University of Alberta

The Role of Entrepreneurship in Canadian Economic Growth

by

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Dedication

To my grandmother - Věnováno Babičce-Karličce

Abstract

Regional income disparity continues to be a source of major concern for Canadian policymakers. This study explores the temporal pattern of income disparity for Canadian provinces, and seeks to identify the role of one particular determinant – entrepreneurship – in explaining regional economic growth. The neoclassical growth framework is applied to a set of panel data drawn from Canadian provinces. An econometric model is applied to test for convergence and to identify the role of entrepreneurship in determining growth. The estimation results suggest that entrepreneurship plays a significant role in regional development in Canada. A dynamic vector autoregression (VAR) model is employed to predict the long-run effects of entrepreneurial policy changes on regional development. The dynamic estimation results suggest that entrepreneurship has long term stimulative effects on regional development in Canada. These findings, while important from a policymakers' perspective, have surprisingly gone unnoticed.

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Table of Contents

CHAPTER 1- INTRODUCTION..1

1.1 Background..1

1.2 Objectives..5

1.3 Data and methods..6

1.4 Thesis outline..8

CHAPTER 2 – LITERATURE REVIEW..9

2.1 Convergence in the economic literature..9

2.1.1 Review of the Solow model with human capital..12

2.1.2 Application to Canada..18

2.2. The role of entrepreneurship in the economy..27

2.2.1 Innovation and entrepreneurship..28

2.2.2 Linking entrepreneurship to economic growth..30

2.2.3 The link between entrepreneurship (self-employment) and unemployment ... 33

2.2.4 Entrepreneurship and the creation of new employment..36

2.3 Empirical evidence of entrepreneurship in Canada..37

2.3.1 Self-employment in the Canadian economy..38

2.3.2 The nature of Canadian self-employment..42

2.3.3 Small businesses and the urban-rural divide..44

CHAPTER 3 – DATA AND DESCRIPTIVE STATISTICS..49

3. 1 Data source and description..49

3.2 Descriptive statistics..53

3.3 Self-employment – Push or Pull?: A correlation analysis..61

CHAPTER 4 – REGIONAL CONVERGENCE ANALYSIS..65

4.1 Empirical model..65

4.2 Panel data estimators - fixed and random effects models 71
4.3 Estimation strategy 73
4.4 Results of econometric models..74
4.6 The effect of growth determinants on convergence 78
CHAPTER 5 – VECTOR AUTOREGRESSION ANALYSIS..80
5.1 Introduction to the VAR methodology..80
5.2 Background of the VAR methodology..82
5.3 The impulse response function..84
5.4 Estimating VAR with panel data..86
5.5 Model specification and estimation results 87
5.5.1 Estimation results.. 88
CHAPTER 6 – CONCLUSIONS 94
6.1 Summary..94
6.2 Policy implications 95
6.3 Limitations and future research 97
REFERENCES: 101

List of Tables:

Table 1. Three types of entrepreneurs 32

Table 2. Disaggregated self-employment according to class of self-employed worker and the goods-producing sector and services producing sector based on the North American Industry Classification System (NAICS) 52

Table 3. Average growth rate and share of class of self-employed worker, Canada, 1976 – 2007 57

Table 4. The average growth rate and share of self employment across industry sectors, based on the North American Industry Classification System (NAICS), Canada, 1987 – 2007 58

Table 5. Variable definitions, descriptive statistics and predicted signs 71

Table 6. Tests for different econometric models 78

Table 7. Residual correlation matrix 88

Table 8. Panel VAR regression results 92

List of Figures:

Figure 1. Total Self Employment as percentage of total employment, in Canada (1976 – 2007) ... 39

Figure 2. Relationship between per capita GDP growth rate 1981 - 2007, and per capita GDP in 2007 for all provinces including Canada ... 54

Figure 3. Annual total self-employment rate for all provinces and all industries, including Canada as a whole, 1976 – 2007 ... 56

Figure 4. Agricultural self-employment as a percentage of total employment across all provinces, including Canada as a whole, 1987 – 2007 ... 59

Figure 5. Non agricultural self-employment as a percentage of total employment across all provinces, including Canada as a whole, 1987 – 2007 ... 60

Figure 6. Non-agricultural self-employment and unemployment in Canada 1987 – 2007, including correlation coefficients by province ... 62

Figure 7. Indices for the number of paid employees and non-agricultural self-employed (1987 = 100) from 1987 to 2007 ... 64

Figure 8. Estimated coefficients on initial GDP in 1987 for different econometric models ... 79

Figure 9. The impulse-responses function for GDP and self-employment. Response of GDP to self-employment shock ... 89

Figure 10. The impulse-responses function for GDP and migration. Response of GDP to migration shock ... 90

Figure 11. The impulse-responses function for GDP and trade. Response of GDP to trade shock ... 91

Chapter 1- Introduction

"Once you start thinking about economic growth, it is hard to think about anything else."

Robert E. Lucas (1988, p.5), Nobel Laureate and professor of economics at the University of Chicago.

1.1 Background

Regional income disparity has been a long standing concern to Canadian policymakers and economists (McInnis, 1968; Lee, 1996; Coulombe, 2003; Beckstead and Brown, 2005). Since the mid 1920s, regions (provinces) of Canada have faced large disparities in income, and this trend has persisted through time (McInnis, 1968). Canada had the highest level of regional income inequality among all other developed countries during the 1950s and the 1960s (Williamson, 1965). While there is some dispute regarding its evolution, income disparity across Canadian regions during the beginning of 1990s was still about 50 percent higher than income disparity in comparable regions in the United States (Coulombe and Day, 1999; Coulombe, 1999).[1]

Although the nature of the evolution of disparities continues to be a subject of debate, there is a consensus that regional income disparities in Canada are problematic from both an economic as well as a public policy perspective. From an economic perspective, disparities in income across Canadian provinces hinder economic growth, productivity, knowledge transfer and innovation. From a public policy perspective, regional inequalities create frictions between provinces over federal budget and public policy priorities. Regional income disparities reflect differences in the fiscal capacity of

[1] Some scholars believe the income disparities have declined across Canadian provinces after World War II (Coulombe and Lee, 1995).

provincial governments and result in differing aggregate levels of public services (such as education, health and social assistance) and taxation (see Cameron, 1981). This implies that Canadians would have differential access to public services based on the income levels of their province of residence.

The overall goal of this thesis is to empirically study regional disparity in Canada and its evolution over time. Two strands of the recent literature motivate this thesis: first, the literature which emphasizes the critical role of entrepreneurship (small self-employed businesses) in accentuating regional growth in developed economies but one that has been ignored in the context of Canada's economy; and second, recent advances in the methodology for studying growth process based on panel growth regressions and dynamic panel vector autoregression analysis which allow us to both identify whether or not entrepreneurship contributes to growth and to predict the long-run effects of deliberate changes in entrepreneurship on economic development.

The first strand of the literature that motivates this study concerns the role of entrepreneurship in regional growth. Entrepreneurship has long been designated an "engine of growth" role by classical economists (Schumpeter, 1947). More recently, there has been a surge in theoretical and empirical models highlighting entrepreneurship in small businesses as the *single* most important factor in stimulating regional growth, and in helping poor regions that were initially left behind to catch up with more developed ones (e.g., Acs et al, 2005; Audretsch and Fritsch, 1994). Entrepreneurship plays a significant role in the process of identifying and pursuing innovations as well as in creating diversity of knowledge (Audretsch and Keilbach, 2006). Entrepreneurship could thus be seen as the missing link between investment in new knowledge (human capital) and economic growth.

However, studies of convergence in Canada, while focusing on determinants of economic growth (e.g., government transfers, capital and education) have completely ignored the critical role potentially played by entrepreneurship. Previous studies of regional growth in Canada are based on the neoclassical theory of growth developed by Solow (1956), which has been empirically formalized by Barro (1991) (Coulombe, 2000; Lee, 1996; Sign 2002). In this approach, entrepreneurship plays no role in the short or long run growth of economies.

To fill this gap in the literature, this thesis explicitly accounts for entrepreneurship in the economic growth process. To do so, it employs a “Barro regression framework” after augmenting it with an entrepreneurship variable. This extension is deemed specifically important for the Canadian economy, where entrepreneurship has been one of the strongest labor market trends relative to the paid employment sector. Since the late 1970s the number self-employed as a proportion of total employment has increased by 27% in Canada, rising from 12.2% in 1976 to 15.5% in 2007; while the paid employment sector increased only by 4.8% in the same time period (Statistics Canada, 2008; Author’s own computations).

The second strand of literature that motivates this thesis concerns the empirical framework of dynamic modeling techniques that can be used to examine the relationship between entrepreneurship and regional incomes in Canada. The main focus of this framework is to apply panel regressions, and panel vector autoregression (VAR) model to explore endogeneity issues and long term effects of policy changes on entrepreneurship.

The panel VAR model is a fairly new econometric innovation and an attractive approach for empirically analyzing and forecasting policy changes. This type of model has become one of the main tools of empirical macroeconomic analysis (Sims, 1980; Blanchard, 1989; Lütkepohl, 1993; Hamilton, 1994; and Mohapatra et al., 1999).

VAR analysis is employed to estimate the *dynamic* impact of entrepreneurship on regional incomes in Canada. The analysis of the dynamic impact of entrepreneurship on regional incomes includes an investigation into the impacts of unexpected shocks or innovations on entrepreneurship (self-employment) and their effect on regional incomes, in terms of future patterns of GDP. The primary focus is to determine whether the impact of entrepreneurship is permanent or temporary. The impact is considered permanent when entrepreneurship continues to have a long run effect on regional incomes over time, that is, a positive entrepreneurship policy shock (e.g., rise in the number of entrepreneurs) has a permanent effect with income showing no tendency to return to its pre-shock level even after several periods. On the other hand, entrepreneurship is a temporary or transient phenomena when marginal increases in entrepreneurship lead to a small change in regional GDP levels with a subsequent disappearance of the impact and without any long run effects. This investigation is critical for a more complete understanding of the role of entrepreneurship in economic growth, considering that economic growth is an inherently dynamic phenomena.

1.2 Objectives

1. Describe the pattern of regional growth, entrepreneurship and entrepreneurial (self-employment) sectoral trends, and to separate out different entrepreneurial sectors (e.g., agricultural and non-agricultural, using descriptive statistics).
2. Based on the neoclassical growth theory, study regional income disparity in Canada, after accounting for the role of entrepreneurship (using panel regression analysis).
3. Based on time series econometric models, study the dynamic relationship between entrepreneurship and economic growth (using vector autoregression analysis).

It is rewarding to focus on the above objectives for several reasons. The results of this research are anticipated to improve our understanding of the entrepreneurial sector of the Canadian economy and their contributions to sustainable regional growth. This research will help to identify what policies are needed to facilitate growth in different regions of Canada, and also contribute to assessing the effectiveness of different policies that are used to correct income disparities, such as income transfers or educational policies (expenditure on higher education).

The analysis is very timely, since increasing pressure from tight federal budgets has led the Canadian government to consider the reduction of regional inequalities as one of its central economic priorities (Finance Canada, 2007).[2] This focus on regional inequalities has been of long-standing interest to the government, since the balanced

[2] This is reflected in the 2007-2008 federal budget, which introduces a renewed and stronger equalization program (providing approximately $1.9 billion more over the next two years than the previous program), to tackle inter-provincial differences in income (Finance Canada, 2007).

development of all regions of Canada in the 1960s (Economic Council of Canada, 1964). In sum, the above objectives have been chosen with a strong focus on policy-relevant issues in mind.

1.3 Data and methods

In order to address the first objective (a description of the pattern of regional growth, entrepreneurship and entrepreneurial sectoral trends), this study draws on data sources from CANSIM II, (Canadian Socio-economic Information Management System), a computerized database provided by Statistics Canada. This database provides annual provincial data from 1976 to 2007[3] for 10 provinces viz., Newfoundland (NF), Prince Edward Island (PEI), Nova Scotia (NS), New Brunswick (NB), Quebec (QB), Ontario (ON), Manitoba (MB), Saskatoon (SK), Alberta (AB) and British Columbia (BC). The collected variables include: GDP per capita in 2002 constant prices, provincial population, proportion of provincial population with university education (age 25 and older), labor force for working population between 15 and 64 years, personal savings rate in percentage, depreciation per person in 2002 constant prices, net migration, net trade, unemployment rate in percentage, employment rate in percentage, and self-employment rate in percentage. The dataset also includes an urbanization variable that represents the urban population as a proportion of the total population (in percentage) and a visible minority variable presented as a proportion of total population (in percentage). Both urbanization and visible minority variables are collected for six time periods (1981, 1986, 1991, 1996, 2001, and 2006), from Statistics Canada's Census database.

[3] Collected data for GDP per capita in 2002 constant prices are available from 1981 to 2007 and data for different self-employment industry groups are available from 1987 to 2007 from the Statistics Canada.

Based on the data collected, the self-employment variable is further disaggregated into two categories. The first category, the class of self employment, consists of incorporated self-employed with paid or unpaid help, and unincorporated self-employed with paid or unpaid help. The second category of self-employment, industry groups, considers the goods and services sectors of the economy: e.g., agricultural, forestry, energy and other resource-based sectors based on the North American Industry Classification System (NAICS). I will specifically focus on the non-agricultural sector and its contribution to productivity and growth of the regions.

In order to address the second objective, this study will explore regional income disparity in Canada accounting for the role of entrepreneurship, applying regression analysis. This approach follows the neoclassical growth theory (Solow, 1956; Barro, 1991). Based on the neoclassical growth theory this study calculates the average growth rate for each region, and then estimates a cross-section regression of the average growth rate (per-capita GDP) on an initial GDP level per capita, and other control variables including entrepreneurship (measured by the number of small self-employed businesses). Convergence is said to exist if there is a negative and significant relationship between the average growth rate of per capita GDP and the initial level of growth. This approach underlies most of the empirical growth literature, and dominates studies of income disparity in Canada.

The last objective of this study is to apply vector autoregression methods in order to study the relationship between entrepreneurship and economic growth. This approach aims to examine GDP patterns in Canada by using a dynamic modeling technique. To do so, this study simulates an unexpected shock in the self-employment rate in order to observe changes in GDP patterns over time, while holding all other shocks constant. These shocks will be summarized using impulse-response functions. The estimated VAR responses will allow an assessment of the extent to which entrepreneurship is enabling Canadian provinces to transition to higher (or lower) GDP regimes.

1.4 Thesis outline

The remainder of the thesis is structured as follows. The second section reviews and discusses literature on the neoclassical Solow growth model and convergence. The convergence literature is followed by an introduction of the role of entrepreneurship in the economy. The literature review concludes with a discussion of empirical evidence of entrepreneurship in Canada. The third section introduces the dataset employed for estimation, and explores a comprehensive overview of the data by presenting descriptive analysis. An analysis of the neoclassical growth model follows in section four, which tests the link between entrepreneurship and economic growth across ten Canadian provinces. Based on dynamic modeling techniques, section five studies the role of entrepreneurship in the economic growth. In particular we apply the vector autoregression methods into our panel dataset to test whether entrepreneurship has a long term dynamic impact on economy. The final section of the thesis summarizes the results and draws conclusions from a policy perspective.

Chapter 2 – Literature Review

2.1 Convergence in the economic literature

Since the mid-1980s, economic growth has been one of the most active fields of research in economics (Jones, 2002). Economic growth is primarily concerned with per-capita income growth, technological change and the productive capacity of economies. Large amount of research focuses on how to measure growth in the economy (e.g., Sen, 1988). Standard macroeconomic measures of an economy are usually represented by GDP or GNP in real and per capita form, converted into one currency. Nevertheless it is important to recognize that these measurements can provide biased estimates since they underestimate real income of poor countries and distort GDP comparisons in terms of exchange rates (Ray, 1998). Although no measurement issues will change the fact that income inequality between countries is large, the poorest countries tend to have the lowest growth rates in comparison to middle or high income countries (Baumol, 1986). This begs the question, why is it that some economies are growing more rapidly than others? This section introduces the literature on convergence which discusses the Solow (1956) neoclassical growth model to answer this question.

The standard theoretical model for understanding economic growth of countries or regions within a country is the Solow (1956) growth model. The primary implication of the neoclassical model is a concept of convergence – the prediction that regions that have low initial incomes will grow faster and catch up with economies with high initial incomes. The Solow model assumes diminishing returns to individual factors of production. Since the marginal productivity of capital is decreasing, countries must use more and more units of capital in order to get the same gains in output. Therefore, poor countries with low ratios of capital to labor have higher marginal productivity of capital than rich countries and hence will grow at faster rates.

Solow's prediction distinguishes between two distinct concepts of convergence – unconditional and conditional. Unconditional convergence means that if initial conditions (that is, savings and depreciation rate, population growth rates) and technological progress are the same for every country then all countries will end up in the same steady state (long run equilibrium), irrespective of their initial levels of per capita income or capital. In other words, history does not matter. Further according to Solow, the common long run growth rates of the per capita income levels will be equal to the rate of technical progress.

Conditional convergence, on the other hand, recognizes that initial conditions may differ across countries, although technical progress is still assumed to be the same. As a result, countries may end up in different long run steady state positions in terms of their per capita income. However, the long run growth rates will be the same. In other words, unlike unconditional convergence, which implies convergence of both growth rate and per capita income levels, conditional convergence implies only convergence in income growth rates.

Both types of convergence provide testable hypotheses. Since unconditional convergence implies that in the short-run, poorer countries will grow faster than richer countries, we anticipate a negative relationship between growth rates and initial per capita income. In case of conditional convergence, the relationship between growth rates and initial per capita income can also be expected to be negative (poorer countries will grow faster than richer countries) after conditioning on the different steady state positions of countries.

Empirical evidence from an extensive and ongoing literature also provides support for the prediction of convergence in particular, and for the Solow model more generally. The hypothesis of unconditional convergence is typically tested in the literature by regressing the time average income per capita growth measure on the initial income per capita level across countries or regions. For example Baumol (1986) empirically tested unconditional convergence using annual data from sixteen countries over the period 1870-1979. Baumol's results provide evidence that unconditional convergence holds only for a relatively homogenous group of countries (industrialized or middle income countries). However this study has been critiqued because of a selection bias in the sample used (Romer, 1994).

Given the restrictive assumptions underlying unconditional convergence (in terms of not conditioning on the different steady state positions across regions), many studies have looked for evidence of conditional convergence (e.g., Barro 1991, Mankiw et al, 1992). The hypothesis of conditional convergence is typically tested in the literature by regressing an income per capita growth measure on the initial income level and a set of additional explanatory variables that control for the different steady-state positions of the sample countries (Barro and Sala-i-Martin, 1991). Several authors have found conditional convergence to hold even when examining a broad sample of countries and regions (e.g., Varblane and Vahter, 2005; McQuinn and Whelan, 2006)

Empirical applications of the Solow model, however, also have emphasized the role an additional determinant of growth that did not explicitly feature in the Solow model – that is, the role of human capital[4] (Mankiw et al., 1992; Barro, 1991). Introducing human capital into Solow, the framework explicitly accounts for different growth trajectories due to differences in education and skill sets of countries. Formally, Romer (1990) develops a growth model where human capital plays a key role in the research sector, which generates new products or ideas that promotes technological progress and therefore determines the level of growth. Therefore, human capital is assumed to be created deliberately within the economy as an endogenous source of growth.

2.1.1 Review of the Solow model with human capital

This section reviews the Solow neoclassical theory of economic growth, augmented with the role of human capital. The simple neoclassical model assumes that output in an economy is produced by two inputs, capital and labor. The neoclassical model has been applied in many influential empirical studies (e. g., Barro and Sala-i-Martin, 1995; Carlino and Voith, 1992). However, these empirical studies noted that in addition to the variables pointed by Solow human capital also played a strong role in determining growth roles of economies. Therefore, this section extends the Solow model by including human capital into the production function, following Mankiw et al. (1992).

The neoclassical model assumes that output per capita is produced according to an aggregated production function. The production function is expressed in Cob-Douglas form:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} (A(t)L(t))^{1-\alpha-\beta} \qquad 0 < \alpha < 1, \qquad (1)$$

[4] Human capital is measured in different ways in the empirical literature. Some studies measure human capital as the average years of schooling in the population (Maddison, 2003; Van der Eng, 1992) others use expenditure on education (Leeuwen, 2006; Bleaney et al., 2001).

where $Y(t)$ is output, $K(t)$ is capital input, $H(t)$ is a stock of human capital, $L(t)$ is a labor input and $A(t)$ is a technological progress that measures the productive efficiency. Increase in $A(t)$ results in higher output without raising the inputs.

Labor and technology are assumed to grow exogenously at rates n and g, respectively:

$$L(t) = L(0)e^{nt}, \quad (2)$$

$$A(t) = A(0)e^{gt}. \quad (3)$$

In equation (1) the number of effective units of labor $A(t)L(t)$ grows at rate $n + g$. Output and physical, human capital input can be divided by effective unit of labor $y = Y/AL$, $k = K/AL$ and $h = H/AL$. The lower case letters $y, k, h;$ represent quantities per effective unit of labor, then the production function (eq. 1) can be rewritten in terms of effective labor force:

$$\hat{y}(t) = \hat{k}(t)^{\alpha}\,\hat{h}(t)^{\beta}. \quad (4)$$

The model assumes that savings are exogenous and constant, and therefore the physical and human capital per effective unit of labor is accumulated according to the following equation:

$$\dot{k} = s_k y(t) - (n + g + \delta)k(t), \quad (5)$$

$$\dot{h} = s_h y(t) - (n + g + \delta)h(t), \quad (6)$$

where s_k and s_h are the fractions of income invested into a physical and human capital. The terms n, g and δ denote the growth rates of the labor force, technological progress and the depreciation rate of physical and human capital. The assumption in the production function (1) is that one unit of consumption can be transformed either into one unit of physical capital or one unit of human capital. Equations (5) and (6) imply that level of physical and human capital per effective unit of labor converges to constant steady state values k^* and h^* that can be expressed as:

$$k^* = \left(\frac{s_k^{1-\beta} s_h^{\beta}}{n+g+\delta} \right)^{1/(1-\alpha-\beta)}, \tag{7}$$

$$h^* = \left(\frac{s_k^{\alpha} s_h^{1-\alpha}}{n+g+\delta} \right)^{1/(1-\alpha-\beta)}. \tag{8}$$

The neoclassical model predicts the impact of savings and population growth on real income. Substituting equations (7) and (8) into a production function and taking logs, the steady state per capita income is obtained

$$\ln\left[\frac{Y(t)}{L(t)}\right] = \ln A(0) + gt - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) + \frac{\alpha}{1-\alpha-\beta}\ln(s_k) + \frac{\beta}{1-\alpha-\beta}\ln(s_h). \tag{9}$$

This equation shows a dependence of income per capita on population growth and accumulation of both physical and human capital.

The Solow model assumes diminishing returns to individual factors of production. In equilibrium $\alpha + \beta < 1$, suggesting that there are diminishing return to both physical and human capital, since labor and technology grow exogenously. The implication of this assumption is that countries must use more units of physical and human capital in order to get the same gains in output, and countries would converge in income per capita, with the same technological progress. If $\alpha + \beta = 1$, there would be constant return to scale in the reproductive factors and no steady state for the model. Countries would not need to converge in income per capita, even if they have the same technological progress. Countries that save more would grow faster indefinitely.

Mankiw et al. (1992) make two predictions about the role of human capital in equation (9). First, higher savings indicate a higher income that leads to a higher steady state level of human capital, even if the proportion of income devoted to human capital accumulation is unchanged. Therefore the presence of human capital accumulation in equation (9) increases the impact of physical capital accumulation on income growth. The second prediction is that the high population growth decreases the income per capita because the amounts of physical and human capital must be distributed more precisely over the entire population.

The assumption is that s and n rates are independent of an error term ε (country specific factors), thus both s and n are exogenous, not influenced by the level of income. Based on this assumption we can use ordinary least square (OLS) to estimate the production function and observe whether there are any biases in obtained coefficients. Like the Solow model, the augmented model with human capital, provides expected signs and magnitudes of coefficients on saving (s) and population growth (n) in equation (9). Because the value of coefficient α, the physical capital share in income is approximately 1/3 this implies that the elasticity of income per capita (Y/L) with respect to the saving rate (s) is expected to be 1/2 and an elasticity with respect to $(n + g + \delta)$ is expected to be -1/2. The human capital's share coefficient β is predicted to have a value between 1/3 and 1/2 that suggest that 50 to 70 percent of total labor income represents the return to human capital (Mankiw et al., 1992).

Equation (9) assumes that the economy is at steady-state. However, since the human capital level at steady-state is not observable, the presence of various government policies is more likely to push an economy out of steady-state (Lee, 1996). Therefore, in order to describe dynamics outside of steady-state, the assumption is that a country is sufficiently close but not at the steady-state. The transitional dynamics around the steady state are expressed by following equation:

$$\left(\frac{d\ln(y(t))}{dt}\right) = \lambda[\ln(y^*) - \ln(y(t))], \tag{10}$$

where y^* is the steady state level on income per effective worker and *y(t)* is the actual value at time *t.* The speed of convergence[5] around the steady state is then given by λ (the rate of convergence), that measures the speed of adjustment to the steady state:

$$\lambda = (n + g + \delta)(1 - \alpha - \beta).$$

To study the rate of convergence, equation (10) implies that:

$$\ln(y(t)) = e^{-\lambda t}\ln(y(0)) + (1 - e^{-\lambda t})\ln(y^*), \tag{11}$$

where y(0) is income per effective worker at an initial time. Subtracting ln(y(0)) from both sides of the equation (10), we get:

$$\ln(y(t)) - \ln(y(0)) = -(1 - e^{-\lambda t})\ln(y(0)) + (1 - e^{-\lambda t})\ln(y^*), \tag{12}$$

by substituting for y^* we get the final model:

$$\begin{aligned}\ln(y(t)) - \ln(y(0)) = &-(1 - e^{-\lambda t})\ln(y(0)) - (1 - e^{-\lambda t})\frac{\alpha + \beta}{1 - \alpha - \beta}\ln(n + g + \delta) \\ &+ (1 - e^{-\lambda t})\frac{\alpha}{1 - \alpha - \beta}\ln(s_k) + (1 - e^{-\lambda t})\frac{\beta}{1 - \alpha - \beta}\ln(s_h).\end{aligned} \tag{13}$$

[5] In the discussion about the Solow neoclassical growth model it is also important to question the speed of the convergence. Solow (1956) not only makes predictions about convergence but also about the speed of convergence to a steady state level. Mankiw et al. (1992) estimate the rate under which convergence occurs; their findings are consistent with Solow, although the values are smaller than he predicted. The parameters are smaller since human capital is included in the model by Mankiw et al. (1992), which implies faster convergence. The value of λ in equation (9) is the parameter governing the speed of convergence, derived from the coefficient on initial level of per capital income.

In this model the growth of income is a function of steady states determinants - physical and human capital, technology, population growth, capital depreciation and the initial level of income. The differences between equation (13) and the earlier equations imply that equation (13) has the advantage of taking into account the out-of-steady states dynamics which means that regions do not have to be in their steady states in order to estimate the convergence. Thus, equation (9) is valid only if regions are already in their steady states or if deviations from steady states are random. However, equation (13) introduces a problem, if regions are permanently different with different initial technology A(0)'s. In this case, these A(0)'s would enter the equation as part of the error term and would be positively correlated with initial income. Therefore, the variation in A(0) would bias the coefficient on initial income (and potentially other coefficients). In other words, permanent cross-region differences in the production function would lead to differences in initial incomes uncorrelated with the growth rates and this would bias the results towards finding convergence (Mankiw et al., 1992).

Since the quantities per effective unit and the share of human capital are unknown, equation (13) cannot be estimated but can be rewritten in terms of quantities per labor.

$$
\begin{aligned}
\ln(y(t)) - \ln(y(0) = -(1-e^{-\lambda t})\ln(y(0)) - (1-e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(n+g+\delta) \\
+ (1-e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(s_k) + (1-e^{-\lambda t})\frac{\beta}{1-\alpha}\ln(h) \\
+ (1-e^{-\lambda t})\ln A(0) + gt,
\end{aligned}
\tag{14}
$$

where y is per capita output (income per person or income per worker in the standard model), *A(0)* is the initial level of technology, s_k is the investment into the physical capital and h is an average (or initial value) of human capital per worker over a sample period.

Equation (14) leads to a specification that serves as basis for empirical analysis. Therefore, the final empirical model that will be estimated is given by following regression equation:

$$(\ln y_{t,i} - \ln y_{0,i})/T = \beta_0 + \beta_1 \ln y_{0,i} + \beta_2 \ln(n+g+\delta) + \beta_3 \ln s_k + \beta_4 \ln h + u_i, \qquad (15)$$

where

$\beta_0 = (1-e^{\lambda t})\ln A(0) + gt$, $\beta_1 = -(1-e^{\lambda t})$, $\beta_2 = -(1-e^{-\lambda t})\alpha/(1-\alpha)$,

$\beta_3 = (1-e^{-\lambda t})\alpha/(1-\alpha)$, $\beta_4 = (1-e^{-\lambda t})\beta/(1-\alpha)$,

i is the regional index, T is the length of the observation interval, the coefficient λ is the rate of convergence, and u_i is an error term. The convergence coefficient, λ, indicates the rate at which a country approaches the steady state value. Equation (15) forms the baseline for most empirical work in the growth literature and is the foundation for the analysis of this thesis.

2.1.2 Application to Canada

Having reviewed the theoretical framework used in the convergence literature, this section examines the available empirical evidence on regional disparities in Canada. There exists a sizeable literature on this issue in the Canadian context (see for e.g., Coulombe, 1996; Coulombe and Tremblay, 2001; DeJuan and Tomljanovich, 2005). A general theme of inquiry in these studies is to identify the regional determinants of growth (e.g., human capital, government transfers, urbanization, physical capital, etc) across Canadian provinces, and to analyze whether or not regional economies are catching up or converging towards a common per capita income level. Most of the empirical work on regional disparity in Canada uses provincial data (e.g., Coulombe, 1999; Lee, 1996). Some studies have also used smaller geographic units, such as Census Division data, available from the Census of Population (e.g., Alasia, 2003; Shearmur and Polèse, 2001).

The bulk of the studies above rely on the theoretical growth model developed by Solow (1956), and empirically formalized by Barro (1991), to estimate the impact of a set of empirical determinants and initial conditions (identified in the neoclassical model) on an outcome variable, which represents regional growth. These studies are similar in the sense that they estimate a growth regression specified under the Barro-Solow framework, using regional data that is obtained at a specific level of disaggregation. What differentiates the studies is the set of determinants used to explain regional growth rates.

The continuing search for new regional growth determinants, as well as establishing the validity of old ones specified by theory, is characteristic of the literature on regional growth in Canada and elsewhere in the world. This is because such exploration and identification of growth determinants has large implications for regional policy formulation. This study fits into this literature, and contributes to it, by exploring the role of a so far empirically unestablished engine of regional growth - entrepreneurship. Therefore, in what follows, I review the literature of regional growth in Canada with a focus on the growth determinants typically used in different studies and some of the most significant empirical results.

The study by Coulombe and Lee (1995) suggests that poor provinces tend to grow faster than rich ones in per capita terms (they find a negative coefficient on the variable denoting initial income level of regions), as predicted by the neoclassical growth model.[6]

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[6] The speed of convergence was estimated 1.05-2.89 per cent per year depending on the measurements of the output growth.

The study concludes that trade, government transfers and taxes have increased the speed of convergence and reduced the level of regional disparities. In terms of identifying the regional determinants of growth, the study focuses on unconditional convergence (also referred to as absolute Beta convergence). Unconditional convergence assumes that regions are catching up or converging towards a common per capita income level while all determinants (savings rate, human physical capital) are constant for all regions. Therefore, this approach does not account for the regional-specific determinants of growth. Coulombe and Lee (1995) use a dataset that includes six different measurements of per capita income and output to study the evolution of provincial disparities and convergence in Canada. Using panel data over the 1961-1991 time periods, the authors divided the data into three sub-periods in order to obviate degrees of freedom problems.[7]

In a subsequent study, Coulombe (1996) used provincial data from 1926 to 1994 and four different measurements of per capita income. The data used for the growth regression was partitioned into nine sub-periods (seven years in duration). The findings reveal that convergence in income per capita did not occur before 1949; however, convergence was detected during the time period 1950-77.[8] The author highlights that convergence will be achieved faster by redistributing income through taxes and transfers. Moreover, the study suggests that industrial structure and barriers to factor mobility will have to change in order to decrease the regional disparities. The study estimated the absolute Beta convergence, assuming that growth determinants are identical for all

[7] Given the limited number of provinces these studies have divided the data into several shorter sub-periods (e.g. 10-year spans) to create pooled cross section time series data. This increases the number of degrees of freedom available for regression analysis.
[8] Specifically the speed of convergence was estimated at the faster rate 3.5-4.2 per cent annually.

regions. Therefore the author did not specify the set of right hand side growth determinants that this thesis is looking to identify.

The literature on convergence also compares the evolution of regional income disparities of Canadian provinces with US states. For instance, Coulombe and Day (1999) analyze the evolution of personal income per capita, output per capita and output per worker to compare Canada and 12 U.S. northern states. [9] However, this study also does not account for different determinants of growth across regions, since its focus is on absolute Beta convergence. The result suggests that disparities in personal income and output were lower in the northern U.S. states in comparison to Canadian provinces between 1929 and 1995. In Canada, regional disparities in output were higher than those in personal income, suggesting that government transfer payments play an important role in redistributing personal income across regions. The authors' findings are consistent with other studies that observed a decline in relative regional income disparities in Canada over time (e.g., Coulombe and Lee, 1995)

While the above studies focused on the evolution of income disparities by measuring the outcome variable, subsequent studies have focused on discovering the appropriate set of right hand side growth determinants in the regression analysis that have an effect on regional growth. For example, Lee (1996) adds determinants of growth into the neoclassical model, and explores whether private, public and human investments, migration and industrial structure effects regional growth and convergence. Lee (1996) was among the first to show that in addition to standard drivers of growth, human capital

[9] The authors draw a distinction between measures of per capita income and output per capita since the capital stock of one region may be owned by residents of another region. Additionally personal income per capita includes transfer payments from government that may be redistributed across regions, therefore the impact of the redistribution might decrease the regional disparities.

has a positive and significant effect on productivity growth in Canada. Further, the findings show that the relationship between human capital and productivity growth becomes even stronger if inter-provincial migration[10] is considered, although migration slows down the process of convergence. Increasing public investment (institutional and government investments) is also shown to affect productivity growth.

Other studies have confirmed Lee's (1996) finding regarding the important role of human capital in regional per capita income growth (e.g., Lee, 1996; Coulombe and Tremblay, 2001). For instance, Coulombe and Tremblay (2001) use educational achievements as a proxy for human capital.[11] The authors also include in their regression analysis other standard growth determinants such as saving rates, growth rates of the population, and variables capturing heterogeneous social and political institutional frameworks. Human capital explains almost 50 per cent of the relative per-capita income growth. Based on this finding the authors suggest that an important factor of long-run growth is to invest into advanced education. Investments into education are purported as a way of decreasing the dependency on income support programs and increasing opportunities for earning higher labor income.

More recently, Coulombe (2000) explored whether or not an additional determinant – urbanization - plays a significant role in the growth of regional economies. Urbanization is represented by a ratio of the percentage of the population living in urban areas to the provincial average.[12] In the study the author suggests that even though the

[10] Migration is captured in this study by "net migration per 1000 population".
[11] According to this study, the best available proxies of human capital at the regional level come from the percentage of males and of the population of both sexes in the population, 15 years and over, and 25 years and over, who have achieved at least one university degree.
[12] Urban population is defined as the population living within census metropolitan areas and census agglomerations with over 10,000 inhabitants, collected from Statistics Canada's census database.

Canadian economy has gone through a process of increased urbanization since the World War II, the relative standing of provinces has not changed significantly in recent years. The growth regressions provide new evidence about the speed of convergence. Provinces have converged at the five per cent rate with a significant effect of urbanization since mid 1980s. Most of the provinces are close to their respective steady states, indicating that the cross sectional dispersion is in equilibrium where all variables will be either constant or grow at constant rates.

A subsequent study by Coulombe (2003) uses the same methodology that was employed for income per capita to estimate the convergence of human capital across Canadian provinces. The study analyzes whether urbanization and inter-provincial migration drive income and human capital convergence.[13] The study measures output growth based on annual per capita income data (provincial personal income less government transfers). The empirical findings on the urbanization rate suggest that is ten per cent higher in rich provinces compare to the provincial average. Other findings suggest that human capital remains in more urbanized regions, which indicates that university graduates tend to migrate from poor to rich provinces. This finding suggests that inter-provincial migration of university graduates does not explain the driving force of human capital and income convergence. The authors conclude that in order to gain more wealth in the long run, it is necessary to have human capital associated with a higher rate of urbanization.

A recent study by Coulombe and Tremblay (2008) further explores the role of skills in economic growth by introducing skills as an additional explanatory variable into

[13] The computation of urbanization variable follows study by Coulombe (2000) and the human capital indicator is based on study by Coulombe and Tremblay (2001).

the regression analysis. The data was constructed from the 2003 International Adult Literacy and Skills Survey (IALSS) released by Statistics Canada. The study compares skill intensity and schooling of the international immigrant, interprovincial migrant, and Canadian born population. The study documents that international immigrants have lower skills than the Canadian born population, whereas interprovincial migrants are more skilled than non-migrants. In terms of convergence results, this implies that international immigration reduces provincial disparities while interprovincial migration tends to increase them.

The literature has also explored the role of urbanization by separating an aggregate urbanization measure into urban and rural regions. For instance Alasia (2003) collected annual data from the Neighborhood Income and Demographics database of the Small Area and Administrative Data Division (SAAD), Statistics Canada, to analyze rural and urban income disparities. Alasia (2003) not only tests for convergence, but also accounts for transition probability matrices (using Markov analysis) – the probability of territories to transition in to a higher, lower income state or remain in a currents state. The study suggests that income disparities have increased between territories but provincial disparities have decreased over the 1990s, which implies that the geography of income disparities is shifting slowly from a provincial to a rural and urban divide. In terms of transition probability matrices, the results demonstrate that most of the census divisions remained in the same income state, and 25% divisions moved to a higher state. The results of this paper are consistent with Coulombe (2000), emphasizing that provincial convergence is affected by an increase in the urban population.

Another strand of the literature on regional disparity in Canada looks at the rural and urban divide without relying on the neoclassical growth model (Singh, 2002; Beckstead and Brown, 2005). A study by Singh (2002) explores the level and incidence of low incomes in rural regions. The study uses Census data to identify rural and urban regions according to the OECD classification of "predominantly rural" and "predominantly urban" and "intermediate" regions.[14] The results suggest that income in rural regions is consistently lower compared to urban regions. Provinces with high average urban income have also a high average income in their rural regions. In terms of income disparities between rural and urban areas, the largest gap was measured within Nova Scotia and Manitoba compared to the smallest gap within New Brunswick, Newfoundland and Labrador. The study concludes that the share of the rural population with low incomes has declined, relatively to the share of urban population with low incomes.

A study by Beckstead and Brown (2005) compares the degree of income disparities across provinces to income disparities across the urban-rural divide. Rural and urban data were defined based on the Census Metropolitan Areas and Census Agglomerations from the 2001 census. Urban regions were subdivided into four classes and rural regions into two classes according to population size. The results are consistent with Singh (2002), indicating that income disparities exist. The Atlantic provinces and Saskatchewan have less than average per capita income because the majority of the population live in small urban and rural regions. This trend is explained by relatively poor labor market conditions in smaller cities and rural areas compared to urban areas.

[14] The OECD defines a region as "predominantly rural" if more than 50 percent of the population lives in rural communities. Regions are classified as "predominantly urban and intermediate" if less than 50 percent of the population lives in rural communities.

Beckstead and Brown indicate that a higher income in urban areas may be caused by a higher level of productivity. Higher productivity is explained by the benefits of access to skilled labor that is located in a center with a larger number of industries. The authors also emphasize that the provincial disparity may be structural since it is hard to replicate a large city economy in rural areas.

While most of the empirical work has been concerned with the cross-sectional analysis of convergence, a time series analysis of convergence had also been examined in several studies. Unlike the cross-section approach, where the rates of convergence are assumed to be equal across regions, the time series analysis allows the rate of convergence to differ across regions (Carlino and Mills, 1993). DeJuan and Tomljanovich (2005) collected data on two measures of income; personal income and personal income minus transfer payments using time series techniques to examine the convergence characteristics between 1926 and 1996. The empirical findings of this study are consistent with others (Coulombe, 1996; Coulombe and Day, 1999), supporting the convergence across Canadian provinces after the World War II. The results suggest that convergence exists in most provinces, although personal income is converging faster then earned income. The authors conclude that there is evidence that the federal government is taxing richer provinces (BC, ONT) more and transferring the funds to poor provinces. The findings also support previous studies (e.g., Coulombe and Lee, 1995) that government transfer payments have a role in reducing income disparities across provinces in Canada. Finally, the results also suggest that Atlantic and Plains provinces have stronger convergence tendencies than Canada as a whole.

2.2. The role of entrepreneurship in the economy

As mentioned in the introductory chapter, the neoclassical economic growth literature (e.g., Solow, 1956; Barro, 1991) has neglected to isolate the role of entrepreneurship and innovation as a source of economic growth. This is a consequence of the neoclassical approach treating innovation as a residual explanatory factor for growth, since innovation is assumed to be determined exogenously. Recognizing that entrepreneurship is inherently linked to innovation (Schumpeter, 1911), and that endogenous innovation is a key driver for endogenous economic growth (Kaldor and Mirrlees, 1962; Mankiw et al. 1992; Grossman and Helpman, 1994; Ruttan, 2001), a more recent strand of literature has focused on isolating the role and nature of entrepreneurship to innovation and growth (e.g., Audretsch and Keilbach, 2006).

Since the focus of the subsequent empirical analysis rests on isolating the role of entrepreneurship in economic growth of the Canadian economy, it is first important to define entrepreneurship, and identify the nature and roles of different types of entrepreneurs in the Canadian economy. The concept and significance of entrepreneurs or entrepreneurial firms has a long history in economic thought. Entrepreneurship can be regarded as the ability and willingness of individuals, on their own, or in teams, to perceive and create new economic opportunities, and to introduce them in the market (Wennekers and Thurik, 1999). Much of the literature suggests that the entrepreneur has a vital role as an innovator who implements changes in the economy by introducing new goods, methods of production (Schumpeter, 1911) and generating new employment (Biggs, 2002). In fact, Baumol (2002a, p. 1) argues that "…entrepreneurs have been the primary source of the technical ideas and innovations that serve as the foundation for the unprecedented growth performance of the world's industrial economies…." Entrepreneurship has also been considered a behavioral characteristic of persons (Carree and Thurik, 2003); and it is not an occupation or a fixed state of existence (Gartner, 1989). Schumpeter (1911) adds that because being an entrepreneur is not a profession or a lasting condition, entrepreneurs do not form a social class in the technical sense.

Most of the entrepreneurs are business-owners or self-employed in small firms (Schumpeter, 1911). The small firm is an extension of the individual in charge (Lumpkin and Dess, 1996), who started up their own business (market entrants) or who already owns a small business (Fölster, 2000; Disney et al., 2003; Castany et al., 2005). The definition of a small firm varies by country, or more specifically by market size. Countries with large economies define a small firm as having fewer than 500 workers. In the developing world the number of workers in small firms is typically defined as fewer that 100 (Biggs, 2002).

Therefore, for the purpose of this thesis, the measurement of entrepreneurship will be the rate of self employment, defined as the ratio of self-employed to total employment. Many empirical studies have employed this measurement of entrepreneurship in the economy (e.g., Blanchflower and Oswald, 1998; Audretsch and Thurik, 2001). For the remainder of this thesis, we will use the terms entrepreneurship and self-employment interchangeably.

2.2.1 Innovation and entrepreneurship

Considering that entrepreneurship is inherently linked to innovation, what does the literature reveal about the relationship between different types of firms (entrepreneurship) and the different facets of innovative performance? Innovation has been measured by an input into the innovative process, such as R&D (Scherer, 1965) or else by a proxy measure of innovative output, such as patented inventions (Mansfield, 1968) or patent applications (Bound et al., 1982). Considering the focus of this thesis on entrepreneurship, different views could be adopted of innovative performance of firms. Hagedoorn and Cloodt (2003) suggest that technological performance, inventive performance, and innovative performance can be analyzed in a narrower sense – individually - in terms of R&D inputs, patent counts, patent citations, and new product announcements. However, the authors emphasize that these indicators can be combined in a multi-dimensional setting to measure innovative performance in the broader sense. Nevertheless, when attempting to link entrepreneurship and the innovative performance of firms, the key problem remains that "the management and applied economics literature on innovation and related topics has a long history of struggling with the measurement of the innovative performance of companies" (Hagedoorn and Cloodt, 2003, p.1365).

Taking a narrow view of innovative performance of firms, Williamson (1985) provides evidence that innovation is more likely to occur in smaller firms, while larger firms are more effective at manufacturing and distributing those innovations. Geroski (1995) suggests that existing firms have a greater interest in exploiting the profit possibilities of their established product program than in searching for new opportunities. Therefore, we are more likely to observe that young and small firms are more innovative than incumbent firms. Link and Rees (1990) also suggest that small firms have the advantage of exploiting new knowledge created by R&D expenditures of large corporations.

Acs and Audretsch (1987) have explored the relative innovative advantage between large and small firms in the U.S. Their results suggest that the innovation rate (the number of innovations) per 1000 employees is, on average, higher in small firms, but they conclude that this average figure clearly varies across industries.[15] Small firms were found to have an innovative advantage in highly innovative industries from utilizing a large component of the skilled labor force, while large firms tend to have an innovative advantage in industries which are capital-intensive, concentrated, and advertising-intensive (Acs and Audretsch 1987).

In sum, we have evidence which suggests that small firms are more likely to be innovative due to their advantage to exploit new knowledge and search for new opportunities. Studies which have explored innovation in terms of R&D and patent invention suggest that small firms produce more patents and are more likely to be engaged in high-impact technology. The literature also differentiates between the impact of innovative small and large firms, as a function of the type of industry. Small firms were found to have an innovative advantage in highly innovative industries, while large firms tend to have an innovative advantage in industries which are capital-intensive.

2.2.2 Linking entrepreneurship to economic growth

Schumpeter's (1911) early analysis suggests that an increase in the number of entrepreneurs leads to an increase in economic growth. In the more recent economic literature, entrepreneurship has received attention as a key driver for endogenous economic growth. Entrepreneurship can influence economic growth through innovation,

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[15] In 1982 the small-firm innovation rate in manufacturing was 0.322, compared to a large-firm innovation rate of 0.225 (Acs and Audretsch, 1987).

and through entry and exit of new firms (Wennekers and Thurik, 1999). The impact of enhanced entrepreneurial activity on growth can also be the result of an expression of entrepreneurial skills, and more precisely, the propensity of entrepreneurs to innovate (Dejardin, 2000).

The literature review of Wennekers and Thurik (1999) on the link between entrepreneurship and economic growth identifies three different types of entrepreneurs (Table 1): Schumpeterian entrepreneurs (entrepreneurial and self–employed), intrapreneurs (entrepreneurial and employee) and managerial business owners (managerial and self–employed).[16] Thus, both Schumpeterian entrepreneurs and intrapreneurs belong to the core of real entrepreneurship and are viewed as the engine of innovation and 'creative destruction' (Schumpeter, 1942).[17] Managerial business owners generally represent the majority of self–employed; this category includes franchisees, shopkeepers and people in professional occupations. Although they play an important role in the economy, through coordination of production and distribution achievements, Wennekers and Thurik (1999, p. 48) suggest that they cannot be viewed as the "…engine of innovation and creative destruction. This is the major function of Schumpeterian entrepreneurs and intrapreneurs."

[16] The fourth type in table 1 corresponds to the executive managers (managerial and employee) that is not considered an entrepreneur.
[17] Schumpeter (1942) introduced the term 'creative destruction' to describe the process of transformation – the destruction of old and creating new economic structures - that accompanies radical innovation.

Table 1. Three types of entrepreneurs

	Self-employed	Employee
Entrepreneurial	**Schumpeterian entrepreneurs**	**Intrapreneurs**
Managerial	**Managerial business owners**	Executive managers

Source: Wennekers and Thurik (1999, p. 47).

The study conducted by Dejardin (2000) also explores the connection between entrepreneurship and economic growth based on a review of recent research. Dejardin (2000) puts forth that the "Schumpeterian" innovative entrepreneurs seek to create new profit opportunities which can result in productivity increases. An increased level of productivity could then lead to an increase in economic growth. Dejardin (2000) suggests that the larger the share of innovative entrepreneurs in the workforce, the greater the increase in economic growth.

A number of studies have investigated the link between small firms and economic growth empirically. Carree and Thurik (1998) analyze the impact of small firms on economic growth in 13 European countries. Their analysis suggests that small firms that existed in 1990 had a positive effect on output growth in the subsequent four years. Audretsch and Thurik (1999) identify a shift in economic activity away from large firms towards small enterprises, and explore the impact of this shift on economic growth in 12 European countries. The authors point out that those countries which experienced greater rates of growth also experienced the greatest shift towards small enterprises. In a more recent study, Audretsch and Thurik (2001) examine 17 European countries over a four year period, to produce empirical evidence that supports their previous study. This evidence suggests that an increased role of entrepreneurial activity can result in higher subsequent rates of economic growth.

Summing up, the literature on entrepreneurship and growth identifies entrepreneurs and their propensity to innovate as a key driver for endogenous economic growth. The literature also distinguishes between entrepreneurs who are innovative and creative in comparison to managerial business owners who are important to the economy, but who may not be viewed as the engine of economic growth. From an empirical perspective, the above studies also provide evidence that small firms can have a positive effect on economic growth.

2.2.3 The link between entrepreneurship (self-employment) and unemployment

Since occupational choices are likely not only driven by intrinsic motivation but also by external conditions that an individual faces, what does the economic literature tell us about the relationship between the unemployment in an economy and the level of self-employment? The economic literature that examines the link between self-employment and unemployment (e.g., Acs et al.; 1994; Schuetze, 1998) is divided over whether the relationship between self-employment and unemployment is positive (the "push" effect) or negative (the "pull" effect). The push effect indicates that the number of self-employed increases once total unemployment increases, which would suggest that workers are "pushed" into self-employment because of poor job opportunities, or during a time of economic distress. In this case, self-employment is positively associated with unemployment (Lin et al., 2000). The pull effect suggests that if regular employment is strong, self-employment is even stronger; workers are being "pulled" into self employment in a vision of better benefits and higher chances of success (Kamhi and Leung, 2005). It is thus assumed that the relationship between self-employment and unemployment would be negative. The study by Fölster (2000) suggests that the pull effect might be due to demand fluctuations over the business cycle, or to structural shifts in business conditions. Fölster (2000) also indicates that the relationship between self-employment and unemployment is an important policy question, since many countries attempt to promote self employment through subsidies or reducing taxes as a way to fight unemployment.

Audretsch et al. (2001) examine whether entrepreneurship in 23 OECD countries reduces unemployment over the period 1974-1998. The results of this study show that the relationship between unemployment and entrepreneurship is both negative and positive. The evidence suggests that an increase in unemployment can have a positive impact on entrepreneurship. At the same time, an increase in entrepreneurship has a negative impact on subsequent unemployment; these are two dynamic inter-temporal relationships, each working in the opposite direction. In this study, the authors conclude that the level of entrepreneurship and unemployment differ considerably across countries, which implies that the public policy approach to address these issues should also differ across countries.

Audretsch and Thurik (2001) investigate why a higher level of entrepreneurship impacts unemployment, by conducting a meta-analysis of previous empirical studies. To do this they refer to Gibrat's Law, which states that the size of firm and its growth rate are independent. Since the expected growth rates of small and large enterprise are identical, Gibrat's Law implies that shifting employment from large to small enterprises should have no impact on total employment. Therefore, Audretsch and Thurik (2001) suggest that “a restructuring of the economy away from large enterprises and towards small firms, should have no impact on the unemployment rate.” (p. 23). However, their conclusion from reviewing previous economic studies suggests that Gibrat’s Law does not hold across a broad spectrum of firm sizes, controlling for differences in country, time period, industry, and methodology used in these studies. Audretsch and Thurik (2001) also suggest that firm growth is negatively related to firm size and age, therefore higher growth rates of small firms should cause lower unemployment rates, which is not consistent with Gilbrat’s Law.

A more recent study by Piergiovanni et al. (2003) uses data of Italian firms, to investigate whether Gibrat’s law can be rejected for five different business groups in the services sector. The results suggest that Gibrat’s Law can be rejected for three business groups and for the industry as a whole, since growth rates are independent of firm size in the remaining two business groups. This evidence suggests that any general conclusion regarding Gibrat's Law cannot be reached without considering firm heterogeneity across industries.

Summing up, there is no consensus from previous studies on whether self-employment has a negative or positive effect on unemployment. Nevertheless, the literature suggests that this relationship is an important policy question, since many countries are fighting with unemployment. The literature also suggests it is important to allow for heterogeneity of firms and business groups, since different sectors are likely to differ in their mix of firm sizes, such that firm size can have a differential impact on economic growth.

2.2.4 Entrepreneurship and the creation of new employment

Much of the entrepreneurship literature pays attention to the relationship between entrepreneurship and the creation of new employment. Employment creation occurs when firms grow or enter the market, while employment destruction occurs when firms shrink or exit the market. A fall in overall employment is likely to make self-employment an attractive option. Some authors describe self-employment as a 'safe choice' for unemployed people, or for people who are discriminated in the labor market (Moore 1983). Based on data from Sweden (1976 to 1995), Fölster (2000) suggests that entrepreneurial firms have a high contribution to job creation and overall employment. The study by Hart and Harvey (1995) focuses on three regions in the United Kingdom during the late 1980s, and suggests that employment creation stems largely from small firms, although employment losses were also found for small firms, supporting the pull hypothesis.

In a more recent survey of the literature, Praag and Versloot (2008) review studies that investigate whether entrepreneurship creates new employment. Their conclusion is that higher business start-up rates are associated with higher immediate levels of employment. However, after some years of operation, the relationship between entrepreneurship and employment growth is negative due to the competitive pressure which leads inefficient incumbents to exit the market. In the longer run, the net effect is positive due to increased competitiveness (Praag and Versloot, 2008). However, as Fritsch (2008) points out, the formation of new businesses cannot be identical in all regions. The overall employment effect of new firms is likely positive in high productivity regions with high-quality entries, rich resources and a well-functioning innovation system. The effect is likely smaller or may even be negative in low productivity regions with low-quality entries, scarcity of relevant resources and an inefficient innovation system (Fritsch, 2008).

Summing up, the literature isolates a strong connection between entrepreneurship and new job creation. From an empirical perspective, the literature concludes that job creation depends on the region, the industry and the period in which the firm undertakes the activity. Further, in the short run, higher business start-up rates are found to be associated with higher levels of employment. However, after some years the relationship with employment growth is negative due to competitive pressure, yet the long run net effect is positive due to increased competitiveness.

2.3 Empirical evidence of entrepreneurship in Canada

As one of the most industrialized country within the Organization for Economic Co-operation and Development (OECD), it has been suggested that Canada enjoys the highest standard of living along with the United Kingdom, Germany and Japan (HRSDC, 2009). In 2006, Canada's GDP per capita was $ 43,356 compared to an average of $35,512 in other 30 OECD countries (OECD, 2009). As of December 2008, Canada's national unemployment was 6.6%, which is 0.2% lower than the average in all OECD countries (OECD, 2009). Historically, Canada, the United Kingdom and Sweden have attracted the largest inflow of foreign direct investment (FDI) among the OECD countries (OECD, 2009), and a large number of multinational enterprises of all sizes (Ensign, 2008). However, what does the available empirical evidence suggest on the role of small to medium size enterprises, and on the role of entrepreneurship in particular to the Canadian economy?

2.3.1 Self-employment in the Canadian economy

There is some evidence that the trend of small business expansion has had a positive impact on the Canadian economy. Evidence from Moore and Mueller (1998) suggests that self-employment has become the primary source of new employment in the economy. Based on Statistics Canada data, over 75 per cent of all new jobs were created between 1989 and 1996 in self-employment (Moore and Mueller, 1998). Further, as part of an international survey, the 'Global Entrepreneurship Monitor' ranked Canada as one of the most entrepreneurial countries in the world for the 1997-2007 period (Bosma et al., 2009).

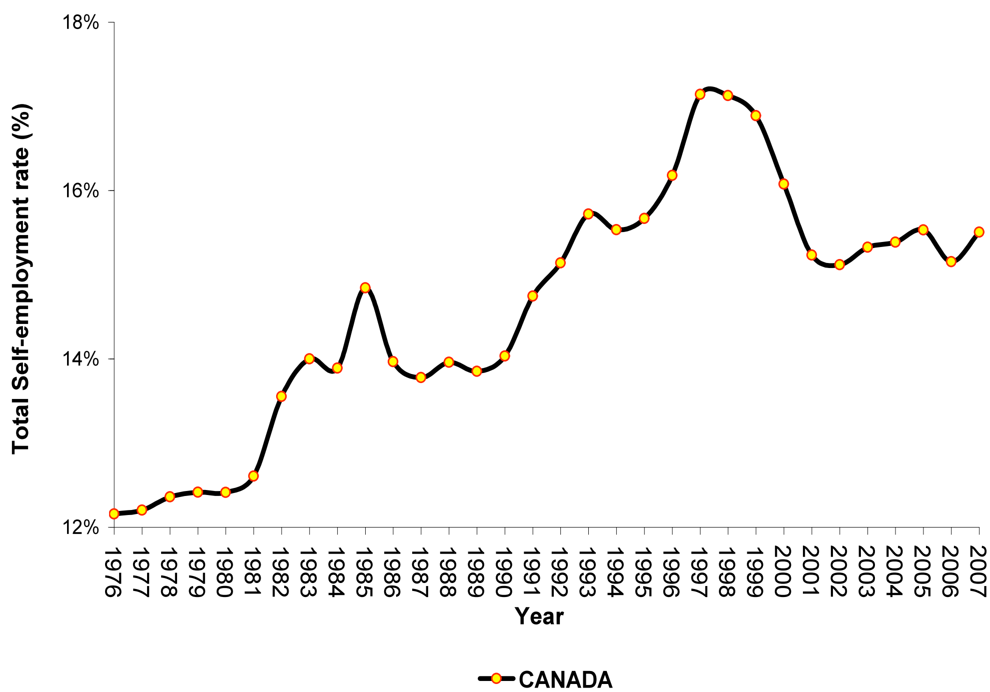
Canadian self-employment has fluctuated considerably over the past 30 years (Figure 1). Between 1976 and 1997, the fraction of self-employed in total employment increased significantly, starting at 12.16 per cent in 1976, and reaching a peak of 17.14 per cent in 1997.[18] The most rapid growth of self-employment occurred between 1990 and 1998 by an average of 3.6 per cent per year. In contrast, over the 1999-2002 period, the self employment rate had a noticeable decline to -0.2 per cent annual growth. During the 2002-2003 period, self-employment rose again to 3.7 per cent. In 2005 the number of self-employed people fell by 3 per cent. In 2007 the growth of self-employed rebounded to 4.6 per cent, adding additional 33.000 of new small to medium-size firms (Tal, 2008). Over the past three decades self-employment grew by an annual average of 2.6 per cent,

[18] Statistics Canada's definition of self-employed includes both owners of incorporated and unincorporated businesses as well as unpaid family workers.

while wage employment grew by an average of 1.7 per cent per year between 1976-2007 (Statistics Canada, 2008; author's own computations).

Empirical evidence on the push versus pull-effect of unemployment is limited in the Canadian context. The study by Tal (2006) suggests that the decline in Canadian self-employment has a positive effect on unemployment, since people transfer to a wage employment. Tal (2006) suggests that falling numbers of self-employed should be seen as a positive development, since strong labor markets have "pushed" workers into self-employment because of poor job opportunities to find suitable wage-employment job.

Figure 1. Total Self Employment as percentage of total employment, in Canada (1976 – 2007)



Source: Statistics Canada, 2008, author's own computation

The above fluctuating trends in the rate of self employment (Figure 1) could be in part explained by the push and pull effect (e.g., Fölster 2000; Audretsch et al., 2001). The empirical study by Kamhi and Leung (2005) has attempted to identify economic conditions (measured by the unemployment rate) that could explain the rise and decline of Canadian self-employment over the period of 1987-2002. Based on their empirical results, the authors suggest that the self-employment rate is pro-cyclical - individuals are being "pulled" into self-employment when economic conditions are better. However, the unemployment rate was higher in 1998 than in 1989, and subsequently declined after 1998; this suggests that cyclical factors cannot fully explain the rise and decline of the self-employment rate. Thus, factors which caused the self-employment rate to rise may be different from those that caused it to decline.

With a focus on a possible relationship between business cycles and unemployment, Lin et al. (2000) analyzes whether high unemployment has had an effect on self-employment in Canada, which might lead to cyclical or permanent trends. The results suggest that there is a significant and negative relationship between self-employment rates and unemployment rates, supporting the hypothesis that self-employed are "pulled" into a dynamic and vibrant economy.

A more recent study that focuses on structural issues underlying self-employment, Kamhi and Leung (2005), suggests that the rise and decline of self-employed has occurred due to shift in the industrial structure and changes within each industry. The increase and the subsequent decrease in self-employment occurred in most industries. Four fields appear to have contributed to the rise of self-employment (Kamhi and Leung 2005): educational services; business services; professional, scientific and technical services; and finance, insurance, and real estate services. Likewise, a large fraction of the decline can be accounted by the following industries: retail trade, manufacturing industries and mainly agriculture. This finding by Kamhi and Leung (2005) suggests that industry-specific factors drive the trends in self-employment.[19]

Most the literature suggests that a significant portion of the decline in self-employment growth is due to the ongoing decline in the importance of the agricultural sector. The decline in agriculture appears to have held back the rise in the overall self-employment rate, but because of its declining overall economic significance, the gap between the self-employment rate for the total economy and that for the non-agricultural sector has closed further (HRDC, 2000). Therefore the declining importance of the agricultural sector has been outweighed by the increasing importance of professional, scientific, technical services, management, administrative, and other support services, and a rebound in the importance of construction (Kamhi and Leung, 2005). Due to the rapid decline of the agricultural sector, some studies exclude workers in the agricultural self-employment sector in the analysis and use non-agriculture self-employment rates either as a proportion of total employment (Kuhn and Schuetze, 2001; Wiklund and Shepherd 2008) or as a proportion of total non-agriculture employment (Acs et al., 2005). In order to abstract from ongoing employment declines in agriculture, which affect self-employment statistics, this study uses the non-agricultural self-employment rate as a proportion of total employment.

[19] The descriptive statistics section of this thesis aims therefore to account for industry-specific factors by investigating the correlation between unemployment and non-agricultural self-employment.

2.3.2 The nature of Canadian self-employment

Even with the recorded decline in the agricultural sector, a high rate of self-employment can be observed in Canada. In 2007, 117,000 Canadians became small business owners, increasing the number of self-employed to 2.6 million in total, the highest in Canada's history surpassing the growth of private and public sector employees (Statistics Canada, 2007). Apart from considering the above factors driving the "push" and "pull" hypotheses, it is of interest to look at the nature of Canadian entrepreneurs in an attempt to better understand Canadian self-employment. Tal (2005) suggests that being a small business owner is a lifestyle choice. Self-employed use their business as a means of generating income, while balancing other commitments or lifestyle choices. Even though entrepreneurs may work longer hours for less pay, they tend to stay in their positions longer than those who work for someone else. Typically, small business owners would also prefer to start small and remain small. Tal (2005) argues that policies aimed at helping small business to grow must first consider the fact that the majority of small firms in Canada do not wish to grow, as lifestyle considerations outweigh financial motivations.

Demographically speaking, there has been an increase in self employment across all age and gender groups over the recent years (Tal, 2005). It appears that the propensity of self-employment increases with age. The most significant increase occurred for older businesses owners of both genders over the age of 55 (Tal, 2005). Currently the age group 45-65 years is the fastest growing segment of the population. Therefore, in the long term, older entrepreneurs are likely to play an even more important role in the economic activity, as the population ages and the traditional workforce age cohort declines. It is possible that the reason behind the trend of increased number of older entrepreneurs is that they are more experienced and more productive. On average, a small business owner was found to often have had over 13 years of related practical industry experience before launching his/her business (Tal, 2006).

Tal (2008) provides more recent evidence that supports this "experience hypothesis". The study identifies six important characteristics that contribute to small business financial success in Canada. The first is previous experience in paid employment that contributes to strong revenue growth. Those self-employed with such experiences are seeing average 60% higher revenue growth compared with no paid-employment experience. Small firms which utilize professional services such as accountants, bankers and lawyers enjoy a 75 per cent faster rise in revenue compared to those small firms who do not employ such support. Higher education also contributes to business success as it helps to increase the ability of the entrepreneur to cope with problems and submit a clear signal of competency to potential clients.[20] Partnership rather than single ownership was found to be a significant factor that improves the resources and skills base of the venture, enhancing credibility among creditors, and provides ongoing psychological support. Technology adoption and connectivity also plays an important factor that led to accelerated growth of small firms. Furthermore, market/export orientation was found to affect small business financial success. During the first half of the decade, those small firms that were more export-oriented grew 20 per cent faster that companies focusing on the Canadian market (Tal, 2008).

[20] In Canada around 40 per cent of small business owners have a university/college diploma (Tal, 2008).

2.3.3 Small businesses and the urban-rural divide

Evidence from Canada suggests that the greater the differences in economic growth and development between rural and urban regions, the greater we can expect consequences in terms of regional economic inequality (Ensign, 2008). In order to provide a more comprehensive view of the differences between rural and urban regions, this section explores employment growth in rural areas and identifies trends in rural employment in Canada. This section also considers studies which have analyzed the urban-to-rural employment growth spillovers and summarizes policy recommendation for regional development in Canada from these studies.

In the Canadian economic literature that analyzes differences between rural and urban regions, the definition of urban and rural regions is based on the Statistics Canada Census data. The term "urban" is defined as a region with a minimum population of 1,000 and a population density of at least 400 people per square kilometer (Statistics Canada, 2006). Conversely, the term "rural" refers to a population with less than 1,000 people per square kilometer. Statistics Canada also disaggregates data according to census divisions, which are referred to Census Metropolitan Areas (CMAs) (population of at least 100,000) and Census Agglomerations (CAs) (population of at least 10,000) from the 2001 census (Beckstead and Brown, 2005). However, given the diversity of socio-economic indicators that can be used to characterize regions, the Statistics Canada distinction of urban vs. rural can only be considered as a proxy for distinguishing regions for analytical purposes. Consider that rural regions are considerably diverse in Canada, for instance regions in rural Ontario are very different compare to the prairies due to the differences in population size and access to markets. Therefore the nature of the rural disparities can be economically different across provinces (Singh, 2002).

The study by Cunningham and Bollman (1996) attempts to identify the trends in rural employment in Canada in early 1990s. The authors find a decline in employment in natural resource industries (e.g., agriculture, fish, forest, and ore) that have traditionally sustained rural growth in Canada. The trends show a shift away from employment in resource industries toward service industries. The authors conclude that rural communities, especially communities that contain one type of industry, are expected to decline unless they can diversify and become less dependent on resource industries. [21]

Similar trends in rural employment growth have also been observed by Wernerheim and Sharpe (2005). Their data suggests that service employment is growing even faster in rural regions compared to urban regions, and that service employment employs the majority of rural workers. The study indicates that the increase in the share of employment in the service industry is very important to rural communities given the decline in employment in natural resource industries. The study points out that in order to revitalize rural regions that are lagging behind and attract employment to the region, policymakers should promote the establishment of new advanced service firms (professional, scientific and technical services) and employ a variety of market interventions (e.g. tax credits and exemptions, loan guarantees, and wage subsidies). The authors conclude that the challenge is not only to establish new firms, but also making them stay after subsidies run out.

[21] Cunningham and Bollman (1996) refer to rural community based on the OECD classification as a small basic administrative or statistical area, which is as homogeneous as possible.

Statistics Canada (2007) states that the shift towards growth in rural employment is a trend that began in 2004 and is still booming. For instance in 2007 the number of people employed in rural areas in Canada rose by 2.7%, slightly higher than in urban areas (2.4%). The employment increase in rural areas from 2002 to 2004 may have been the result of the recovery in mining and farming, while manufacturing employment losses affected employment in urban and rural areas. Also, the rise in international commodity exports likely increased rural employment in the primary industries and transportation (Statistics Canada, 2007).

The trends in employment growth in rural regions also apply to self-employment. The study by Plessis (2004) looks at the differences in rates of self-employment activity between rural and urban workers. Based on the census data, the study finds that the rural workers represent a substantial proportion of all self-employed workers in Canada. The rates of self-employed workers were much higher in rural places although the differences between rural and urban self-employment decreases after the agriculture data are excluded from the sample. The study concludes that there has been a significant decline in the proportion of self-employed workers in the farming industry in rural areas; on the other hand non-farm activities are on the rise. Since the mid 1990s more rural workers have been engaged in non-farm self-employment activity than in farm self-employment activity. The findings of the study also indicate that about half of the rural workers who reported to earn self-employment income relied on this source for at least 75 percent of their total income in 2000. Considering self-employed in the farming sector, this also implies that these individuals have a diversity of income streams (Plessis, 2004).

Another stream of the literature on the rural and urban divide seeks to analyze the urban-to-rural employment growth spillovers. The study by Feser and Isserman (2006) finds that employment growth which originated in highly urbanized region had a positive effect on nearby rural regions.[22] Nevertheless, this U.S. study suggests that rural regions do not benefit from employment growth in other nearby rural regions or other nearby mixed rural/urban regions. The study also suggests that declining employment in an urban region is associated with declining employment in proximate rural regions, whereas a decline in employment in mixed urban/rural regions is associated with growth in proximate rural regions.[23] This paper concludes that the success of rural development depends on the spatial structure surrounding the target region such that urban employment spillovers can influence rural prosperity measured through job growth.[24] This conclusion appears also to apply for Canada, where employment growth in the services sector is rising in those rural regions that are close to metropolitan centers (Cunningham and Bollman, 1996).

In an earlier study, Bollman et. al. (1992) recommend three directions that rural Canada needs to follow in order to have a prosperous future: *Macro-diversification*: rural areas need to become less dependent on traditional rural industries. *Metro-ization*: the market for rural goods and services will become more and more urban; new rural jobs will be based on innovative goods and services of interest to metropolitan residents. *The*

[22] In this US study the term "rural" is defined as a region that has an urban population of 10 percent or less or 10,000 or fewer in total urban population; and a population density of fewer than 500 per square mile. The term "urban" is defined as a region with a population that is at least 90 percent urban; and a minimum of 50,000 in urban population; and a population density of at least 500 people per square mile (Feser and Isserman, 2006).
[23] Barkley et al. (1996) estimated a residential population density functions for three US states to show that employment growth spillovers are strongly associated with population growth spillovers.
[24] The study refers to six common spatial development scenarios: the expanding monocentric city, the declining urban core, the sprawling low-density city, the large multi-centered urban region, the central place and its hinterland, and the isolated resource-dependent rural community.

new economy: Canada's comparative advantage was predicted to be in the “knowledge intensive” industries (Bollman et. al., 1992, p. 619-620). However, 15 years later the evidence shows that the urban-rural divide has only been partially overcome, since the knowledge-intensive industries still dominate urban regions in Canada (Wernerheim and Sharpe, 2005).

Summing up, the literature suggests that employment activity and economic growth differ between rural and urban areas. In recent years the trends of rural areas show a shift away from employment in resource industries toward service industries (Cunningham and Bollman, 1996). The number of self-employed workers is smaller in urban regions compared to rural regions where non-farm activities are on the rise (Plessis, 2004). The literature also investigates the urban-to-rural employment growth spillovers, suggesting that employment growth originated in highly urbanized regions have a positive effect on nearby rural regions. Therefore, success of rural development depends on the spatial structure surrounding the target region such that urban employment spillovers can influence rural job growth (Feser and Isserman, 2006). In conclusion, and for the purpose of this thesis, it is important to determine the impact of entrepreneurship and economic growth on rural and urban regions in Canada. Many studies have associated the employment growth spillover with population growth spillover (e.g., Barkley et al., 1996). Hence, the best available proxy variable that will account for the different economic structures between rural and urban places for our provincial dataset is the urbanization variable expressed as a proportion of urban population to a total population.

Chapter 3 – Data and Descriptive Statistics

3. 1 Data source and description

The data for this study is drawn from the computerized database CANSIM II, (Canadian Socio-economic Information Management System) and from the Census statistical database provided by Statistics Canada. The socio-economic database CANSIM provides access to current and historical time series data derived from surveys and programs on a variety of subjects. Using CANSIM, annual time series data were collected from 1976 to 2007 for ten provinces: Newfoundland (NF), Prince Edward Island (PEI), Nova Scotia (NS), New Brunswick (NB), Quebec (QB), Ontario (ON), Manitoba (MB), Saskatoon (SK), Alberta (AB) and British Columbia (BC). The data from CANSIM was matched with demographic data from the Census database. The Census database is a survey of the entire population in Canada that provides extensive information on the levels and the sources of income of Canadians conducted every 5 years.

To describe the pattern of regional growth, data on per capita GDP in 2002 constant prices was obtained from the Provincial Economic Accounts program, CANSIM table 384-0002 available from 1981 to 2007. The Provincial Economic Accounts targets population in the Canadian economy including persons and unincorporated business, corporations, governments and non-residents. The program produces annual estimates of selected aggregates by province and territory. The date are extracted from administrative files and derived from other Statistics Canada surveys or other sources.

To describe the pattern of entrepreneurship and entrepreneurial sectoral trends, the self-employment variable was derived from the Labour Force Survey (LFS) estimates, CANSIM table 282-0012. The LFS is a household survey that provides a detailed, current picture of the labour market including self-employment and total employment, targeting a population 15 years of age and older across all provinces. The data collection for the LFS involves interviews that are conducted by telephone or by personal visit. The sample size of LFS has been approximately 54,000 households since July 1995. For LFS, self-employed are defined as following: "Working owners of an incorporated business, farm or professional practice, or working owners of an unincorporated business, farm or professional practice. The latter group also includes self-employed workers who do not own a business (such as babysitters and newspaper carriers). Self-employed workers are further subdivided by those with or without paid help. Also included among the self-employed are unpaid family workers. They are persons who work without pay on a farm or in a business or professional practice owned and operated by another family member living in the same dwelling" (Statistics Canada, 2009, p.16). The self-employed person is considered to work in a private sector, but can receive contracts from a government department or other public sectors. Self-employed person may or may not have more than one job. Full-time students and those who, on average, work less than 11 hours per week are excluded (Bowlby, 2005).

The self-employment variable is further disaggregated into two categories; class of self-employment and industry groups. The class of self employment consists of incorporated self-employed with paid or unpaid help, and unincorporated self-employed with paid or unpaid help. The *incorporated with paid help* class includes working owners of an incorporated business, farm, or professional practice who had employees. The *incorporated with no paid help* class includes working owners of an incorporated business, farm, or professional practice who did not have employees. The *unincorporated with paid help* class includes working owners of a business, farm, or professional practice that is not incorporated and self-employed persons who do not have a business (this group had employees). The *unincorporated with no paid help* class includes working owners of a business, farm, or professional practice that is not incorporated and self-employed persons who do not have a business (this group did not have employees). Finally the *unpaid family worker* class includes persons who work without pay on a farm or in a business or professional practice owned and operated by another family member living in the same dwelling. In this study unpaid family worker class was excluded.

The second category of self-employment, industry groups, includes desegregation of self-employment according to goods-producing sectors and services-producing sectors based on the North American Industry Classification System (NAICS). Table (2) shows the different industry groups. Statistics Canada offers these desegregated data from the 1987 to 2007 time period.

Table 2. Disaggregated self-employment according to class of self-employed worker and the goods-producing sector and services producing sector based on the North American Industry Classification System (NAICS)

Class of Self-employed worker	▪ Incorporated, with paid help ▪ Incorporated, no paid help ▪ Unincorporated, with paid help ▪ Unincorporated, no paid help ▪ Unpaid family worker	
North American Industry Classification System (NAICS)	**Goods-producing sector**	▪ Agriculture ▪ Forestry, fishing, mining, oil and gas ▪ Utilities ▪ Construction ▪ Manufacturing
	Services-producing sector	▪ Trade ▪ Transportation and warehousing ▪ Finance, insurance, real estate and leasing ▪ Professional, scientific and technical services ▪ Business, building and other support services ▪ Educational services ▪ Health care and social assistance ▪ Information, culture and recreation ▪ Accommodation and food services ▪ Other services ▪ Public administration

Source: Statistics Canada, 2008.

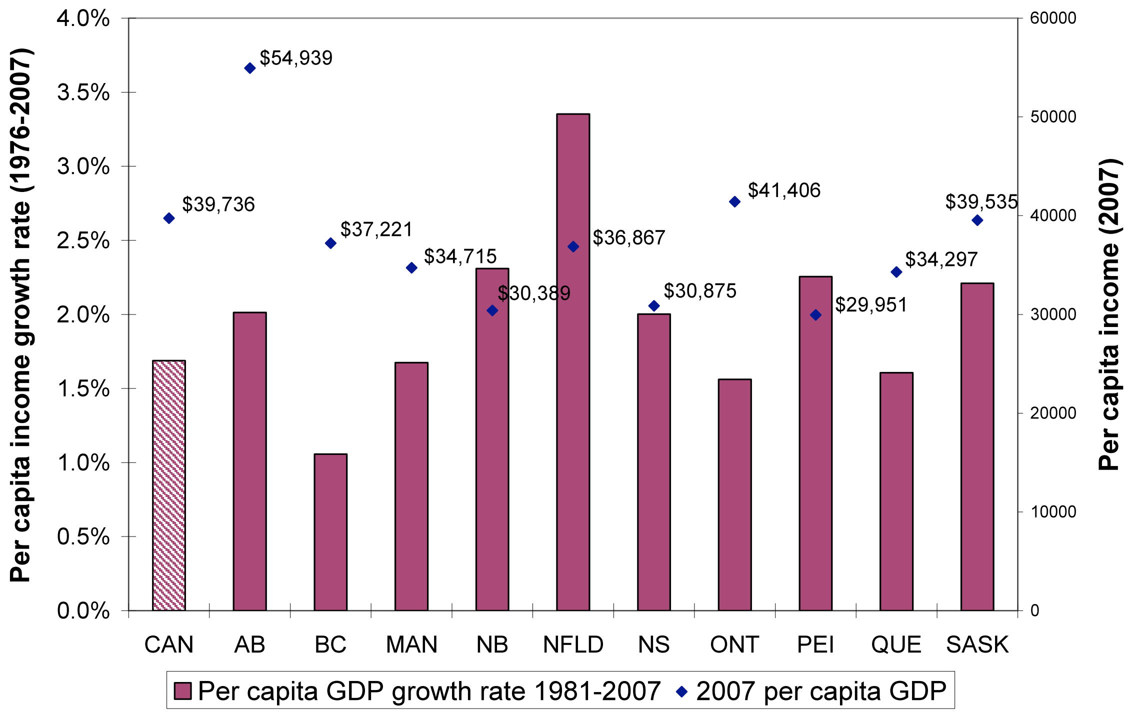
A set of variables were drawn from Statistic's Canada, CANSIM database to specify the econometric model. These variables are population, depreciation per person in 2002 constant prices, university education, net trade, net migration and employment rate. The econometric model also includes a visible minority variable and urbanization variable collected from the Statistic's Canada Census database for a five year period from 1981 – 2006. The depreciation per person, university education, urbanization and visible minorities variables are presented as a proportion of provincial population. The net trade variable is expressed as provincial imports minus exports of goods and services, and net migration accounts for the proportion of the provincial population by subtracting out-migrants from in-migrants.

3.2 Descriptive statistics

Using the GDP per capita in 2002 (at constant prices) in Figure (2), the pattern of regional Canadian growth can be seen in terms of the relationship between the per capita GDP growth rate from 1981 to 2007 and the per capita GDP in 2007. It is noticeable that the greater the GDP growth in the last three decades the lower the per capita GDP is in 2007 (with the exception of Alberta). The highest growth was accounted in Newfoundland (3.34%), likely due to a large number of off-shore oil projects, followed by New Brunswick (2.30%), best known for the exploitation of its natural resources such as forestry and mining as well as manufacturing and expansion of services sector. Also Alberta and Saskatchewan has accounted a boom in the economy with a 2.20% and 2.22 % growth rate, thanks to strong industries such as oil, uranium, and potash production in Saskatchewan, and oil and gas resources in Alberta.

Low GDP growth between 1976 and 2007 was observed in British Columbia (1.00%) and Ontario (1.56%). The Business Council of British Columbia reports that productivity in the province has declined due to low levels of investment in machinery and equipment (Anderson, 2005). Ontario's economy has been greatly affected by the challenges to manufacturing, exports and the high corporate tax burden that behave as a sharp deterrent to investment (RBC, 2007). Ontario and British Columbia along with Alberta and Saskatchewan have enjoyed the highest GDP per capita in 2007. The lowest GDP in 2007 was found in Prince Edward Island and New Brunswick. Considering Canada as a whole, the level of GDP per capita in 2007 reached $ 39,735. From 1976 to 2007 the average GDP in Canada has grown by 1.69%.

Figure 2. Relationship between per capita GDP growth rate 1981 - 2007, and per capita GDP in 2007 for all provinces including Canada



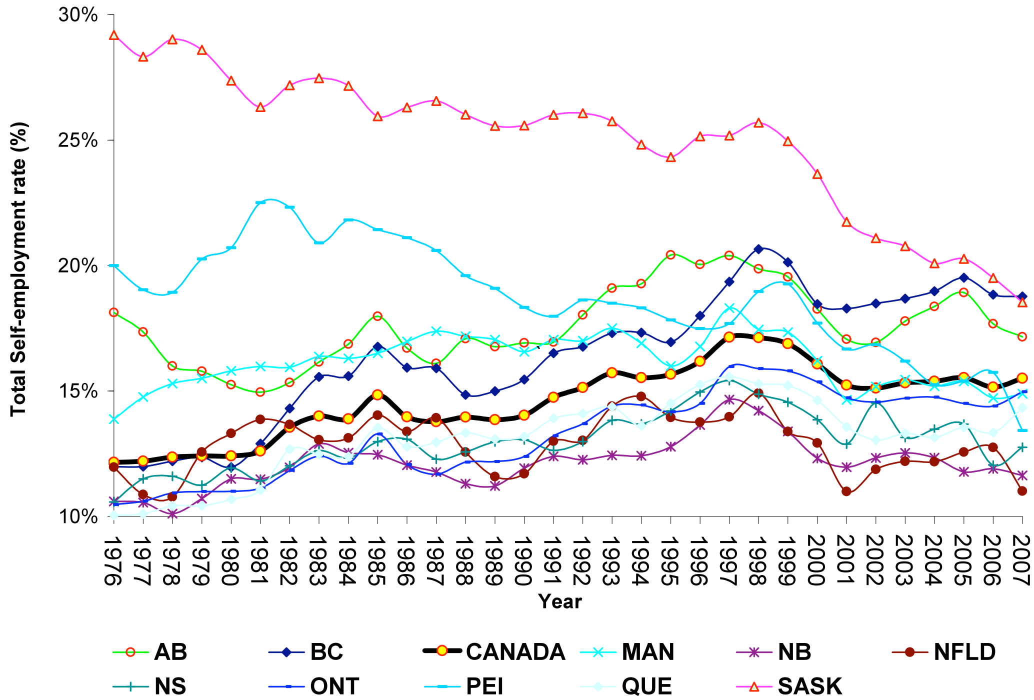
Source: Statistics Canada, 2008, author's own computation

Considering self-employment as a proportion of total employment for all sectors of economy, Figure (3) shows high volatility over the last three decades. Figure (3) reports self-employment rates across all provinces and all industries in Canada from 1976 to 2007. A cyclical trend in self-employment rates appears to be visible in Newfoundland, Labrador and Manitoba where in 1976 the self-employment rate was 12.0% and 13.8%. In the 1990's both provinces had reached the overall peak in terms self employment rate; Newfoundland and Labrador increased to 14.9% and Manitoba to 18.3% in 1998. By the end of this period, the self-employment rate in Newfoundland and Labrador declined to 11.0% and 14.9% in Manitoba in 2007.

The trends in the total self-employment rate have significantly increased in some provinces over the 1976 to 2007 period. After calculating the annual growth rate of the self-employment rate over the 31 years, the highest was documented in British Columbia 1.6%; increasing from 12.0% in 1976 to 18.8% in 2007. The second largest annual growth rate was documented in Quebec, 1.3%, increasing from 10.0% in 1976 to 14.3% in 2007. Ontario is the third province that has indicated an annual self-employment growth rate of more than one per cent (1.2%). In 2007, the self-employment rate was 10.5% increasing to 15% in 2007. The fourth largest annual self-employment growth was accounted in Nova Scotia (0.76%) increasing from 10.5% in 1976 to 12.8% in 2007.

Other provinces have accounted a decline in the self-employment growth rate. Based on the Figure (3) a negative self-employment annual growth rate was accounted in Saskatchewan (-1.4%) and Prince Edward Island (-1.2%). The self-employment rate has decreased in Saskatchewan from 29.2% in 1976 to 18.5% in 2007, and from 20.0% in 1976 to 13.4% in Prince Edward Island. Similar developments can be also observed in Alberta with the growth rate -0.08%, remarkably decreasing from 18.1% to 17.2%.

Figure 3. Annual total self-employment rate for all provinces and all industries, including Canada as a whole, 1976 – 2007



Source: Statistics Canada, 2008, author's own computation

To further examine the trends in self-employment, the self-employment variable is disaggregated according to two categories, the class of self-employment and the industry groups. Table (3) presents the disaggregated self-employment rate according to class of self-employed worker from 1976 to 2007 in Canada. This table shows an average growth rate and the share of each class of self-employment. The highest annual growth, nearly six per cent is observed in incorporated class with no paid help, with 8.8% of total share. The incorporated class with paid help is the second highest growing class of self-employment with 1.87% annual growth rate and the highest share of self-employed firms (22.95%). Almost 50% of all small firms fall in the unincorporated class with no paid help, where the annual growth rate reaches one per cent. A negative growth rate of more than -6% can be observed for unpaid family workers, with 4.27% of total share of small firms.

Table 3. Average growth rate and share of class of self-employed worker, Canada, 1976 – 2007

	Share of SE rate (%)	Average growth rate (%)
Self-employed incorporated, with paid help	22.95%	1.87%
Self-employed incorporated, no paid help	8.79%	5.99%
Self-employed unincorporated, with paid help	15.57%	-1.33%
Self-employed unincorporated, no paid help	48.41%	0.96%
Unpaid family worker	4.27%	-6.34%

Source: Statistics Canada, 2008, author's own computation

Table (4) shows disaggregated data on self-employment according to 16 different industry sectors in Canada, contrasting the average growth rate and the share of each sector among the self-employed individuals. The highest growth was in the service-producing sector, particularly in the educational services (4.53%), where 1.64% of small firms are employed. This growth rate is followed by business, building and other support services (4.43%) with a total share 4.97% of small firms. A total of 12.04% of Canadians firms have been self-employed in the professional, scientific and technical services sector, where the growth rate reached 3.84% from 1987 to 2007 time period. The highest share of self-employment (14.3%) is observed in the trade sector, although this sector declined by more than one per cent. The highest decline in the growth rate of self-employment was accounted for the agricultural sector (-3.42%) during 1987–2007, which is remarkable considering its large share of self-employment (12.55%).

Table 4. The average growth rate and share of self employment across industry sectors, based on the North American Industry Classification System (NAICS), Canada, 1987 – 2007

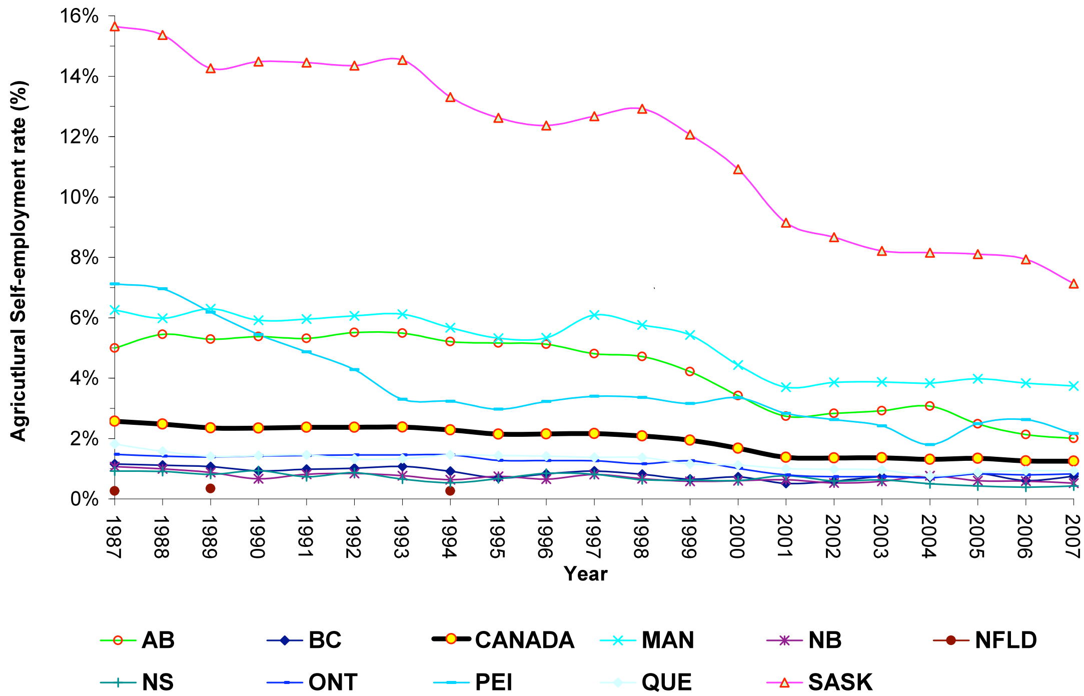
	Share of SE rate, 1987 – 2007 (%)	Average growth rate, 1987 – 2007 (%)
Goods-producing sector	**30.90%**	**-0.88%**
Agriculture	**12.55%**	**-3.42%**
Construction	11.68%	1.52%
Manufacturing	4.42%	0.12%
Forestry, fishing, mining, oil and gas	2.21%	-0.41%
Utilities	n/a	n/a
Services-producing sector	**69.10%**	**1.36%**
Trade	14.30%	-1.13%
Professional, scientific and technical services	12.04%	**3.84%**
Other services	9.51%	-0.24%
Health care and social assistance	8.23%	1.83%
Finance, insurance, real estate and leasing	5.45%	**3.79%**
Transportation/warehousing	4.98%	1.71%
Business, building and other support services	4.97%	**4.43%**
Information, culture and recreation	4.02%	2.02%
Accommodation/food services	3.94%	0.11%
Educational services	1.64%	**4.53%**
Public administration	n/a	n/a

Source: Statistics Canada, 2008, author's own computation

Consistent with previous studies (Tal, 2006), the data reveals that the self-employment rates have declined steadily in the agricultural sector. Figure (4) documents agricultural self-employment as a proportion of total employment from the 1987 to 2007 time period. The declining role of agricultural self-employment is noticeable across all provinces and thus for Canada as a whole. The major decline is observed in provinces with a particular focus on agricultural production. For instance, in Saskatchewan the agricultural self-employment rate has decreased from 15.7% in 1987 to 7.1% in 2007.

Similar declines in agriculture are observed in Alberta, Manitoba and Prince Edward Island. The data also shows that the decline in agricultural self-employment is smaller in provinces that do not focus primarily on agriculture, such as Ontario, Quebec or British Columbia. In sum, the gradual shift away from agriculture has changed the nature of self-employment in Canada.

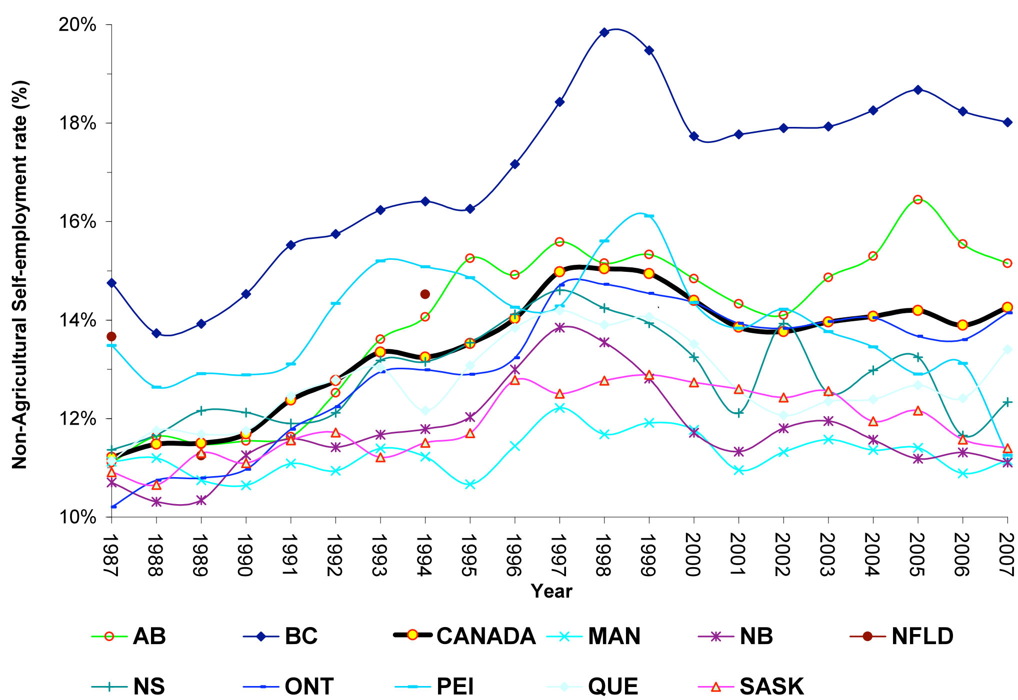
Figure 4. Agricultural self-employment as a percentage of total employment across all provinces, including Canada as a whole, 1987 – 2007



Source: Statistics Canada, 2008, author's own computation

A new variable – non-agricultural self-employment rate – can be generated by grouping the goods and service producing sectors together, while excluding the agricultural sector. The data show that non-agricultural self-employment rates have grown steadily in Canada. Figure (5) presents non-agricultural self-employment as a proportion of total employment from 1987 to 2007. To compare the growth of non-agricultural self-employment between provinces I have calculated the annual growth rates. The highest annual growth rate in non-agricultural self-employment over this time period was accounted for in Ontario (1.7%) and Alberta (1.7%), followed by British Columbia (1.1%) and Quebec (1.0%). Canada as whole shows a 1.2% annual average growth rate of non-agricultural self-employment, since the number of self-employed increased from 11.2% in 1987 to 14.3% in 2007. In sum, a Figure (5) shows that the majority of the increase in self-employment was due to a rise in sectors other than agriculture. Therefore, this study uses the non-agricultural self-employment as a proportion of total employment in order to account for the ongoing employment declines in the agricultural sector.

Figure 5. Non agricultural self-employment as a percentage of total employment across all provinces, including Canada as a whole, 1987 – 2007



Source: Statistics Canada, 2008, author's own computation

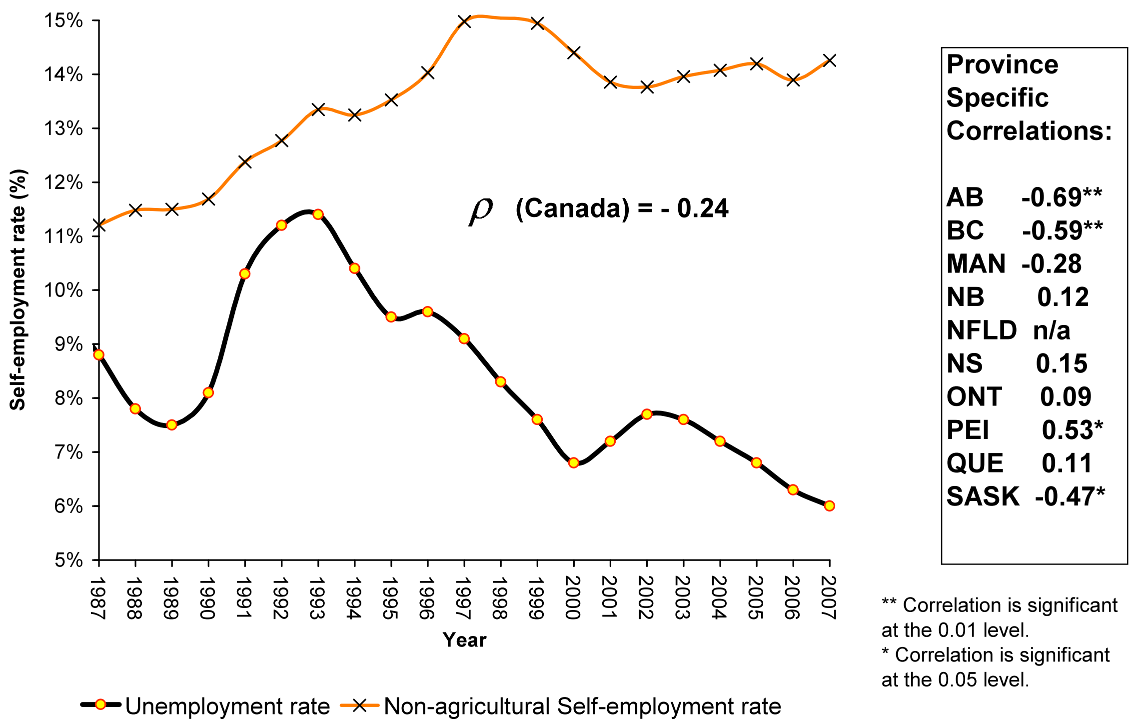
3.3 Self-employment – Push or Pull?: A correlation analysis

The above pattern in the growth of self-employment can be better understood by examining the correlation between unemployment and non-agricultural self-employment. This analysis will also contribute towards an improved understanding of whether people are being pushed or pulled into self-employment. Workers are likely pushed if the number of self-employed people is rising while the number of employment is falling (or growing at a smaller rate) in case of poor job opportunities and times of economic distress. Workers are likely being "pulled" into self-employment if the employment is strong and self-employment is even stronger in a vision of better benefits and higher chances of success (Kamhi and Leung, 2005). For the purpose of this correlation analysis, the unemployment variable was collected from Statistic's Canada LFS table 282-0008.

Figure (6) shows the relationship between the unemployment rate and the non-agricultural self-employment rate for Canada, for the time period 1987 – 2007, including correlation coefficients. The data shows that non-agricultural self-employment has been steadily increasing since 1987 to 1997, whereas after 1999 we observe a dip in the non-agricultural self-employment rate followed by a recovery in 2002. The unemployment rate increased substantially between 1989 and 1993, reaching peak of 11.4% in 1993 during the recession, but then showing a significant and overall consistent decline until to 2007 (with the exception of 2000).

The correlation coefficients as shown in Figure (6) examine a relationship between the non-agricultural self-employment and unemployment. For Canada as a whole, the correlation coefficient is negative (-0.24) suggesting that workers are being pulled into self employment in a vision of better benefits and higher chance of success. The same negative relationship with even stronger coefficients are observed in Alberta (-0.69; P < 0.01), British Columbia (-0.59; P < 0.01), Saskatchewan (-0.47; P < 0.05), and Manitoba (-0.28). We conclude that in these provinces and in Canada as whole, non-agricultural self-employment is a dynamic and vibrant sector that people get pulled into. The majority of the remaining provinces have a positive relationship, although the correlation numbers are low and not highly significant, varying from 0.09 in Ontario to 0.12 in Nova Scotia. The exception is PEI with a relatively large and significant coefficient (0.53; P < 0.05).

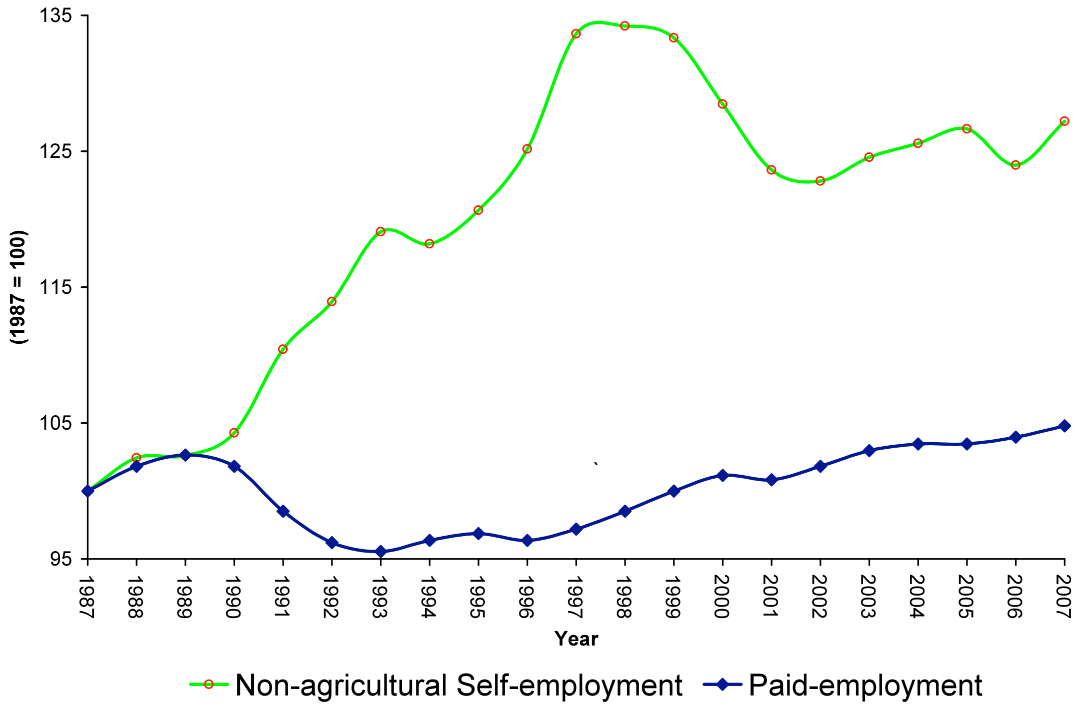
Figure 6. Non-agricultural self-employment and unemployment in Canada 1987 – 2007, including correlation coefficients by province



Source: Statistics Canada, 2008, Author's own computation

To further examine self-employment using descriptive data, the following analysis focuses on the relationship between paid employment and non-agricultural self-employment. This provides an indication of whether workers prefer to enter into paid employment or self-employment. Figure (7) shows the indexed number of paid employees and self-employed in all industries (1987 = 100). After 1990 the number of self-employed increased rapidly until 1997, while the number of paid employment dipped during the 1990-93 period indicating a higher new job creation in self-employment. Considering Kamhi and Leung, (2005) the increase in self-employment was caused by the deterioration in labour market conditions for employees in the early 1990s. In 1997 the economy recovered, and the figure clearly shows an end in the acceleration of self-employment and an increase in paid employment. Kamhi and Leung (2005) suggest that the increase in self-employment during the 1990's was due to the increased attractiveness of the self-employment sector, rather than due to depressed conditions for paid employees. Similarly, the follow up decline in the self-employment rate after 1998 is more likely a result a reversal in the attractiveness of self-employment. Paid employment variables were collected from Statistic's Canada LFS table 282-0002 and represent all working individuals in the work force who are not self-employed.

Figure 7. Indices for the number of paid employees and non-agricultural self-employed (1987 = 100) from 1987 to 2007



Source: Statistics Canada, 2008, author's own computation

Chapter 4 – Regional Convergence Analysis

4.1 Empirical model

This section develops an econometric model of regional growth for the Canadian economy. The model focuses on isolating the role of entrepreneurship as an additional determinant of regional growth – that is, in addition to the conventional determinants often specified in the literature. The standard econometric model used for understanding the determinants of economic growth is a cross sectional growth regression. Given the limited number of provinces in Canada, using cross-sectional data would result in a problem with degrees of freedom. Therefore, previous work on Canadian growth (e.g., Coulombe and Lee, 1995; Coulombe, 1996) has relied on panel data of real per capita GDP and its determinants for all ten provinces observed over a period of time (usually 1980s to the 2000s).

The following econometric growth model is specified using panel data for ten different provinces in Canada from the 1987 to 2007 time period. In this analysis, the provincial data is divided into seven sub-periods, where each sub-period is three years in duration. Specifically, a growth regression is defined over an interval, *T*, for each sub-period between two points in time t_0 and $t_0 + T$ in the following general empirical model:

$$\left(\frac{1}{T}\right)\ln\left(\frac{y_{i,t_0+T}}{y_{i,t_0}}\right) = \beta_0 + \beta_1 \ln y_{i,t_0} + \beta_2 \ln se_{i,t} + \sum_j \beta_j \ln x_{i,j,t} + \varepsilon_{i,t}\,, \qquad (16)$$

where, $i = 1,...,10$ refers to regional index; $t = 1,...,7$ refers to each sub-period and $T = 3$ is the length or duration of each sub-period. The slope coefficients β_i, represents the effect of initial conditions and regional attributes on growth. The error term $\varepsilon_{i,t}$ represents the effects all unobservable factors that are not included in the growth regression on the dependent variable (Wooldridge, 2003).

The specification of the determinants of the dependent variable - the output per worker - draws on the theoretical and empirical literature on economic growth. In general, the theoretical (and empirical) models of economic growth, as discussed in Section 2.1, point to two broad measurements of output in the model: income or GDP. The dependent variable employed in equation (16) is the growth rate of real GDP per worker (output per worker). The growth rate is defined over the three years sub period.

To understand the determinants of Canadian regional growth and to be able to statistically test if entrepreneurship has an impact on growth, we include a set of control variables $x_{i,j,t}$ in the growth regression. The explanatory variables include both determinants of growth as identified by the neoclassical growth model as well as other variables discussed in more recent growth models.[25] First, as specified by Solow (1956) we include a measure of $(g + n_{i,t} + \delta_{i,t})$, where g denotes to growth rate of technological progress (0.02), $n_{i,t}$ is the average population growth rate and $\delta_{i,t}$ is the depreciation rate of the capital stock. The term $(g + n_{i,t} + \delta_{i,t})$ is expected to have a negative affect on GDP growth since high population growth lowers the output variable (Mankiw et al., 1992).

[25] These variables were constructed in the dataset as an average value of each sub-period.

Second, we include a measure of the endowment of human capital in the economy as an additional important determinant of growth (Mankiw et al., 1992). In the study by Mankiw et al (1992) human capital in a country was expressed by the percentage of the working-age population that is in secondary school. Following this approach, to represent the endowment of human capital in a province, we use the number of people with a university degree as a proportion of the provincial population (age 25 and older). The human capital variable is expected to have a positive effect on GDP growth.

Third, we also include a measure of urbanization to account for the differences between rural and urban regions. Canada is a large country with a sparsely distributed population along a narrow band of land close to the US boarder (Coulombe, 2000). As from the above Section 2.3.3, empirical evidence suggests that the greater differences in economic growth and development between rural and urban regions in Canada, the greater we can expect consequences in terms of regional economic inequality (Ensign, 2008). In this thesis, urbanization is computed as the proportion of total population of a province that lives in urban areas. The urbanization variable was collected from a census dataset per five years periods from 1986 to 2006, and is expressed as a proportion of total provincial population. Provinces with higher rates of urbanization have a higher GDP per capita Coulombe (2003); therefore we expect the urbanization variable to have a positive sign.

As the fourth explanatory variable, we include a measure of visible minorities. There is an intensive debate in the literature regarding the economic value of the visible minority variable. For instance, some papers recognize visible minorities as an important contributor to economic growth. A study by the Antunes et al. (2004) found visible minorities to be a large contributor to the real GDP growth, stating that "Canada's future prosperity relies on its people, including an increasing number of visible minorities" (p. 1). Other research on visible minorities distinguishes between Canadian born and immigrant minorities. Canadian-born minorities have higher earnings than immigrants (Hum and Simpson, 1999). The earnings gap is largely a reflection of quality differences in education, language proficiency and experience (de Silva, 1997).

The literature also suggests that most of the immigrant visible minorities in Canada have lower economic status in terms of high unemployment and low income rates (Hou, 2004). Such economic discrimination of visible minorities may play an important role in the labour markets in Canada (Pendakur and Pendakur, 1998). According to Harvey and Reil (2000) visible minorities did not benefit from the recent economic growth in Canada prior to 2000, and their economic situation in the labour market has worsened. Based on the above literature, there are no obvious analytical answers as to whether visible minorities have a positive or negative effect on the economy; an empirical investigation is required. The visible minority status employed in this thesis is based upon country of origin and self-reported identity. The minority variable has been collected from a census dataset per five years period from 1986 to 2006 and is expressed as a proportion of total provincial population.

Through the fifth variable, we account for paid workers in the economy by including the employment rate. Given the empirical evidence, higher employment rates tend to increase the economic growth by higher GDP growth rates. The employment rate is expected to have a positive effect on the output variable (Beckstead and Brown, 2005).

The employment rate is expressed as the number of people employed as a proportion of the provincial population (age 15 and older).

As the sixth variable, interprovincial net migration is included in the growth regression. The analysis aims to control for migration in our analysis since people who tend to migrate towards more urbanized and richer provinces have an effect on economic growth and regional disparities in Canada (Coulombe, 2003). The inter-provincial migrants are expected to have higher skill sets. The net migration variable is expressed annually as a proportion of the provincial population by subtracting out-migrants from in-migrants. It is expected that the inter-provincial net migration to have a positive effect on the dependent variable.

The seventh variable is net trade to study the effect of trade on regional growth. The net trade variable accounts for provincial imports and exports of goods and services into other provinces and countries (international and interprovincial). Considering the empirical literature, trade is expected to have a positive effect on the GDP growth rate and reduce the regional disparities by increasing the speed of convergence (Coulombe and Lee 1995). Net trade is expressed as exports of goods and services minus imports of goods and services.

Finally, the initial level of real GDP per worker (y_{i,t_0}) is included into the growth regression. This variable was created using a value from the first year of each sub-period. Based on the Solow neoclassical theory of growth, the coefficient on initial GDP is expected to be negative. A negative sign predicts convergence and shows that differences in per capita incomes among economies (regions) are transitory, and that regions with low initial incomes will grow faster and catch up to economies with high initial incomes (while controlling for other determinants of economic growth).

Given the above empirical framework, to test the main hypothesis a self-employment variable is included in the analysis ($se_{i,t}$). Including self-employment contributes to the existing empirical Canadian work by testing whether entrepreneurship plays a role as an additional determinant in accentuating regional growth. The self-employment rate was constructed as a ratio of non-agricultural self-employment to total provincial employment, as expressed in equation (16).[26] The initial level in each sub-period is based on the non-agricultural (and non-unpaid family worker) self-employment rate as specified in equation (16).

Table (5) reports predicted signs, descriptive statistics and definitions for the dependent variable and all explanatory variables. The dependent variable is expressed as a growth rate in logarithmic form. All explanatory variables are expressed as an average value of each sub-period in their logarithmic forms.

[26] From the non-agricultural self-employment rate the unpaid family worker class were excluded in the analysis as it does not fall into "paid employment", "self-employment" or "un-employment" categories (Kuhn and Schutze, 2001).

Table 5. Variable definitions, descriptive statistics and predicted signs

GDP growth	Mean	Standard Deviation	Predicted sign	Definition
GDP growth rate	0.021	0.016		1/3 * ln[GDP(t+T)/GDP in t)]
Initial GDP	10.231	0.252	-	Ln(initial real GDP per worker)
n+g+δ	6.103	0.304	-	Ln(technical progress + population growth rate + depreciation rate)
University education	2.633	0.265	+	Ln(university education proportion of total population, 25 years and older)
Urbanization	4.158	0.234	+	Ln(urban population, proportion of total population)
Minority	1.176	1.087	+/-	Ln(visible minorities as a proportion total population)
Employment rate	4.048	0.116	+	Ln(number of employed persons as a proportion of the population 15 years of age and over)
Net Migration	1.709	9.206	+	(In migrants – out migrants)
Net Trade	-1.516	4.462	+	(Exports – imports of goods and services)
SE non-agri	2.568	0.138	+	Ln(total self-employed as a proportion of total employed minus the agriculture SE sector and unpaid family worker)

4.2 Panel data estimators - fixed and random effects models

In the model specified in equation (16), the data is of panel nature. For the model to be properly specified and to yield consistent estimates, we need to control for province-specific variables that affect economic growth. Since such provincial differences are unobservable, we rely on our access to panel data to help us control for the unobserved differences. Specifically, panel data allows us to explicitly control for unobserved time invariant province specific effects using random or fixed effects approaches (Gujarati, 2003).

With panel data, and without actual data on unobserved characteristics, one approach of accounting for unobserved heterogeneity and individual-specific omitted variables biases is to use a fixed effects model. This is often achieved by including a dummy variable for each province in the regression. However, estimating models with many dummy variables may reduce the number of degrees of freedom and also increases the chance of multicollinearity. Note that the assumption of a fixed effects model implies that differences across provinces are captured in differences in the constant term β_0 in equation (16) (Greene, 1997). In the standard case, the error term $\varepsilon_{i,t}$ is assumed to be independent and identically distributed over provinces and time with mean zero and variance $\sigma_\varepsilon^{\ 2}$ (Verbeek, 2004).

An alternative approach assumes that unobserved heterogeneity is not fixed but random, and consequently has a distribution. This leads to the specification of a random effects model. Unobserved heterogeneity β_0 in equation (16) under the random effects model is considered to be a random variable that represents individual specific effects. Consistency of the random effects estimator requires regressors $x_{i,j,t}$ and individual effects, β_0, to be uncorrelated. In this thesis our choice of using a random or fixed effects model is based statistical criteria (the Hausman test).

The Hausman test helps investigate whether to treat the individual effects of β_0 as random or fixed (Hausman, 1978; Verbeek, 2004). Under the null hypothesis, the two estimators are both “good” and therefore should yield estimates that are similar. The alternative hypothesis is that the fixed effects model is better and the random effects model is a misspecification. The test exploits the fact that the random effects model assumes that the unobserved effects are uncorrelated with the regressors while the fixed effects model does not. If this assumption is violated then the random effects model is inconsistent, while fixed effects estimator is still consistent, and therefore there will be a difference in the coefficients of the two models. A larger difference implies a larger Hausman test statistic and a rejection that the two models are equivalent – and one should use fixed effects rather than random effects.

4.3 Estimation strategy

The objective of this section is to estimate a regional growth model for Canada, and to identify the role that self-employment plays in the economic growth of regions. The estimation strategy is to begin our specification of the econometric regression using the simplest growth theory and adding more variables based on newer and more complex growth models. Four different econometric models are estimated. In the first model, the growth of GDP per capita is regressed on a single explanatory variable -- the natural log of GDP per capita in the initial period (1987). This preliminary and baseline model allows us to test for unconditional convergence, since no other steady state conditioning variables are included as explanatory variables. The hypothesis of unconditional convergence implies a negative relationship between the GDP growth rate and initial GDP. If there is support for this hypothesis it implies that provinces with low initial incomes are growing faster and catching up with richer ones.

In the second model, an explanatory variable denoting sum of technical progress, population growth rate and depreciation rate $(g + n_{i,t} + \delta_{i,t})$ is added to the initial specification (above). This model allows us to test for conditional convergence while controlling for the standard growth determinants. Conditional convergence has been empirically tested by many previous authors (Barro and Sala-i-Martin, 1991).

The third model adds human capital and a set of regional growth determinants into the growth regression. By introducing human capital into Solow, the model explicitly accounts for different growth trajectories due to differences in education and skill sets of provinces. The regional growth factors introduced in this model are urbanization, visible minorities, employment rate, migration and trade. In the final and fourth model we introduce self-employment as an additional regressor to address the main objective of this study and to quantify the role of entrepreneurship in regional economic growth.

4.4 Results of econometric models

We apply the Hausman test to determine whether a fixed or a random effect model is more efficient. While estimating Models 1 to 4, the objective is to be consistent with the choice of using random or fixed effect method across all 4 models. Therefore, we apply the Hausman test to the most complete model (Model 4) and use the results of the test to decide on using fixed or random effects for all of the models that we estimate in this section. Recall that the null hypothesis for the Hausman test is whether or not the coefficients estimated by the random effects estimator are the same as the ones estimated by the fixed effects estimator. The test statistic is built on the differences between the two sets of estimates. We fail to reject the null hypothesis at the 5% level of significance, which implies that we can use the random effects specification.

Given that our main objective is to quantify the role of self-employment in economic growth we start the discussion of our econometric results by analyzing the specification which includes self-employment as a growth covariate (Model 4, Column 4, Table 6). The R^2 measure of goodness of fit is 0.44. Most of the estimated coefficients are highly significant and have expected signs. A striking finding which provides strong support for the main hypothesis of this study is the positive and significant coefficient on the non-agricultural self-employment variable. We find that self-employment, although not included as a determinant in standard growth regressions for the Canadian economy, is in fact one of the most significant growth determinants. The effect of self-employment is a net effect on growth after holding constant the effect of other determinants such as trade, migration and urbanization which we discuss below.

Results from Model 1 to 3, presented in the first three columns of Table (6), also reveal interesting findings regarding the Canadian economy. The R^2 measures of goodness of fit for Model 1 to 3 range from 0.026 to 0.370. The estimated coefficients represent the effect of initial conditions and regional attributes on growth. In the first column, Model 1, the coefficient on the initial GDP is negative but not significant. Based on this finding alone, there is no evidence supporting the (unconditional) convergence theory for Canada. The coefficient on initial GDP in Models 2 and 3, however, are estimated as negative and statistically significant. These findings show that after conditioning on steady states in the growth regression, there is a significant tendency for convergence in provincial GDPs.

All of the coefficients of the variables in Models 2 and 3 have the expected signs and some are highly significant. The term $(g + n_{i,t} + \delta_{i,t})$ which controls for technology, population growth rate and depreciation rates was found positive in both Models 2 and 3. The coefficient on university education in Model 3 reported in the third column of Table

(6), is positive and highly significant. Thus, consistent with our expectations, the analysis demonstrates the importance of human capital in the process of economic growth. More university educated workers in Canadian economy have a greater positive effect on productivity growth. This finding suggests that encouraging development of human capital, by investing into higher education, will increase economic growth.

The coefficients on the employment rate, urbanization, visible minorities, migration and trade were estimated in the third model. Not surprising, the employment rate was found to have a positive and highly significant impact on GDP growth. The urbanization variable was used to explore whether the population living in urban areas are an important determinant of regional economic growth or not. Consistent with predictions from economic theory, the third model yielded a coefficient on urbanization with a positive and significant sign. The higher the population is in urban provinces, the greater effect on economic growth. This finding is exactly the same as that in earlier studies, such as Coulombe (2003). The positive effect of urbanization on growth is a consequence of income and capital converging to highly urbanized and rich provinces.

In the present analysis, the estimated coefficient on visible minorities was found significant with a negative sign. One interpretation is that visible minorities appear to have a negative impact on the GDP growth rates. However, the expected sign, of visible minorities is an empirical issue which likely also depends on the level of disaggregation of the data. In the present analysis, an aggregated variable was employed that accounts for immigrants as well as Canadian-born visible minority. It is possible that once the data would be disaggregated between Canadian born and immigrant visible minorities, the above results could be different. Given the discussion in the literature on visible minorities, the estimation result in this thesis may contribute to addressing the ambiguity that currently rests with this important policy issue.

The net migration variable and the net trade variable were both found to be positive in Model 3. The inter-provincial net migration was found significant at the 10% level, indicating that migrants are considered as a significant factor that boosts economic growth. On the other hand, the net trade variable was not found to be significant in the growth regression. This finding is consistent with earlier results by Coulombe and Lee (1995) who also found that an increase in trade does not necessarily stimulate provinces to grow.

Model 4 with the inclusion of non-agricultural self-employment demonstrates that findings hold up to Models 1 to 3; only the migration variable becomes insignificant. The estimates also suggest that if the self-employment variable is controlled for in the analysis, inter-provincial migration does not impact productivity growth.

Table 6. Tests for different econometric models
(Standard errors in parentheses)

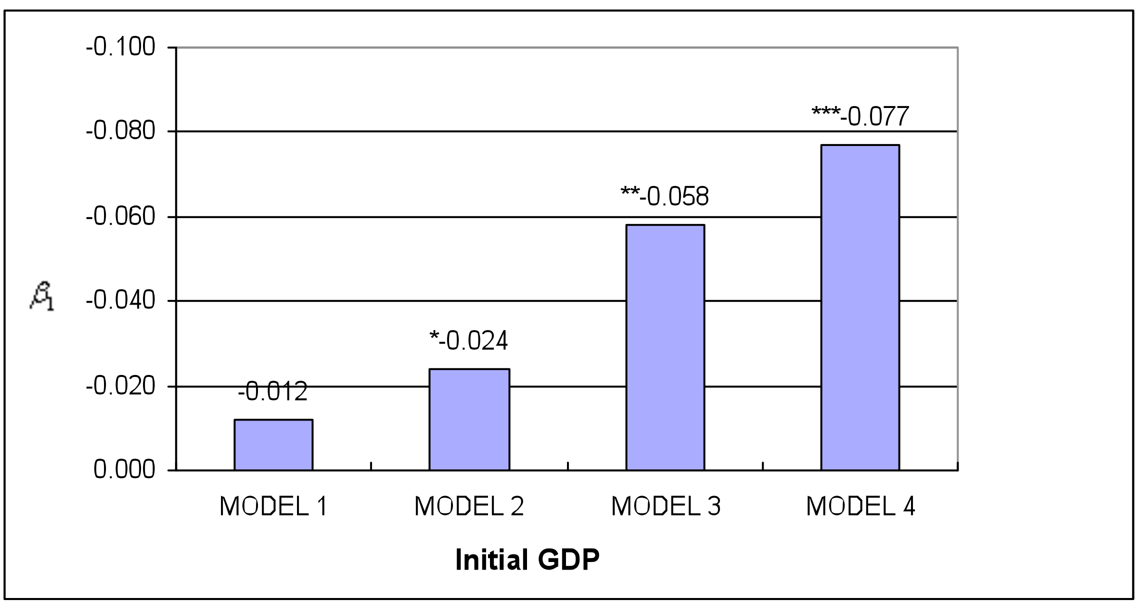
GDP growth	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Initial GDP 1987	-0.012	***-0.024**	**** -0.058**	*****-0.077**
	(0.008)	(0.015)	(0.023)	(0.023)
n+g+δ		0.014	0.007	0.007
		(0.015)	(0.020)	(0.018)
University education			**** 0.042**	****0.036**
			(0.017)	(0.015)
Urbanization			***** 0.085**	*****0.065**
			(0.024)	(0.024)
Minority			***** -0.028**	*****-0.023**
			(0.006)	(0.006)
Employment rate			***** 0.087**	*****0.149**
			(0.033)	(0.037)
Migration			*** 0.001**	0.001
			(0.001)	(0.001)
Trade			0.000	0.000
			(0.000)	(0.000)
SE non-agri				****0.031**
				(0.015)
Constant	0.145	**0.178	-0.207	*-0.261
	(0.077)	(0.084)	(0.137)	(0.136)
R^2	0.026	0.072	0.370	0.438

(, **, *** denote P < 0.1, P < 0.05, P < 0.01)*

4.6 The effect of growth determinants on convergence

The following section demonstrates graphically the effect of growth determinants on the convergence parameter (the coefficient on initial income) in Canada. To do so we plot the magnitude of the convergence parameter for each of the models (Figure 8). In a sense the graphic demonstrates chronologically how empirical growth theory has evolved over the last four decades. The first bar in Figure (8) reflects the lack of unconditional convergence model since the coefficient of initial GDP per capita is negative but insignificant. The second bar is based on Model 2 which conditions on some steady-state determinants introduced by including the term $(g + n_{i,t} + \delta_{i,t})$ in the regression. After conditioning on the different steady state positions of provinces, the coefficient on initial GDP becomes negative and significant. This finding supports the theory of conditional convergence for Canada. The inclusion of additional variables to the growth regression in Models 3 and 4 increase the tendency towards convergence by increasing the magnitude of the coefficient on initial GDP. Thus, Figure (8) suggests that if provinces did not vary in their additional growth determinants, there would be a strong tendency for poor provinces to grow faster than rich ones, just as conditional convergence theory predicts. In the fourth model, the inclusion of non-agricultural self-employment in the analysis decreases the coefficient on initial GDP per capita even further, which improves the fit of the regression and suggests a faster convergence process.

Figure 8. Estimated coefficients on initial GDP in 1987 for different econometric models



(, **, *** denote P < 0.1, P < 0.05, P < 0.01)*

Chapter 5 – Vector Autoregression Analysis

5.1 Introduction to the VAR methodology

In this section we will continue with the estimation of the relationship between entrepreneurship (self-employment) and economic growth. In our earlier empirical analysis, we have shown that entrepreneurship plays a significant role in accentuating regional growth in the Canadian economy. Now we would like to pose a slightly different and more in-depth question – given that entrepreneurship triggers economic growth in Canadian regions – what is the *dynamic* impact of entrepreneurship on regional incomes? Is the impact permanent, whereby entrepreneurship in one period continues to have long run simulative effects on income? Or is entrepreneurship only a transient phenomena, marginal increases in which simply produces a blip in regional GDP levels and then disappears, without any long run effects? The answers to these questions are critical for a true understanding of the role of entrepreneurship because economic growth is inherently a dynamic phenomena.

Yet, there is a glaring absence of empirical research using dynamic modeling techniques to address these issues for the case of Canada. In this section we apply vector autoregression (VAR) methods to our panel dataset which spans the years 1987 to 2007. This analysis uncovers important, intuitive multiyear patterns of self-employment impacts not previously identified in the vast literature on economic growth in Canada.

Our hypothesis that entrepreneurship may have a dynamic impact on economic growth has a long standing history. Since the early 20^{th} century, entrepreneurship has been identified as an "engine" of long run economic growth (e.g., Schumpeter, 1911). In the more recent literature, entrepreneurship has received attention as a key driver for endogenous economic growth that can be sustained over time. For instance, Audretsch and Thurik (1999) pointed out that the countries which sustained greater rates of growth also experienced the greatest shift towards small enterprises. This is an important finding, since entrepreneurship is known as an innovative, skilled and highly creative activity which may have a long run effects on economic growth (Dejardin, 2000). However, not all self-employment is "good" self-employment, and the positive long run effects in any economy cannot be taken for granted (e.g., see Mohapatra et al., 2007); rather, the dynamics of entrepreneurial effects on regional GDP is an empirical question and one that we address for Canada in this section.

Recall (from Section 2.3.1) that the number of small businesses is on the rise in Canada. During the period 1976 – 2007, self-employment grew by an annual average of 2.6 per cent (Statistics Canada, 2008; authors' own computations), however there has been noticeable fluctuation over these three decades. There was significant growth between 1976-1989 followed by a more rapid growth in self-employment that occurred between 1990 and 1998; in the next 3 years period the growth slowed down and speed up again in 2007. These variations in self-employment across regions and over time will help us isolate the linkages between entrepreneurship and economic growth.

To study the dynamic impact of self-employment on regional incomes (or GDP levels), we apply a VAR model to our panel data. Our focus is on analyzing impulse-response functions -- an analytical tool that allows us to characterize the dynamic path of the response of a variable to a shock in other variables. Specifically, based on the impulse-response functions, we are able to identify the time path of changes in GDP to a unit increase in self-employment, while holding other shocks constant. Our hypothesis is that, over time after controlling for other effects, the response of GDP will be positive and possibly permanent. If this hypothesis is supported by our data, then we will conclude that entrepreneurship can be an engine of long run growth and hence entrepreneurial policy should pay a closer attention releasing this potential in laggard regions. As mentioned earlier, there are no obvious analytical answers to whether or not the dynamic impact of self-employment on regional incomes is temporal or permanent; it demands empirical investigation.

5.2 Background of the VAR methodology

The VAR model suggested by Sims (1980) involves estimating a system of equations that represents the reduced form of an unknown dynamic structural model. Under this approach the main variables of interest are all treated as endogenous (unlike in our previous econometric analysis where self-employment was treated as an exogenous variable). Moreover, the VAR model imposes very few restrictions on the nature of linkages between the different variables and the dynamics over which the linkages evolve.

To see this more clearly, consider a two-system VAR as an example (for details on VAR models see Enders, 2004; Hamilton, 1994). Let y_t and z_t denote regional GDP and self-employment, respectively, observed at time t. The dynamic structural econometric model of the relationship between these two variables can be written as:

$$y_t = b_{10} - b_{12} z_t + \gamma_{11} y_{t-1} + \gamma_{12} z_{t-1} + \varepsilon_{yt}, \tag{17}$$

$$z_t = b_{20} - b_{21} y_t + \gamma_{21} y_{t-1} + \gamma_{22} z_{t-1} + \varepsilon_{zt}. \tag{18}$$

The errors ε_{yt} and ε_{zt} are uncorrelated white-noise structural disturbances with constant variances. The coefficients b_{21} and b_{12} denote contemporaneous feedback linkages in the system while the γ coefficients represent system dynamics. As specified, the contemporaneous effects in the structural model above creates problems in estimation. This problem, that emerges due to the presence of contemporaneous effects, can be eliminated by deriving the reduced form of the system where the contemporaneous effects are normalized. To do so, we first rewrite the structural model in equations (17) and (18) in compact notation as:

$$Bx_t = \Gamma_0 + \Gamma_1 x_{t-1} + \varepsilon_t \tag{19}$$

where $B = \begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix}$, $x_t = \begin{bmatrix} y_t \\ z_t \end{bmatrix}$, $\Gamma_0 = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix}$, $\Gamma_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix}$, $\varepsilon_t = \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix}$

Premultiplying equation (19) with B^{-1} yields the reduced form VAR representation:

$$x_t = A_0 + A_1 x_{t-1} + e_t \tag{20}$$

where: $A_0 = B^{-1}\Gamma_0$ with typical element a_{i0}; $A_1 = B^{-1}\Gamma_1$ with typical element a_{ij}; $e_t = B^{-1}\varepsilon_t$ with typical element e_{it}. We assume that the reduced form VAR errors, e_{1t} and e_{2t}, which are composed of the structural white-noise errors, ε_{yt} and ε_{zt}, have zero means, constant variance and are individually serially uncorrelated ($E(e) = 0; E(e_t e_s') = 0 \ \forall\, t \neq s; E(ee') = \Omega$). The focus of our interest is on the coefficients in A_1 which characterize the dynamics of the system and feed into the computations of impulse response functions. Note that the difference between the systems (17) and (18) versus (20) is that the first is a structural model and the second is a VAR in reduced form. While we used the example of a 2 variable system – it is true that any dynamic structural econometric model can be represented by reduced form VAR (see Enders, 2004).

5.3 The impulse response function

Due to complex interactions and feedback between the variables in the model we use impulse-response function that summarize the *total* effect of a shock in one variable on the other and how the effect evolves over time. The impulse response function informs us of the sign and time path of the impact of one standard deviations shock (or some other chosen unit) on other variables in the system (Hamilton, 1994).

Technically speaking, the impulse-response function is based on the Vector Moving Average (VMA) representation. The VMA is a useful tool to study the relations between y_t and z_t sequences. The VMA representation allows tracing out the time path of various shocks on the variables contained in the VAR system. The representation specifies the response variable as function of the structural error terms:

$$x_t = \mu + \sum_{i=0}^{\infty} \phi_i \varepsilon_{t-i} . \tag{21}$$

Note that ϕ_i (the impact per period) is made up of both the coefficients in A_1 (equation 20) as well as the contemporaneous effects (see Enders, 2005). The estimated coefficient $\phi_i(0)$ in the equation (21) is impact of one unit change (shock) in error term ε_{yt} and ε_{zt} on time path of y_t and z_t sequences.[27] In the same way $\phi_i(1)$ is the one period responses of unit changes in ε_{yt-1} and ε_{zt-1} on y_t. Updating to another period, $\phi_i(1)$ also represents the effects of unit change in ε_{yt} and ε_{zt} on y_{t+1}. The accumulated effects of

[27] $\phi_i(0)$ is the impact multiplier, (0) represents instantaneous shock.

unit impulses in ε_{yt} and/or in ε_{zt} can be obtained by summation of the coefficients of the impulse response functions. For example, after *n* periods, the effect of ε_{zt} on the value of y_{t+n} is ϕ_i (n) (Enders, 2004).

To identify the impulse response function, we have to impose restrictions. The estimation of the reduced form model yields fewer estimates than the number of parameters of the structural model. Therefore, to identify the system some restrictions on the parameters of the structural model are necessary. One way is to use the Choleski decomposition of variance-covariance matrix of residuals and set some of the contemporaneous effects to be zero. The error term of equation (21) can be decomposed as follows (e.g. where b_{12} =0):

$$e_{1t} = \varepsilon_{yt}, \tag{22}$$

$$e_{2t} = \varepsilon_{zt} + b_{21}\varepsilon_{yt}. \tag{23}$$

Note that by imposing the restriction $b_{12} = 0$, impulse-responses will depend on the order of the variables in the VAR model. The importance of the ordering depends on the magnitude of the correlation coefficient between e_{1t} and e_{2t}.[28] Although if the correlation is small, or the error terms are uncorrelated, the ordering of the variables in the VAR system is not as important.

[28] For example the Choleski decomposition forces a one way recursive relation -- consider a system of equations in a VAR – Y1, Y2 and Y3. The Choleski decomposition imposes the restriction that Y1 contemporaneously affects Y2 and both have contemporaneous effects on Y3 and so on – but Y3 does not affect Y2 contemporaneously and neither does Y2 affect Y1 contemporaneously.

5.4 Estimating VAR with panel data

In our analysis we apply the VAR procedure to panel data.[29] This methodology combines the time-series VAR approach, which treats all variables in the model as endogenous, with the panel-data approach (Love and Ziccino, 2006). Using panel data we need to control for unobserved individual heterogeneity among regional units (e.g., differences in policies, resource endowments and other initial conditions etc.). One way, is to introduce fixed effects (as we did in our previous growth regression estimation in Section 4.2) to purge out the differences in underlying structure across provinces. However, with our panel VAR model, fixed effects estimation is complicated and we must take into consideration an econometric problem. The problem is that after applying fixed effects, for example using dummy variables, the unobserved province specific characteristics may be correlated with explanatory variables. For instance consider our VAR model (in equation 20) in a panel setting

$$x_{it} = A_0 + A_1 x_{it-1} + u_{it}, \qquad (24)$$

where $u_{it} = v_i + e_{it}$,

where, $i = 1,\ldots,10$ refers to a regional index and $t = 1,\ldots,20$ refers to a time index in each cross-section. v_i denotes unobserved province specific fixed effects and e_{it} are white noise errors. Clearly x_{it} depends on v_i; this implies that x_{it-1} also depends on v_i. But x_{it-1} is an explanatory variable and v_i is (part of) the error term – this implies that an explanatory variable is correlated with the errors in the panel VAR making the OLS estimator biased (Baltagi, 2005).

[29] We would like to thank Inessa Love for allowing us to use the STATA codes for the panel VAR.

So we cannot use fixed effects, and to cope with the problem, we apply a transformation to first remove the individual effects. We use the Helmert transformation - also referred to as forward mean-differencing (see Arellano and Bover, 1995). Applying this procedure the error term can be rewritten as: $\Delta u_{it} = \Delta v_i + \Delta e_{it}$ or $u_{it} - u_{i,t-1} = (v_i - v_i) + (e_{it} + e_{i,t-1}) = e_{it} + e_{i,t-1}$. The Helmert transformation removes the difference between each variable and its forward mean. In other words, to each of the first (T - 1) observations are subtracted the mean of the remaining future observations available in the dataset (Arellano and Bover, 1995). The Helmert transformation will allow the lagged right-hand side dependent variables to be uncorrelated with the error term. However, there still may be some leftover correlation between the explanatory variables (viz., the lagged dependent variable) and the error term. So the solution is to use the transformation and then use instrumental variables for X (which is x_{it-1}) and estimate the model. This is usually done using General Method of Moments (GMM) (see Arellano and Bover, 1995). The mean-differenced lagged dependent variable will be instrumented with its past levels.

5.5 Model specification and estimation results

In our specification of the VAR model we chose to include the relationship between the following variables – GDP, self-employment, migration and trade. So in our econometric model (equation 24), x_t is specified as a four-variable vector (GDP, Self-employment, migration and trade), while, as discussed earlier A_1 is a matrix of dynamic coefficients related to the four dependent variables in x_t and v_i is a vector of individual fixed effects (calculated using the Helmert procedure of forward mean-differencing).

Note that the fixed effects are removed using the Helmert procedure. After some experimentation with different lag lengths, we found that five yearly lags encompassed all the significant dynamic relationships among the four variables quite well.

In our panel VAR model the variables are sorted with the following order: GDP, self-employment, migration and trade based on the size of the residual correlation matrix (Table 7). The correlation across errors of both equations in the panel VAR system is statistically insignificant suggesting that the ordering of variables we adopted should not matter (see Arias, 2007 for more details on orderings).

Table 7. Residual correlation matrix

	GDP	**Self-employment**	**Migration**	**Trade**
GDP	1			
Self-employment	-0.151 (0.081)	1		
Migration	0.028 (0.748)	-0.073 (0.400)	1	
Trade	0.008 (0.927)	-0.153 (0.076)	-0.135 (0.120)	1

Notes: P-values are reported in parentheses. As suggested by the low correlation coefficient between self-employment and the GDP, migration and trade, the ordering of the variables made little difference to the estimated impulse response functions. The variables were ordered as shown in the table.
The variables used in the analysis are as follows:
• **GDP** −Annual GDP per worker (logged)
• **Net Trade** − Annual export of good and services minus import of good and services.
• **Migration** − Annual inter-provincial migration, out-migrants from in-migrants as a proportion of the provincial population
• **Self-employment** − Annual non-agricultural self-employment as a ratio of total provincial employment (logged)

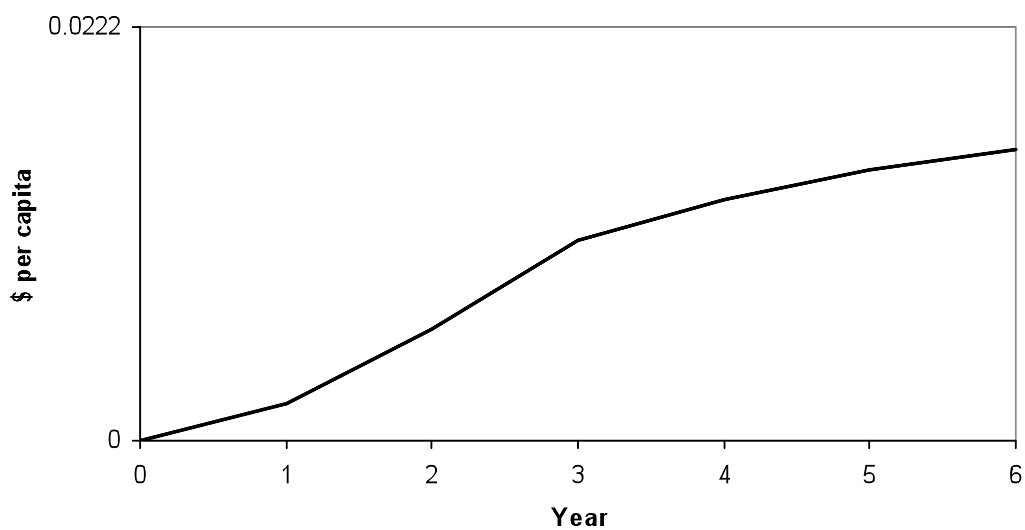
5.5.1 Estimation results

The estimated coefficients of the economic system given in equation (24) are reported in Table (8). While we are interested in the coefficients of the dynamic panel

VAR system, the real motivation of this work focuses on the dynamic reduced form effects of shocks to self-employment (and migration and trade) on regional economies. To simulate these effects we follow up estimation of the with impulse response function analysis which traces the effect of an innovation in one variable on the others.

Consistent with our hypothesis of entrepreneurship effects, a one standard deviation increase in self-employment initially increases GDP (in the first year, Figure 9). This increase escalates over the next couple of years and the stimulative effect of self-employment shock continues over time through the end of the period of analysis. Thus, we find strong support for our hypothesis that increases in self-employment has a *positive and permanent* effect on provincial incomes. Thus this econometric finding indicates that entrepreneurship can be used as an engine of long run growth and used as a policy tool for stimulating growth in laggard regions.

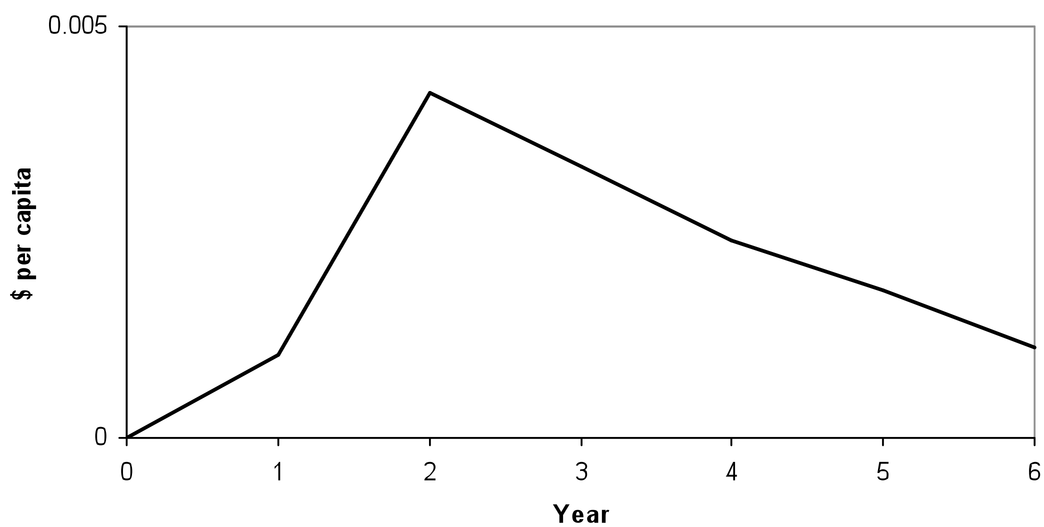
Figure 9. The impulse-responses function for GDP and self-employment. Response of GDP to self-employment shock



Notes: The X axis represents logged GDP per capita in $CAD.
The self-employment variable was shocked by one std. deviation.

The estimation results also show interesting findings for the migration and trade variables that are included in the panel VAR model. Figure (10) depicts the response of the GDP to the shock in one standard deviation in migration. We observe that an increase in net trade initially yields higher GDP in the first two years, as we would expect, but ultimately after the second year the effect of greater trade starts to diminish. This means that an increase in interprovincial and international trade has an immediate effect on growth in the short run, although this effect dies out in later periods. This result most likely shows that trade is not a long term determinant of growth it although has a short-term stimulative effects on the economy.

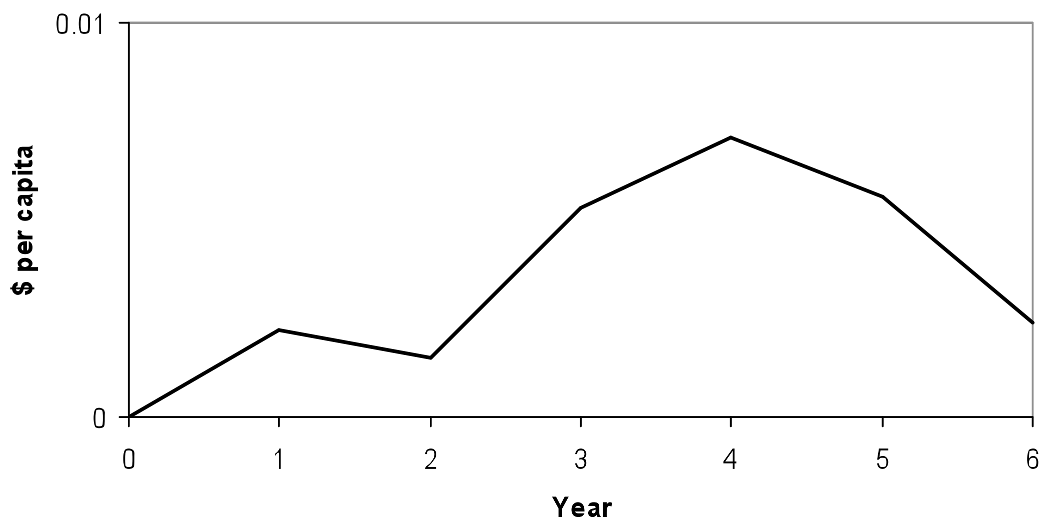
Figure 10. The impulse-responses function for GDP and migration. Response of GDP to migration shock



Notes: The X axis represents logged GDP per capita in $CAD.
The migration variable was shocked by one std. deviation.

A shock to the migration variable yields a similar response from regional income as a shock to the trade variable, although with more fluctuations (Figure 11). We observed that in the first year an impulse into migration increases GDP; in the second year, the level of GDP sharply declines. After the second year, GDP increases for the next three periods, however this increase eventually dies out and GDP starts to come back to its original, pre-shock level after the fifth period. Given this result it appears that an increase in the number of people who tend to migrate towards more urbanized and richer provinces has an initial high effect on the level of GDP but only in the short run. In the long run, after 5 years, the level of GDP would decline to the original level. Taken together and comparing only these three variables (self-employment, trade and migration) we conclude that self-employment is the factor that has the most bang for the buck and one that has the most lasting effects on economic growth.

Figure 11. The impulse-responses function for GDP and trade. Response of GDP to trade shock



Notes: The X axis represents logged GDP per capita in $CAD.
The trade variable was shocked by one std. deviation.

Table 8. Panel VAR regression results

Results of the Estimation by system GMM
number of observations used : 135

	GDP	Self-employment	Migration	Trade
GDP				
L1	***1.071	0.053	0.002	0.000
	0.158	0.049	0.002	0.001
L2	-0.204	0.063	-0.002	0.001
	0.142	0.040	0.001	0.001
L3	-0.050	0.028	**0.004	**-0.001
	0.123	0.048	0.002	0.001
L4	0.190	-0.038	-0.002	0.001
	0.108	0.042	0.002	0.001
L5	-0.090	0.029	-0.001	0.000
	0.081	0.039	0.001	0.001
Self-employment				
L1	-0.083	***0.770	-0.001	-0.002
	0.305	0.128	0.003	0.001
L2	0.175	-0.021	-0.001	0.001
	0.271	0.117	0.003	0.001
L3	-0.277	-0.018	0.006	-0.001
	0.277	0.111	0.003	0.002
L4	0.084	-0.108	-0.005	0.001
	0.262	0.119	0.003	0.001
L5	0.052	0.151	0.003	0.000
	0.178	0.088	0.002	0.001
Migration				
L1	**-28.320	8.545	***0.896	0.015
	12.228	4.660	0.171	0.059
L2	24.844	3.829	***-0.558	0.041
	13.830	3.657	0.155	0.054
L3	0.600	2.938	0.256	-0.061
	11.218	3.889	0.168	0.062
L4	3.837	-0.431	0.010	0.070
	11.028	3.952	0.143	0.069
L5	-4.581	0.717	-0.131	-0.036
	7.066	3.394	0.100	0.043

	GDP	Self-employment	Migration	Trade
Trade				
L1	47.035	-1.898	0.110	***1.224
	31.819	9.576	0.294	0.141
L2	*-48.428	-3.372	-0.064	-0.258
	27.848	9.208	0.247	0.174
L3	-30.445	-12.616	*0.637	0.045
	21.222	10.961	0.347	0.294
L4	**53.170	10.863	**-0.760	0.335
	22.938	8.194	0.368	0.217
L5	-21.784	-1.339	0.318	***-0.338
	18.535	5.485	0.270	0.097

(, **, *** denote P < 0.1, P < 0.05, P < 0.01)*

Notes: Standard errors are presented in parentheses below the regression coefficients.
The four variables VAR model was estimated by GMM. All regression variables were de-meaned using a Helmert transformation.

Chapter 6 – Conclusions

6.1 Summary

This thesis analyzes the role of entrepreneurship, as measured by non-agricultural self-employment, in regional economic growth in Canada. It develops a regional economic growth model, based on the neoclassical growth theory (Solow, 1956). Through this growth model, regional economic disparity in Canada is analyzed, with an emphasis on the role of entrepreneurship. In order to explore endogeneity issues and long term growth effects of policy changes on entrepreneurship in the economy, dynamic modeling techniques are employed. Vector autoregression (VAR) analysis is applied to predict long-run effects of changes in policy and thus entrepreneurship on regional income in Canada. Both analyses yield statistically significant findings, providing information that could be used for further policy analyses. The descriptive analysis suggests that non-agricultural self-employment contributes importantly to the Canadian economy in terms of the creation of new employment. The descriptive analysis focuses on non-agricultural self-employment, since there has been a rapid decline of self-employment in the agricultural sector. The analysis reveals a negative relationship between non-agricultural self-employment and unemployment. These findings suggest that workers are being pulled into the sector and possibly become entrepreneurs in a vision of better benefits and higher chances of success, compared to taking a career in paid employment. This finding is significant for Alberta, British Colombia and Saskatchewan.

Considering the regional economic growth model estimated, the findings suggest that entrepreneurship stimulates economic growth significantly in Canada. A large body of recent theoretical literature emphasizes the relevance of entrepreneurship in economic growth models. However, the empirical growth literature on Canada does not account for the role of entrepreneurship. Unlike previous empirical Canadian studies, this thesis accounts explicitly for entrepreneurship in the analysis on economic growth processes. After including non-agricultural self-employment into the growth regression, the estimation results suggest a positive and significant effect of non-agricultural self-employment on GDP growth rates. In this sense, the results suggest that economic growth models in Canada which do not account for the role of entrepreneurship have so far been misspecified.

The VAR analysis uncovers multiyear patterns of economic growth that have not been identified previously in the Canadian literature. It also reveals a positive and significant long-run dynamic relationship between non-agricultural self-employment and regional income. The VAR analysis includes three determinants of economic growth; migration, trade and self-employment. The estimated impulse response functions suggest that the major determinant of long-term growth is non-agricultural self-employment. After controlling for shocks to self-employment, the response of GDP levels to changes in non-agricultural self-employment are predicted to have positive long-run effect. Therefore, the results suggest that larger numbers of self-employed individuals in an economy are a sign of long term economic prosperity and progress.

6.2 Policy implications

Regional income inequalities are undesirable both from an economic and from a policy perspective. Despite the ongoing debate over the nature of the evolution of income growth disparities, economic analyses predominantly show that regional income inequality impedes economic growth (e.g., Alasia, 2003; Coulombe and Tremblay, 2008). As a result of the structure of Canada's system of fiscal federalism, regional income inequalities put direct pressure on the federal budget. Consequently, the Canadian government has made the reduction of regional income disparities as one of its top priorities. This was reflected in the 2007-2008 federal budget, which introduced a renewed and stronger equalization program (providing approximately $1.9 billion more over the next two years than the previous program), to tackle inter-provincial differences in income (Finance Canada, 2007). An improved understanding of the extent of and the reasons for regional income gaps is therefore critical for Canadian policymakers who are seeking to accelerate regional growth and diminish regional income disparities.

The so-called "innovation report" by the Council of Canadian Academies (2009) focuses on the long run determinants of economic growth and productivity. The analysis suggests that Canada has a serious productivity problem, which is rooted in weak business innovation and in the low effectiveness with which labor and capital are used in the economy. Considering the issue of productivity growth, the report suggests to sharpen the incentives for innovation-oriented business strategies, specifically by focusing on increasing exposure to competition and by promoting exports. Thus, developing stronger export orientation of Canadian small businesses, and ensuring that those firms have access to affordable sources of financing for export development can be expected to help to firms to succeed in global markets.

Empirical work from Fritsch (2008) also suggests that the growth of new businesses in national markets can be achieved by advocating policies that are directed at stimulating entry of new entrepreneurs, and that decrease administrative barriers to the development of new businesses. Consequently, a supportive business environment that stimulates the growth of self-employment can not only be expected to have positive implications on domestic income growth, but also on the competitiveness of small businesses in national and international markets. In this sense, the results of this thesis contain valuable policy implications, as the results suggest that non-agricultural self-employment is an important engine for innovation and economic growth in Canada.

6.3 Limitations and future research

When considering the above findings, several limitations of this study should be taken into account. We can distinguish two key limitations, one relates to the employed methodology and a second relates to the collected data.

The majority of the empirical literature on convergence that uses growth regression analysis has been criticized more recently. This empirical work uses cross sectional regression while controlling for a set of initial conditions that affect the long run growth trajectories of regional economies. If the coefficient on the initial income level is negative, it is taken as evidence that poor regions are catching up with rich ones, and that regional income disparities are narrowing. However, this empirical approach has been critiqued in a series papers by Quah (1993a; 1993b, 1996a, 1996b; also see Durlauf and Johnson, 1995; Cheshire and Magrini, 2000). Future research of this type could consider recent advances in methodology for studying growth processes based on distributional dynamics methods (e.g. Markov models).

A Markov model is a tool for analyzing the evolution of systems over time. At the heart of the Markov model is a transition probability matrix which can help to explain how the distribution of regional income levels evolve over time. The Markov model reveals changes in the shape of the regional income distribution from one period to the next, and thus could contribute to identify the probabilities with which a given province remains in the initial income state, or transitions to other states, while accounting for the effect of entrepreneurship. In other words, a Markov model can help explain how income growth unfolds over time with respect to self-employment and other controlled variables. Thus, as an extension of this thesis, a regional Markov model could be estimated using maximum likelihood methods, thus potentially improving our understanding of the regional convergence process among Canadian provinces (e.g. Kay, 1986; Jackson et al., 2003 and Sakamoto and Islam, 2008).

Considering the limitations of our data, we encountered two issues. First, non-agricultural self-employment was used as a proxy for measuring "entrepreneurship". Other measures of entrepreneurship that may be more suitable to represent entrepreneurial activity were unavailable at the provincial level (e.g., the rate of new business formation; a distinction of non-agricultural self-employment by firm size to test for growth differences by firm size and its relationship to unemployment, i.e., Gibrat's Law).

The second issue relates to the level of aggregation of the data used for the analysis. For the purpose of this thesis, data was collected for ten Canadian provinces. Census data may be more appropriate as it is collected from 280 census divisions covering the entire country. The advantage of census data (which is, however, only available every five years) over provincial data is that it provides more detailed demographic information. Census data would allow an assessment of the rural and urban trends in a broader regional context, and therefore potentially provide a more comprehensive assessment of the differences between rural and urban regions (Alasia, 2003).

Since the focus of this thesis is to tackle inter-provincial differences in GDP, the decision was made to collect provincial data instead of census division data. The key advantage of using provincial data from Statistics Canada's CANSIM database is that annual data could be used in the analysis. However, the provincial level of aggregation does not allow for more detailed single agent data with regards to innovative performance of firms in terms of R&D, or information related to education. While education of self-employed has been addressed at the provincial levels, specific effects related to how tacit knowledge verses formal knowledge affect provincial income growth could not be accounted for. It was also not possible to distinguish self-employed in the non-agricultural sector in terms of their skill-set, as it is distinct from knowledge.

Furthermore, the analysis does not account for interprovincial differences in market structure and its relationship to innovation and economic growth. This aspect is significant, since the literature has established three aspects of market structure which can affect the relative innovative advantage of small (and large) firms: the size distribution of firms, the existence of certain barriers to entry, and the stage of the industry in the product life- cycle (Acs and Audretsch, 1987).

In sum, perhaps the most significant limitation that arises from the aggregate nature of the dataset relates to the inability of the analysis to link innovation (product and/

or process innovation) with entrepreneurship. Although we have evidence that the propensity to innovate is related to entrepreneurial activity, and that entrepreneurship is commercialized through innovative activity (e.g., Acs and Audretsch 1990; Baumol, 2002b; Agarwal et al., 2007), as part of this thesis no matching data could be obtained to identify cross- provincial patterns of entrepreneurship and innovation, and to link this to economic growth.

Considering the above data limitations in terms of the inability of the analysis to control for innovative activity and for differences in market structure, the policy recommendations emerging from this thesis should be interpreted with a corresponding degree of caution. Furthermore, the analysis in this thesis cannot be used to strictly identify policy implications in the absence of quantifying social welfare measures. Keuschnigg and Nielsen (2001) emphasize that public policy towards entrepreneurship and the formation of new businesses should be guided by its welfare implications. Thus, to quantify welfare gains e.g. from government services (training, infrastructure), subsidies and investments, as they potentially stimulate entrepreneurship, an even more detailed analysis of entrepreneurship and Canadian economic growth would be needed.

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