OECD.

Poterba, James (1989). Capital Gains Tax Policy toward Entrepreneurship. *National Tax Journal* 42: 375–89.

Robson, M.T., and C. Wren (1999). Marginal and Average Tax Rates and the Incentive for Self-Employment. *Southern Economic Journal* 65: 757–773.

Rosen, Harvey, S. (2004). Entrepreneurship and Taxation: Empirical Evidence. In Vesa Kanniainen and Christian Keuschnigg (eds.). *Venture Capital, Entrepreneurship, and Public Policy*. CESifo Seminar Series. MIT Press.

Torrini, R. (2005). Cross-Country Differences in Self-Employment Rates: The Role of Institutions. *Labour Economics* 12: 661–683.

Wen, J.-F., and D. Gordon (2014). An Empirical Model of Tax Convexity and Self-Employment. *Review of Economics and Statistics* 96, 3: 471–482.

Acknowledgments

The Fraser Institute would like to acknowledge the Bob and Barbara Mitchell Fund for its generous support for this project. The author wishes to thank Charles Lammam and the anonymous reviewers for their comments and suggestions. Any remaining errors are the sole responsibility of the author. As the researcher has worked independently, the views and conclusions expressed in this paper do not necessarily reflect those of the Board of Directors of the Fraser Institute, the staff, or supporters.

About the author

Ergete Ferede

Ergete Ferede, Ph.D., is an Associate Professor of Economics at MacEwan University in Edmonton where he has held an academic appointment since 2006. He has previously taught at Addis Ababa University (Ethiopia), University of Alberta, and University of Windsor. Dr. Ferede has been actively engaged in research in the area of public finance and macroeconomics. His research has been published in the *National Tax Journal*, *International Tax and Public Finance, Small Business Economics*, etc. He is also currently pursuing various research projects on corporate income tax policy, intergovernmental grants, marginal cost of public funds, and tax reform.

Publishing information

Distribution

These publications are available from <http://www.fraserinstitute.org> in Portable Document Format (PDF) and can be read with Adobe Acrobat® or Adobe Reader®, versions 8 or later. Adobe Reader® DC, the most recent version, is available free of charge from Adobe Systems Inc. at <http://get.adobe.com/reader/>. Readers having trouble viewing or printing our PDF files using applications from other manufacturers (e.g., Apple's Preview) should use Reader® or Acrobat®.

Ordering publications

To order printed publications from the Fraser Institute, please contact:

- e-mail: sales@fraserinstitute.org
- telephone: 604.688.0221 ext. 580 or, toll free, 1.800.665.3558 ext. 580
- fax: 604.688.8539.

Media

For media enquiries, please contact our Communications Department:

- 604.714.4582
- e-mail: communications@fraserinstitute.org.

Copyright

Date of issue

July 2018

ISBN

978-0-88975-500-0

Citation

Ergete Ferede (2018). *The Effects on Entrepreneurship of Increasing Provincial Top Personal Income Tax Rates in Canada*. Fraser Institute. <http://www.fraserinstitute.org>.

Supporting the Fraser Institute

To learn how to support the Fraser Institute, please contact

- Development Department, Fraser Institute
  Fourth Floor, 1770 Burrard Street
  Vancouver, British Columbia, V6J 3G7 Canada
- telephone, toll-free: 1.800.665.3558 ext. 548
- e-mail: development@fraserinstitute.org
- website: <http://www.fraserinstitute.org/donate>

Purpose, funding, and independence

The Fraser Institute provides a useful public service. We report objective information about the economic and social effects of current public policies, and we offer evidence-based research and education about policy options that can improve the quality of life.

The Institute is a non-profit organization. Our activities are funded by charitable donations, unrestricted grants, ticket sales, and sponsorships from events, the licensing of products for public distribution, and the sale of publications.

All research is subject to rigorous review by external experts, and is conducted and published separately from the Institute's Board of Trustees and its donors.

The opinions expressed by authors are their own, and do not necessarily reflect those of the Institute, its Board of Trustees, its donors and supporters, or its staff. This publication in no way implies that the Fraser Institute, its trustees, or staff are in favour of, or oppose the passage of, any bill; or that they support or oppose any particular political party or candidate.

As a healthy part of public discussion among fellow citizens who desire to improve the lives of people through better public policy, the Institute welcomes evidence-focused scrutiny of the research we publish, including verification of data sources, replication of analytical methods, and intelligent debate about the practical effects of policy recommendations.

About the Fraser Institute

Our mission is to improve the quality of life for Canadians, their families, and future generations by studying, measuring, and broadly communicating the effects of government policies, entrepreneurship, and choice on their well-being.

Notre mission consiste à améliorer la qualité de vie des Canadiens et des générations à venir en étudiant, en mesurant et en diffusant les effets des politiques gouvernementales, de l'entrepreneuriat et des choix sur leur bien-être.

Peer review—validating the accuracy of our research

The Fraser Institute maintains a rigorous peer review process for its research. New research, major research projects, and substantively modified research conducted by the Fraser Institute are reviewed by experts with a recognized expertise in the topic area being addressed. Whenever possible, external review is a blind process. Updates to previously reviewed research or new editions of previously reviewed research are not reviewed unless the update includes substantive or material changes in the methodology.

The review process is overseen by the directors of the Institute's research departments who are responsible for ensuring all research published by the Institute passes through the appropriate peer review. If a dispute about the recommendations of the reviewers should arise during the Institute's peer review process, the Institute has an Editorial Advisory Board, a panel of scholars from Canada, the United States, and Europe to whom it can turn for help in resolving the dispute.

Editorial Advisory Board