How to Embrace Change: Provincial Unemployment After the 2008 Recession

by

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Abstract

Five years after the 2008 recession, provincial unemployment rates in Canada remain higher than pre-recession levels. In some provinces, initial declines in unemployment have plateaued. When structural changes occur, a higher unemployment rate can persist even after a full economic recovery. This study undertakes an empirical analysis of provincial panel data to uncover potential causes of persistent unemployment across Canada. The results indicate that, after the recession, the structural component of unemployment increased in all provinces except for Saskatchewan. Several policy options are suggested to expedite the adjustment of effected workers and to prevent future structural unemployment.

Keywords: Provincial unemployment; structural unemployment; 2008 recession; structural change; worker displacement

This work is dedicated to my partner, Graham Norris, whose patience, love, and support have carried me through the challenges of graduate school and life.

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Executive Summary

During the 2008 recession, the Canadian unemployment rate reached its peak at 8.1 percent, a rate unseen since the late 1990s. While the unemployment rate has declined to 6.9 percent as of October 2013, it has not returned to pre-recession rates. A higher long-term unemployment rate and changes in industry employment levels suggest that the Canadian labour market may have undergone fundamental changes following the 2008 recession. This study undertakes an empirical analysis of Canadian unemployment to determine whether structural changes in the labour market explain persistent levels of unemployment and if so, analyzes policy options to address unemployment.

There are several types of unemployment. Understanding which type explains the current data is crucial in helping to determine policy directions. Cyclical unemployment represents short-term unemployment, which changes with fluctuations in the business cycle. The natural rate is the rate of unemployment that exists in the long-term, in a steady economic state. The natural rate is made up of frictional and structural unemployment. The frictional rate is the level of unemployment necessary for the ongoing allocation of labour, while the structural rate represents mismatches in the skills or geographic location of unemployed workers and existing job vacancies. If an economic recession persists for a long time, what starts out as cyclical unemployment can evolve into structural unemployment. In addition, when structural changes occur, a higher unemployment rate can continue even after a full economic recovery.

In Canada, the federal and provincial governments share jurisdiction over labour market policies. While the federal government is responsible for the Employment Insurance (EI) program, the largest income security program in Canada, provincial governments regulate the legislation over minimum wage rates and maximum hours worked. Together, these, and other policies, influence the functioning of the labour market and can affect unemployment. Overall, unemployment represents a loss of production to the Canadian economy and poses substantial financial hardships for Canadian families. In addition, high levels of unemployment increase the demand for government services, and diminish the mental and physical health of unemployed individuals.

Since the 1970s, the unemployment rate in Canada has fluctuated as the Canadian economy experienced a number of economic shocks. Evidence from previous recessions suggests that the sharp declines in employment are often long-lasting. Several studies have analyzed changes in the Canadian unemployment rates throughout the 1980s and 1990s, and there is some evidence that structural unemployment has occurred in the past. Due to structural and demographic factors, there are significant differences in how unemployment rates behave within the individual provinces. A different industry mix and distinct institutional factors can create substantial differences in the magnitude of economic shocks and the speed of labour market adjustments in each province. While there is some ambiguity in the behaviour of the national unemployment rate, disaggregated provincial unemployment rates show that the initial decline in unemployment following the 2008 recession has plateaued in most provinces.

The policy problem addressed in this study is why higher rates of unemployment have persisted in most Canadian provinces following the 2008 recession. Accurately understanding the underlying causes of unemployment and implementing policies that address those causes is critical for the well-being of the Canadian economy and society. The purpose of the empirical research is twofold: to find out whether the 2008 recession affected the structural component of unemployment, and to see whether there are differences in how structural changes affect unemployment rates within the individual provinces. The empirical estimation used to evaluate the composition of unemployment is based on panel data of ten provinces over a 25-year period. Using a set of provincial and countrywide variables, I estimate factors that influence structural unemployment, while controlling for a set of cyclical, demographic, and institutional variables.

Results indicate that several cyclical factors have significant impacts on provincial unemployment rates. These include aggregate demand, the interest rate, and the price of oil. The impact of EI benefits is also highly significant, indicating that an increase in the length of EI benefits contributes to higher provincial unemployment rates. These results have substantial policy implications, given that the length of EI benefits is longer for regions with high unemployment rates. Next, a higher participation rate of older workers has been found to significantly reduce provincial unemployment rates. Finally, the study finds that the structural component of unemployment has increased in

all Canadian provinces, excluding Saskatchewan, following the 2008 recession. This finding is significant because structural unemployment requires a set of specific and long-term policy responses.

I identify three policy options that could reduce structural unemployment in the Canadian provinces. The first policy option is to increase funding for retraining programs focused on certification or credential attainment for structurally unemployed workers. The second policy option is to implement mandatory assessments for all unemployed workers collecting EI benefits for six months or more. This policy option aims to identify structurally unemployed workers in order to refer them to further employment services. The third policy option is to monitor and enforce the active job-search requirement for all EI claimants in order to limit misuse. Lastly, I consider a combination of options one and two, and evaluate all policy options using five criteria: efficiency, budgetary impact, equity, administrative complexity, and stakeholder acceptance. Increasing funding for training programs is found to have the most favourable results. Current analysis, however, also indicates that EI assessment and monitoring policies, which ensure that EI claimants actively and effectively look for work, play a key role in preventing future structural unemployment. In the long-term, successfully implementing these policies at the regional level will decrease the current level of unemployment and expedite future labour market adjustments.

1. Introduction

During the 2008 recession, the Canadian labour market lost over 400,000 jobs between 2008 and 2009. The unemployment rate reached its peak at 8.1 percent in 2009, a rate unseen since the late 1990s. While the unemployment rate declined to 6.9 percent in October 2013, it has not returned to pre-recession rates. Similarly, the actual number of unemployed Canadians remains high. During the peak of the recession, 1.5 million workers were unemployed, as opposed to 1.1 million prior to the economic downturn. In October 2013, 1.4 million Canadians were still looking for work (Statistics Canada, 2013).

Unemployed workers represent a loss of production to the Canadian economy. In addition, high levels of unemployment increase demand for government services, diminish the mental and physical health of unemployed individuals, and put considerable strain on Canadian families. This capstone examines unemployment changes following the 2008 recession in order to identify trends in the labour market structure and conditions that may have led to increased unemployment. The policy question is why higher rates of unemployment have persisted in most Canadian provinces following the 2008 recession. Different types of unemployment have different causes and may or may not require policy responses. While it is evident that unemployment increased sharply after the recession, there are several possible types of unemployment. Therefore, an empirical study analyzing the composition of unemployment is necessary in order to identify the underlying changes. Accurately understanding the causes of unemployment and designing policies that address those causes remains critical for the well-being of the Canadian society and economy.

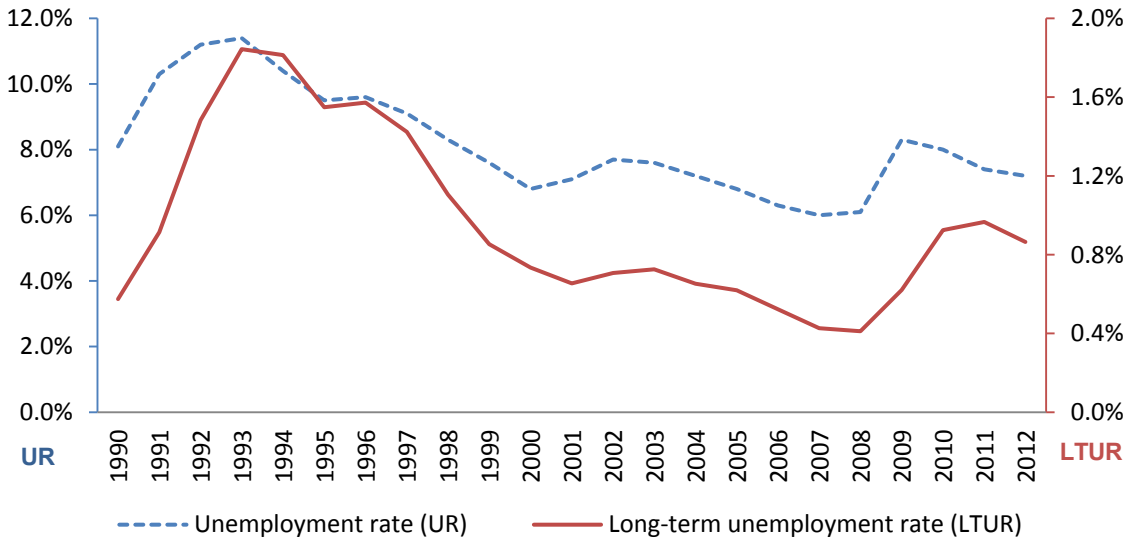
This capstone is organized as follows. Chapter 2 describes recent changes in the Canadian labour market, following the 2008 recession. Chapter 3 presents definitions, examines major labour market institutions, and discusses the direct and indirect consequences of unemployment in Canada. Chapter 4 provides a historical context for major developments in the Canadian labour market and discusses provincial

unemployment disparities. Chapter 5 discusses the policy question and rationale for the study design. Chapter 6 presents the theory and model for analyzing provincial unemployment rates. Chapter 7 describes the empirical investigation and discusses major findings that inform the policy options and analysis in the final chapter.

2. Unemployment in Canada in recent years

In October 2013, 1.4 million unemployed Canadians were still searching for work, compared to 1.1 million unemployed prior to the 2008 recession, and 1.5 million during the peak of the recession (Statistics Canada, 2013). Out of the total number of unemployed Canadians, 262,300 have been unemployed for six months or more and over half of those have been out of work for over a year (Statistics Canada, 2013). Figure 1 shows that the share of the labour force unemployed for 52 weeks or more, the long-term unemployed, has more than doubled (from 0.41 to 0.92 percent) between 2008 and 2010. The rate remains at 0.86 percent in 2013. Therefore, following the recession, unemployed Canadians experienced longer spells of unemployment. Figure 2 also shows that the decline of the unemployment rate has slowed after 2011. This slowdown raises questions about potential changes in the underlying conditions of the Canadian labour market.

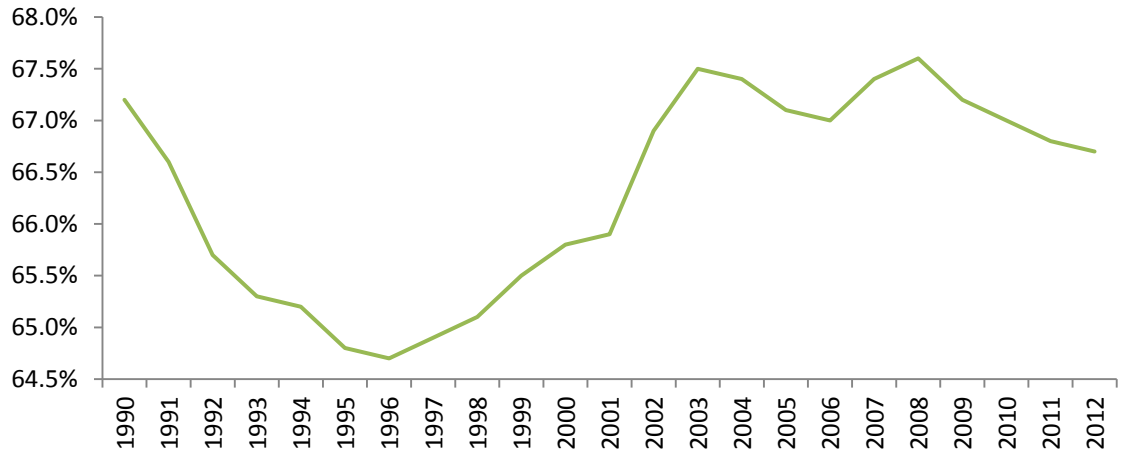
Figure 1 Canadian unemployment rate and long-term unemployment rate



Source: Statistics Canada (2013)

Many workers who are unemployed for extended periods of time eventually become discouraged and exit the labour force (Ragan and Lipsey, 2011). Discouraged workers are individuals who desire to work, but have given up searching because of a perceived lack of available jobs. Inability to secure work may be due to a lack of skills or other personal factors (Kaufman, 1991). As shown in Figure 3, between 2009 and 2012, the labour force participation rate declined by one percentage point, increasing the number of individuals dropping out of the labour force by almost half a million (469,400). At the same time, the unemployment rate declined by 1.1 percent (Figure 1). Therefore, the decline in the unemployment rate may be partially attributed to the fall in the participation rate (Statistics Canada, 2013).

Figure 2 Canadian labour force participation rate

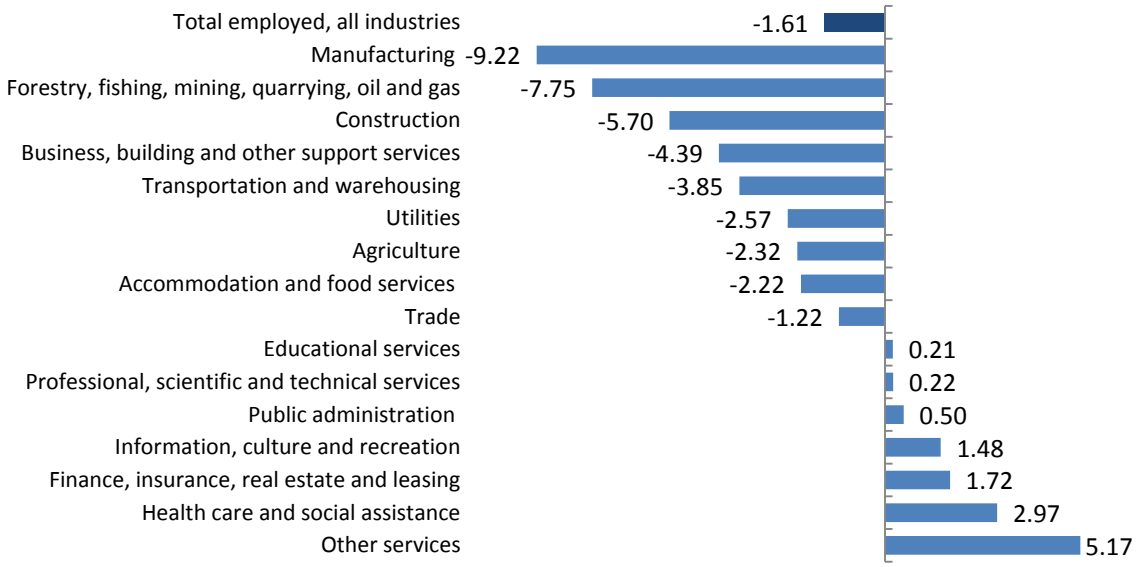


Source: Statistics Canada (2013)

Some sectors of the economy were especially hard hit by the 2008 recession (Figure 3). Between 2008 and 2009, 10 out of 18 Canadian industries lost jobs. Manufacturing, primary resource extraction, and construction industries showed the largest percentage point drops: 9.2, 7.8, and 5.7 respectively. Between 2008 and 2010, employment in manufacturing and primary industries fell by 12 and 13 percent, respectively (Statistics Canada, 2013). Manufacturing continued to lose jobs until 2012, when it experienced a modest 1.2 percent increase in employment. Several industries in the private sector, including professional, scientific and technical services; information, culture and recreation; and finance, insurance, real estate, and leasing continued

expanding following the recession, potentially signalling a continued shift away from goods-producing industries towards services (Statistics Canada, 2013).

Figure 3 Percentage point change in industry employment 2008-2009



Source: Statistics Canada (2013)

These economic indicators suggest that the Canadian labour market may have experienced fundamental changes following the 2008 recession. This study undertakes a detailed analysis of Canadian unemployment to uncover potential shifts in the underlying conditions of the labour market. In the next several chapters, I set up the framework and historical context that will serve as a background for my empirical investigation.

3. Definitions, institutions and costs

In this section, I describe the different types of unemployment, discuss relevant labour market policies, and examine both direct and indirect costs of unemployment.

3.1. Definitions

Defining terms is crucial to deconstruct and document potential changes that have occurred in the labour market following the 2008 recession. Unemployment represents the number of individuals who are out work and are actively searching for a job. The unemployment rate is the number of unemployed workers over 15 years of age, expressed as a share of the labour force. While the unemployment rate is one of the most conventional indicators of labour market conditions, it can be misleading for two reasons. First, it excludes discouraged workers from the total number of the unemployed. Second, it fails to recognize people who are underemployed. During economic downturns, many individuals work part-time involuntarily because their hours are cut back or because they are unable to find full-time employment. Yet, according to the definition, working even one hour classifies workers as employed. While the extent of underemployment is difficult to estimate, it represents another important channel that contributes to the true extent of unemployment (Kaufman, 1991).

Economic literature distinguishes between three different types of unemployment: cyclical, frictional, and structural. One of the major defining characteristics in this type of literature is the time dimension, as total unemployment can be divided into short- and long-term. Short-term unemployment is called cyclical because it fluctuates with changes in economic conditions. Changes in aggregate demand influence the demand for labour, resulting in the rise and fall of unemployment. Long-term unemployment is referred to as the natural rate of unemployment, which exists in a steady economic state. The natural rate experiences less variability and is composed of two components: frictional

unemployment and structural unemployment (Kaufman, 1991).[1] Under full employment conditions where all economic adjustments have taken place, structural unemployment dissipates and only frictional unemployment remains.

Frictional unemployment results from an ongoing turnover of labour, as workers move between jobs. Also referred to as search unemployment, it depends on the time required for workers and firms to make good matches in the labour market. This type of unemployment results from the ongoing allocation of labour, which occurs in a steady economic state. The amount of frictional unemployment depends on the availability of information, as well as the institutional and legal constraints that affect the labour market. For example, programs that provide temporary income support for unemployed workers can increase the duration of unemployment because benefits reduce the cost of being unemployed. In addition, this type of unemployment occurs when students enter the labour force for the first time or when women re-enter the labour force after having children. Therefore, a rise in the share of workers who tend to have higher rates of frictional unemployment, such as youth and women, can influence unemployment. Similarly, older workers (55+), who tend to experience longer periods of unemployment, could also affect the frictional rate (Benjamin et al., 2002).

Structural unemployment results from a mismatch between the types of available jobs and the types of workers seeking employment. A mismatch can occur with respect to skills, occupations, industries, or geographic location. Because it takes time to retrain or re-allocate workers, structural unemployment tends to persist for long periods. Unlike frictional or cyclical unemployment, structural unemployment can be concentrated among specific groups of workers. This type of unemployment can arise due to a decline of a major industry or due to technological advancements, which entail new occupational requirements. For example, some studies demonstrate that technological change produces skill-biased demand shifts, which increase the employment demand in high- and low-skill occupations relative to middle-skill jobs (Acemoglu and Autor, 2010; Yan,

[1] Some researchers define natural unemployment as the rate of unemployment that occurs during stable inflation, also known as the non-accelerating inflation rate of unemployment (NAIRU). This definition is used in the context of the Phillips curve, which defines the relationship between unemployment and inflation (Kaufman, 1991). This approach is not the one taken in my capstone.

2006). Therefore, any changes in industrial composition that alter the type of labour demanded can create mismatches that give rise to structural unemployment (Kaufman, 1991).

If an economic recession lasts a long time, what starts out as cyclical unemployment can evolve into structural unemployment. During economic downturns, firms lay off workers and the unemployment rate rises. Many workers, who become unemployed, return to work in their former industries once aggregate demand recovers. Some sectors of the economy, however, can be especially hard hit by a recession and workers in these industries may experience longer spells of unemployment. The longer a worker is unemployed, the more likely his or her skills are to become obsolete. Firms may also modify their production processes to adjust to new economic conditions. As demand recovers and firms begin to hire workers back, the skills of the long-term unemployed may no longer match the skills required for the new jobs (Lazear and Spletzer, 2013).

Because different types of unemployment have different underlying causes, they also require different policy responses. While governments often use short-term fiscal policies to lower cyclical unemployment, influencing structural unemployment requires long-term, targeted investments. Changes to existing labour market institutions are often required to affect the frictional unemployment rate (Kaufman, 1991).

3.2. Canadian labour market institutions

In Canada, federal and provincial governments share jurisdiction over many labour market and employment policies. While the federal government has exclusive jurisdiction over the EI program[2], provincial governments control the legislation regulating minimum wage and maximum hours worked (Brooks, 2009). The provinces are also responsible for the delivery of post-secondary education and labour market training programs (Brooks, 2009). Additionally, macroeconomic and industrial policies influence the demand for labour and, in turn, can change the level of unemployment.

[2] Unemployment benefits were introduced in Canada in 1940 after an amendment to the British North America Act (1867) (Brooks, 2009).

Together, these policies influence the functioning of the labour market and the unemployment rate (Benjamin et al., 2002).

Arguably, the most influential policy in the Canadian labour market is the EI program, which provides temporary income assistance to eligible workers that become unemployed. Originally introduced in 1940, the program has undergone a number of philosophical and structural changes, which have sometimes relaxed and sometimes tightened the benefits and entrance requirements (Zhengxi, 1998). Generally, unemployment insurance programs protect workers against the risk of income loss due to unemployment. A system that provides financial assistance during times of unemployment, however, also influences workers' behaviour in the labour market. The generosity of unemployment benefits can act as a disincentive to look for work and can therefore contribute to search or frictional unemployment. Since the 1990s, the federal government has implemented many provisions to limit dependence and promote active measures for EI claimants (Benjamin et al., 2002; Ragan and Lipsey, 2011).

Today, the EI program remains the largest single income security program in Canada. EI covers over 90 percent of the labour force and represents one third of total spending on non-retirement income security (Benjamin et al., 2002). During 2009-2010, the fiscal year with the highest number of active claims following the 2008 recession, EI benefits represented eight percent of total government spending (Finance Canada, 2013). The benefits are financed through employee premiums and employer contributions. In 2013, the employee rate was 1.88 percent and the employer rate was 2.63 percent. The Employment Insurance Operating Account consolidates EI program revenues and expenditures to ensure that total expenditures equal total revenues over the next seven years. Following three years of account deficits incurred after the 2008 recession, the net debt in the account reached $7.9 billion in 2012 (Leonard, 2013).

As of 2013, the replacement rate, the percentage of lost income that claimants can receive as benefits, is 55 percent, up to a maximum of insurable earnings of $47,400. The qualifying requirement ranges between 12 and 20 weeks of full-time employment, depending on the unemployment rate in an applicant's region. The length of benefits also varies based on the local unemployment rate and is usually between 14 and 45 weeks (Service Canada, 2013). In 2009, the federal government temporarily

extended the length of benefits by providing five additional weeks, up to a maximum of 50 weeks of benefits. At the same time, higher provincial unemployment rates, resulting from the recession, automatically increased local entitlement to benefits (Service Canada, 2013). Because increasing the length of unemployment benefits can increase frictional unemployment, these changes may have contributed to the persistence of unemployment, following the 2008 recession.

3.3. Direct costs of unemployment

Every person counted as unemployed is able and willing to work, but is unable to secure employment. A primary goal of a market-based economy is to efficiently utilize limited resources, such as land, labour, and capital. The unemployed workers can then be seen as valuable resources that are not being utilized. Therefore, unemployment is a loss of potential output that could have been produced. Although the level of output rises when workers regain employment, the output lost during unemployment is lost forever. Okun's Law estimates the economic loss resulting from unemployment (Kaufman, 1991). Roughly, a one percentage point rise in a country’s unemployment rate is equal to approximately a 2.5 percent decline in GDP from its potential level. Therefore, for all unemployed workers, unemployment represents lost output and underutilization of valuable human capital (Kaufman, 1991; Ragan and Lipsey 2011).

At the same time, unemployment imposes significant personal costs on workers and their families because the loss of production also represents a loss of personal income for these workers. Since wages are the primary source of income for most Canadian families, prolonged unemployment can place significant financial hardship on individuals and their families. These effects are further exacerbated in families with a single earner. While EI benefits compensate workers for some income loss, specific program criteria, such as the replacement rate for lost earnings and the maximum insurable earnings threshold, indicate that some families may face a considerable drop in their living standards. In addition, long unemployment spells produce what is known as scarring effects, which imply that the loss of employment today may have cumulative impacts in the future. Scarring occurs when prolonged unemployment causes depreciation in skills and employment contacts. As a result, long-term unemployment can severely

undermine future salary negotiations and career advancement opportunities. The longer a worker is unemployed, the more difficult a successful transition out of unemployment becomes (Kaufman, 1991).

Economic costs of unemployment also include additional government spending on social programs. For example, most unemployed workers collect EI benefits and this can put a strain on government finances at a time when government revenues are in decline. Because EI premiums are tied to earnings, high levels of unemployment diminish program revenues and produce deficits in the Employment Insurance Operating Account (Leonard, 2013). Raising premiums to balance the account can put undue pressure on employed workers and businesses during a downturn. As a result, the federal government has been hesitant to increase EI premium rates in an effort to support economic recovery. Finally, some unemployed workers may eventually become discouraged and permanently lose their attachment to the labour market as they transition into the social welfare system. Therefore, both provincial and federal governments face additional costs due to a rising demand for government services (Kaufman, 1991).

3.4. Indirect costs of unemployment

Unemployment also imposes significant health and psychological costs on workers and their families. There is considerable research that documents the negative effects of unemployment, including increased depression and anxiety, higher rates of suicide and mental hospitalization, increased smoking and alcohol use, increased risk of chronic illness, hospitalization, and early death.[3] As a result, the cost of healthcare also tends to rise during times of high unemployment (Rosenthal et al., 2012). Following the 2008 recession, Astell-Burt and Feng (2013) found a significant increase in poor health status in the United Kingdom, especially for cardiovascular and respiratory health. Incidence of

[3] Similarly, in the United States, full time employment is highly correlated with health and well-being, while unemployment has adverse effects on the population's mental health, chronic diseases, and health damaging behaviours (Rosenthal et al., 2012).

poor health increased regardless of geographical and socioeconomic circumstances, after controlling for other factors.[4]

In Canada, findings show that past unemployment has had significantly adverse impacts on psychological health, even after controlling for income levels (Latif, 2010). These studies suggest that indirect costs of unemployment far exceed the actual income loss of unemployed individuals. Long-term psychological impacts include lower self-esteem, helplessness, and low productivity. In addition to increasing health costs, these effects can compound the difficulties individuals face in the job market, increasing the likelihood of becoming discouraged and exiting the labour force (Latif, 2010).

The impact of job loss on family well-being is also well documented in social research, with evidence showing intergenerational impacts and increased likelihood of divorce. Stevens (2008) finds that children whose fathers experienced work displacement have future annual earnings that are nine percent lower than earnings of children in similar socioeconomic conditions whose fathers did not experience job loss. In addition to lower annual earning, these children are also more likely to receive unemployment insurance and social assistance benefits (Oreopoulos et al., 2008). As a result, social problems associated with unemployment can have long-lasting fiscal impacts for governments (Kaufman, 1991).

To summarize, there are different types of unemployment, which have different underlying causes. While some unemployment is short-term in nature, other forms of unemployment are prolonged and may require relocation or retraining. Existing federal and provincial labour market institutions can influence the functioning of the labour market and can affect the unemployment rate. Finally, unemployment, and especially long-term unemployment, imposes considerable direct and indirect costs on individuals and governments.

[4] Interestingly, the decline in health was associated with the unemployed and those who remained employed, suggesting that stress from job insecurity was the main mechanism for lowering health outcomes (Astell-Burt and Feng, 2013). Some countries of the European Union, reported increased rates of suicide immediately prior to and during the 2008 recession, pointing to the fact that anticipation of potential job loss is also an important factor (Astell-Burt and Feng, 2013).

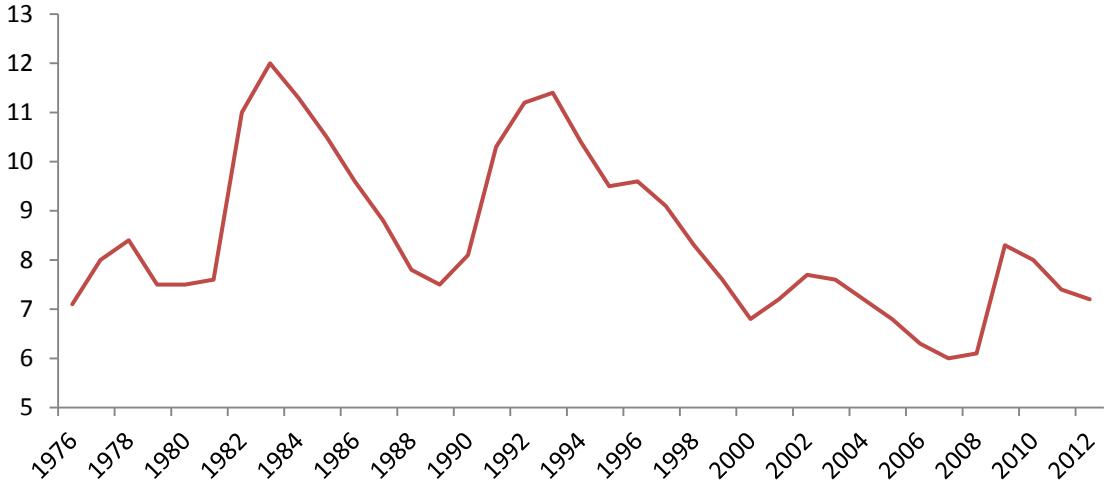
4. Historical evolution of unemployment

This chapter looks at the historical evolution of Canadian unemployment since the 1970s. The first section examines historical changes in the Canadian labour market and how major economic recessions affected the national level of unemployment. The second section presents provincial disparities in unemployment rates for the same period and highlights some underlying factors that influence how provincial labour markets behave.

4.1. Canadian unemployment since the 1970s

Evidence from previous severe recessions suggests that the sharp declines in employment are often long-lasting (Guichard and Rusticelli, 2010). Over the past five decades, the Canadian unemployment rate has experienced several fluctuations; however, two of these were particularly large, in the early 1980s and early 1990s (Keil and Symons, 1990). Figure 4 shows the Canadian rate of unemployment from 1976 to 2012. Following the first energy crises of the early 1970s, the Canadian labour market experienced a second oil shock in the early 1980s. The unemployment rate increased from 7.5 percent in 1981, to 11.0 percent in 1982, and peaked at 11.8 percent in 1983. This sharp increase in unemployment also coincided with a global economic downturn. Canada's rise in unemployment was the highest among the Organisation for Economic Co-operation and Development (OECD) countries, partially because the Bank of Canada contracted its monetary policy, intensifying the effects of the recession (Keil and Symons, 1990).

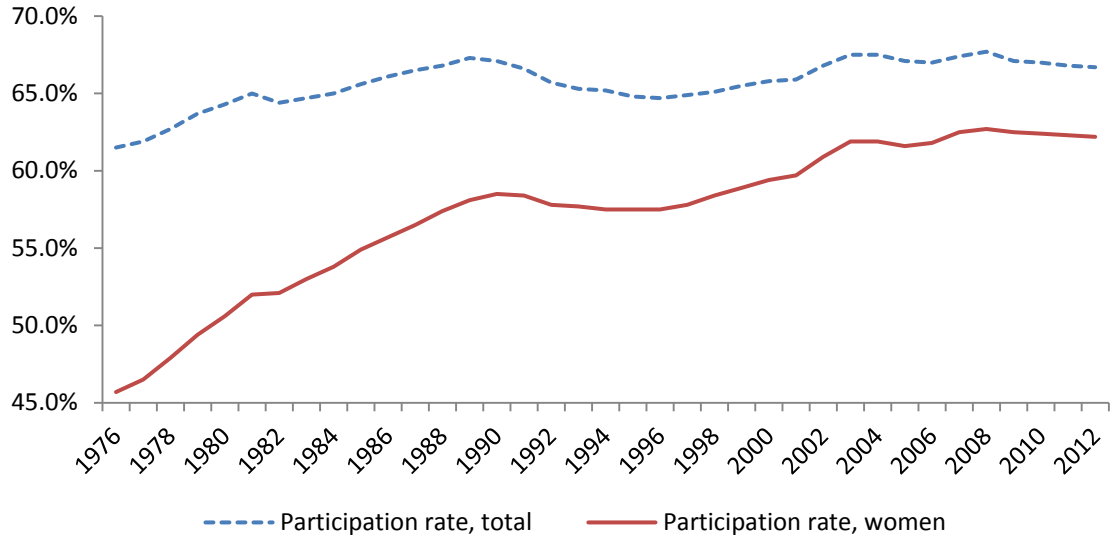
Figure 4 Canadian unemployment rate, 1976-2012



Source: Statistics Canada (2013)

The severe macroeconomic fluctuations of the early 1980s resulted at a time when the composition of the labour force was undergoing fundamental changes, resulting from the postwar baby boom. The workforce was becoming younger and the participation of women continued to increase (Keil and Symons, 1990). Figure 5 shows the evolution of the female participation rate. As the labour supply increases, an economy needs to create additional jobs in order to keep up with a growing number of workers, just to maintain a stable unemployment rate. Because different groups of workers have different likelihoods to be unemployed, the nature of the demographic changes can also alter the overall unemployment rate. As indicated in Section 3.1, a change in the participation rate of women can impact the overall unemployment rate and may have contributed to unemployment throughout the early 1980s (Keil and Symons, 1990). More recently, the participation rate of women has stabilized close to that of men's, diminishing its impact on unemployment.

Figure 5 Participation rate of women 1976-2012



Source: Statistics Canada (2013)

In the 1990s, the Canadian labour market again experienced a deep recession and a slow recovery. The unemployment rate fluctuated between 9.3 and 11.4 percent. Most of the decade was characterized by weak aggregate demand, global economic integration, and fast technological change (Picot and Heisz, 2000a). GDP growth declined from a 3.0 percent average in the 1980s to a 1.8 percent average in the 1990s, contributing to weak employment growth. As a direct consequence, there was little full-time job creation until 1998. The unemployment rate remained high by historical standards and the decline of unemployment in the 1990s was accompanied by a sharp decline in the youth participation rate (Picot and Heisz, 2000a).

Several studies have analyzed changes in the composition of Canadian unemployment throughout the 1980s and 1990s, and there is some evidence that structural unemployment has occurred in the past (McPherson and Flores, 2012; Picot and Heisz, 2000; Riddell, 2005). Osberg and Lin (2000) estimate that structural unemployment increased in the 1980s and contributed to high levels of unemployment throughout the 1990s. The authors argue that roughly one percentage point of the high levels of unemployment seen in the 1990s can be attributed to structural causes. At the time of writing, there are no published empirical studies evaluating the composition of Canadian unemployment after the 2008 recession, which leaves a considerable

research gap. Thus, the underlying conditions of the Canadian labour market during this period remain largely unknown.

4.2. Provincial differences

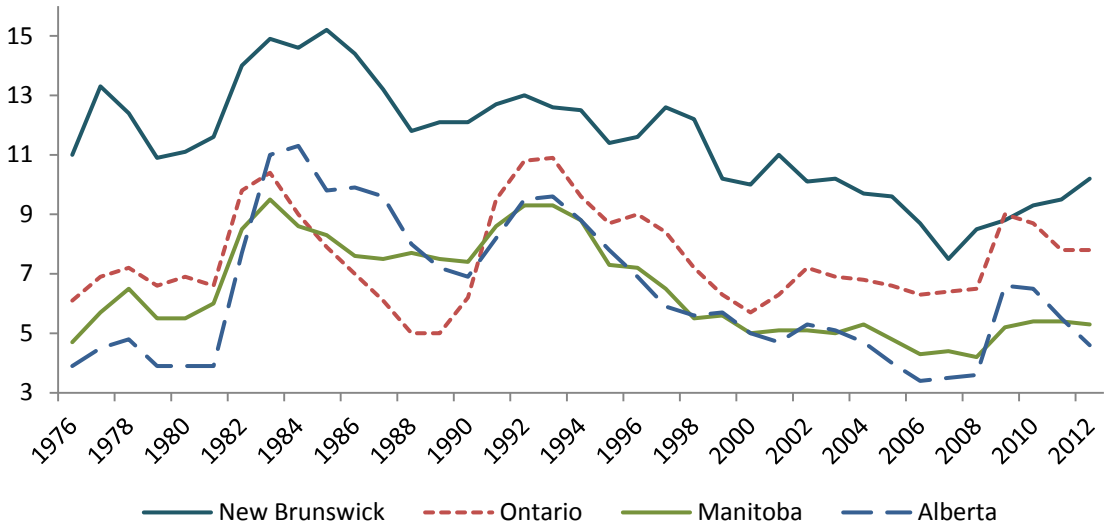
Since the 1970s, provincial unemployment rates show broad trends similar to the Canadian rate (Figure 6).[5] Individual provinces, however, illustrate considerable variation in the magnitude of unemployment resulting from specific economic shocks and the subsequent speed of labour market adjustments. In Figure 6, I depict the most representative provinces. The unemployment rate in Ontario appears to mimic closely the national rate in Figure 4, which is likely due to the province's large share of the national labour force. The unemployment rate in Manitoba appears to have been less affected by the past three major recessions. In Alberta, the 1981 recession produced much higher levels of unemployment compared to the recession of the early 1990s.

While there is some ambiguity in how the national unemployment rate has behaved since the 2008 recession, disaggregated provincial unemployment rates show a clearer picture. Figure 6 shows that Ontario's unemployment rate remains above the pre-recession levels and its rate of decline has plateaued. Alberta's rate exhibits a steady downward trend, while the rate in New Brunswick continues to rise. Manitoba's unemployment rate has also plateaued at higher than pre-recession levels.[6] A slowdown in the initial decline of the provincial unemployment rates may signal changes in the underlying structures of the provincial labour markets.

[5] For graphs of all ten provinces, see Figure A1 in Appendix A.

[6] The unemployment rates of Quebec, Prince Edward Island (PEI), and Nova Scotia show similar trends.

Figure 6 Provincial unemployment rates 1976-2012

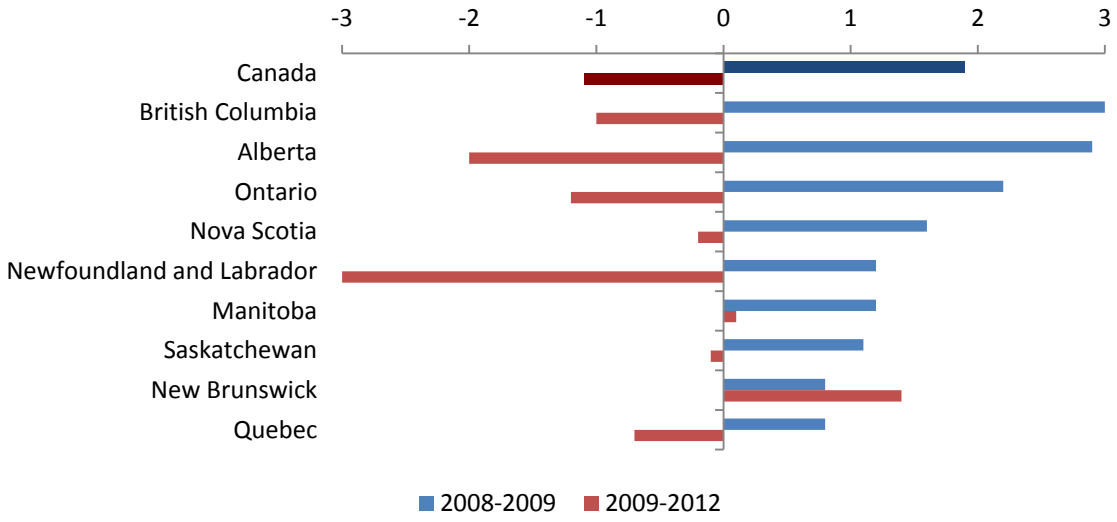


Source: Statistics Canada (2013)

A specific industry mix in each province can create varying adjustment speeds to economic shocks. Aggregate demand shocks, such as the 2008 recession, reduce the demand for exports and tend to have a disproportionate effect on the manufacturing sector. Because Canadian manufacturing is centered in Ontario, its unemployment rate is much more sensitive to such changes compared to other provinces. Sudden changes in the price of oil, however, would have larger effects in Alberta, where the oil production is centered. Hence, there is considerable rationale for evaluating each provincial labour market separately (Fallahi and Rodriguez, 2011).

As seen in Figure 7, the rise in unemployment following the 2008 recession varies across the individual provinces. British Columbia (B.C.), Alberta, and Ontario exhibit the largest percentage point increases in their unemployment rates, while Quebec and New Brunswick show the smallest. Additionally, following the economic recovery, individual provinces also demonstrate marked differences in the magnitude of their labour market adjustments. From the peak of the recession in 2008 to 2012, Alberta and Newfoundland show the largest declines in their unemployment rates, followed by Ontario and B.C. The figure illustrates that the nature of the economic shock and the underlying labour market characteristics produce vastly different unemployment results across the provinces.

Figure 7 Unemployment rate changes in percentage points



Source: Statistics Canada (2013)

A common characteristic among all the provincial unemployment rates is that five years after the 2008 recession, the rates have not returned to pre-recession levels, with the exception of Newfoundland. Therefore, further research is needed to understand potential underlying causes. In the next chapter, I briefly define the policy question and discuss the relevant stakeholders.

5. Policy question and rationale

The policy question addressed in my capstone is why higher rates of unemployment have persisted in most Canadian provinces following the 2008 recession. When structural unemployment increases, a higher unemployment rate can persist even after a full economic recovery because the unemployed workers no longer have the skills demanded in the labour market (Kaufman, 1996). Therefore, the aim of this study is to reveal the impact of structural changes on provincial unemployment rates before and after the recession. An empirical study analyzing the composition of unemployment is necessary in order to identify the underlying causes in each province, especially because different types of unemployment require markedly different policy responses.

The primary stakeholders for this policy problem are the unemployed workers, who have been adversely affected by the recent labour market conditions. Any changes to policies affecting unemployment will have tangible consequences for these individuals and their families. Other major stakeholders include the federal and provincial governments, who develop and deliver various policies that affect the labour market. The federal Department of Employment and Social Development is responsible for employment policies, skills upgrading, the EI program, and other labour market policies. Policies that influence the number of unemployed workers affect the demand for unemployment benefits and other support programs, producing tangible fiscal impacts for the federal budget. Moreover, because long-term unemployed workers often become discouraged and transition from EI benefits to social assistance, any policies influencing these individuals will also impact provincial fiscal spending. Through their respective labour ministries, provincial governments are responsible for the delivery of active labour market policies, such as skills training and job search assistance. In addition, the provinces have jurisdiction over primary and post-secondary education policies. Minor policy stakeholders include various industry associations, labour unions, educational institutions, and non-government organizations providing labour market programs.

6. Methodology

The purpose of the empirical research is twofold: to find out whether the 2008 recession affected the structural component of unemployment, and to see whether there are differences in how structural changes affect the unemployment rates of the individual provinces. In this chapter, I describe the empirical estimation used to evaluate the composition of unemployment following the 2008 recession. My primary methodology involves estimating factors that influence the structural component of unemployment, while controlling for a set of cyclical, demographic, and institutional variables. My secondary methodology validates my results by comparing them with past empirical studies.

6.1. Theory and existing literature

While Canada has historically experienced marked economic differences between the provinces, most studies of structural unemployment focus on the national level. Using aggregate data, however, does not allow for regional differences and a national analysis may mask key differences in the direction and magnitude of structural changes in each province. As seen in Figure 6, provincial unemployment rates differ widely at any given time. Therefore, a study based on provincial data can provide more targeted policy recommendations relevant to each provincial labour market (Fallahi and Rodriguez, 2011; A. Myatt, 1992; A. E. Myatt, 1996).

According to neo-classical theory, regional disparities cannot persist in an integrated economy like Canada. Regional imbalances generate relative wage changes, which trigger labour market adjustments. These adjustments take place through changes in the labour force participation on the supply side and changes in the firms' input mix on the demand side. If regional disparities persist, they are likely due to inherent differences in the long-run equilibrium unemployment rates (Gross and Schmitt, 2012).

Previous studies confirm that specific determinants of the natural unemployment rate differ across provinces (Gross and Schmitt, 2012; Johnson and Kneebone, 1991). For example, while the Western provinces experienced a decline in structural unemployment in the mid-1990s, Central and Eastern provinces did not (McPherson and Flores, 2012). Additionally, differences in labour market institutions play an important role in determining the natural rate. Regional differences in the generosity of EI benefits and minimum wage rates have been shown to contribute to a persistent dispersion in the provincial unemployment rates (Fallahi and Rodriguez, 2011; McPherson and Flores, 2012; Myatt, 1992; Myatt, 1996). These disparities become especially pronounced during economic downturns.

Many studies have found that certain explanatory variables have provincially specific effects because their impact depends on the underlying industry mix and provincial demographic factors (Fallahi and Rodriguez, 2011; McPherson and Flores, 2012; Myatt, 1992). As a result, provincial unemployment rates differ at any given time and often exhibit different sensitivities to the same exogenous shocks. Moreover, a different industrial structure and performance can create varying adjustment speeds within each provincial labour market, further influencing the unemployment rates. My study contributes to existing literature by analyzing the impact of structural changes on provincial unemployment rates following the 2008 recession. In addition, I investigate the province-specific impacts of structural changes as one of the potential channels via which provincial unemployment rates differ across Canada.

6.2. Model

I begin my analysis by identifying factors that have been found to influence unemployment in existing literature. As indicated in Section 3.1, the total rate of unemployment is equal to the cyclical and the natural rates. In order to control for cyclical factors, I include three variables. First, the output gap measures changes in aggregate demand at the national level (AD_t). When an economy is in an expansion phase, the unemployment rate falls; when it is in a recession, the unemployment rate rises. Second, the price of oil ($Poil_t$) captures oil shocks through changes in the price level. A rise in the oil price produces different impacts on individual provinces, depending

on their industrial mix. An increase in the price of oil tends to increase unemployment in regions with manufacturing production, because it represents an increase in the energy price; it tends to decrease unemployment in regions with natural resource developments because it increases production (Gross and Schmitt, 2012; McPherson and Flores, 2012; Myatt, 1992). Moreover, if changes in oil prices persist, firms may alter their production processes leading to structural unemployment (Kaufman, 1991). Therefore, the price of oil also takes into account these effects.

Third, the real rate of interest ($Intr_t$) represents changes in the cost of capital. The impact of the interest rate depends on whether capital is predominantly used as a substitute or complement to labour (Myatt, 1996). If capital is a substitute input, when the interest rate rises, the demand for labour increases as producers switch away from capital. As a result, unemployment falls. If capital is a complement input, when the interest rate rises, the demand for labour falls along with the demand for capital. As a result, unemployment increases.

Next, I look at the natural rate of unemployment. Johnson and Kneebone (1991) specify that the natural rate is a function of institutional, structural, and demographic variables. Starting with the institutional factors, previous Canadian studies have used the unionization rates, unemployment insurance benefits, and relative minimum wages. Several empirical studies, however, demonstrate that the unionization rate no longer has a significant impact on unemployment in Canada, likely due to falling rates of unionization (Gross and Schmitt, 2012; Johnson and Kneebone, 1991). Therefore, this variable is not taken into account in my model.

Several studies argue that, especially prior to the 1996 changes to the EI program, EI benefits contributed to unemployment persistence in regions with high unemployment (Fallahi and Rodrigues, 2011; Gross and Schmitt, 2012; Myatt, 1996). These studies show that higher generosity of EI benefits and reduced eligibility requirements in regions with high unemployment increase the average duration of unemployment, and reduce incentives to move to regions with lower unemployment rates. Therefore, I include a province-specific variable to control for the generosity of EI benefits ($Eiben_{j,t}$). I also control for the impact of provincial minimum wages ($Minw_{j,t}$) because wages influence the demand for labour. If the minimum wage is higher than the

market-determined wage, demand for labour declines and unemployment increases (Kaufman, 1991).

Structural factors are measured using an index developed by David M. Lilien (1982). The index ($Lilien_t$) measures employment growth dispersion between major industrial sectors. During periods of structural change, employment growth rates become more varied, creating changes in the demand for labour. Because it takes time for workers to adjust to changing demand conditions, the rise in reallocative activity increases the structural component of unemployment. Economic shocks can also change the industrial composition and alter the demand for labour. Therefore, even after aggregate demand recovers, unemployment can persist due to structural changes.

Some studies have emphasized that changes in industrial structure need to be analyzed, alongside changes in the demographic composition of the labour force to properly estimate the structural component of unemployment. Beach and Kaliski (1985) suggest that demographic changes can actually accommodate or exacerbate changes of the industrial structure. If both the demand and supply of labour change structurally at the same time, then the two effects can either offset each other or reinforce each other. Therefore, the model controls for provincial demographic factors by including the participation rate of women ($Wpart_{j,t}$) and older workers ($Opart_{j,t}$) in the labour force. As a result, the implicit function for the total rate of unemployment in the province *j* is:

$$UR_{j,t} = f\left(AD_t, Intr_t, Poil_t, Eiben_{j,t}, Minw_{j,t}, Lilien_t, Wpart_{j,t}, Opart_{j,t}\right) \quad (1)$$

The next sub-section describes the specific measures of the dependent and explanatory variables.

6.3. Measures

In this section, I briefly describe the measures for variables included in the basic model.[7] The Labour Force Survey (Statistics Canada, 2013) collects regular information

[7] Detailed descriptions of variable definitions, computations, and sources are provided in Appendix B.

on unemployment by province, employment by industry, and various participation rates, and provides the majority of data for analysis. Other sources of data include the Minimum Wage Database (Labour Program, 2013) and the United Nations Conference on Trade and Development (UNCTAD, 2013) for the market price of oil. In total, four variables are measured provincially: the participation rate of women ($Wpart_{j,t}$), the participation rate of older workers ($Opart_{j,t}$), EI benefits ($Eiben_{j,t}$) and provincial minimum wages ($Minw_{j,t}$). Country-wide explanatory variables include the output gap (AD_t), the real rate of interest ($Intr_t$), the price of oil ($Poil_t$), and the Lilien index ($Lilien_t$). Table 1, at the end of this section, presents descriptive statistics for all the explanatory variables, and Table 2 summarizes the hypotheses.

6.3.1. Dependent variable

The model is estimated on a panel dataset of ten provinces. While provincial unemployment data is available since 1976, the sample is constrained to 25 years by the availability of data for the structural measure. Therefore, using quarterly data, the sample runs from 1988Q2 to 2013Q3.[8] Data is unadjusted for seasonality; therefore quarterly dummies are introduced to control for these effects.

The maximum value of the unemployment rate in the panel is 22.367 percent and is observed in Prince Edward Island (PEI) in the first quarter of 1992. The minimum value is 3.133 percent and is recorded in Alberta in the fourth quarter of 2006. The Maritime provinces exhibit much greater seasonal variation and tend to have unemployment rates at the upper end of the total sample, between 12 and 23 percent.[9] Saskatchewan and Manitoba, on the other hand, tend to have unemployment rates at the lower end of the total sample, between 3 and 11 percent. Ontario and Quebec unemployment rates fluctuate between the two previous groups and closely track the national rate, ranging between 5 and 16 percent. B.C.'s and Alberta's unemployment rates vary between 3 and 15 percent, with Alberta's unemployment rate staying

[8] Statistics Canada did not collect unemployment data for the territories prior to 1992; therefore Yukon, the Northwest Territories, and Nunavut cannot be included in the empirical analysis. (Also Nunavut wasn't a territory in 1992).

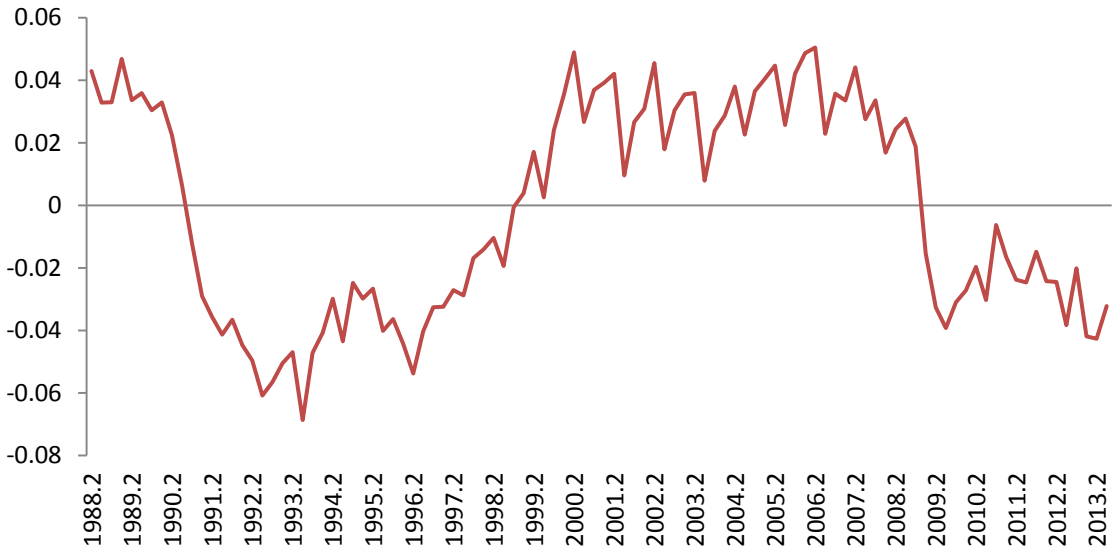
[9] Please refer to Appendix, Figure A.2 for illustration.

consistently one to two percentage points below B.C.'s. Differences in magnitudes of the provincial unemployment rates suggest that there may be province-specific fixed effects in the panel. The mean value of the unemployment rates for all provinces in the sample is 9.326 percent. The standard deviation is 3.816 percent and is roughly a third of the mean, suggesting a moderate distribution of values.

6.3.2. Cyclical factors

Demand shocks (AD_t) are represented by the national quarterly GDP, purged of trend and seasonal variations to control for changes in the business cycle. Figure 8 illustrates that during the sample period, the national labour market went through two complete business cycles, from peak to trough. The lowest value of the output gap is observed in the third quarter of 1993 and the highest is in the second quarter of 2006. Because GDP is detrended, the mean value is close to zero. The standard deviation is 0.034 (Table 1). Aggregate demand is expected to have a negative impact on the rate of unemployment.

Figure 8 Aggregate demand fluctuations



The real price of oil ($Poil_t$) is measured using free market commodity prices per barrel, average of U.K. Brent, Dubai, and Texas crude prices, converted from U.S. to Canadian dollars and adjusted for inflation. The price of oil coefficient is made province-

specific by creating interaction terms between provincial dummies (D_j) and the real price of oil. Because of oil production in Western Canada and new developments in Newfoundland, the price of oil is expected to have a negative relationship with the rate of unemployment in Alberta, B.C., and Newfoundland, and a positive relationship elsewhere (Gross and Schmitt, 2012). The lowest real price of oil is observed in 1991Q1 at $22.66 per barrel, and the highest at $116.38 in 2008Q2. The standard deviation is $25.129 and is roughly half the mean value ($52.078), pointing to a wide distribution.

The real rate of interest ($Intr_t$) is measured by the prime business rate administered by chartered banks. The rate has fluctuated between 14.8 percent in 1990Q2 and 2.25 percent for the period of 2009Q2–2010Q1. The maximum value is observed at a time when the Bank of Canada maintained a tight monetary policy to target inflation. The minimum value was observed following the 2008 recession when the bank instituted accommodative policy to help support the economic recovery. The standard deviation of 3.0 percent is half the size of the mean (6.2 percent), indicating a wide distribution. The real rate of interest is expected to have industry-specific effects depending on whether or not it is a complement or a substitute to labour. Therefore, the net effect can be either positive or negative.

6.3.3. Frictional factors

To control for frictional factors, I first use a measure of the generosity of EI benefits ($Eiben_{j,t}$) calculated as the maximum length of benefits for an individual with a minimum qualifying requirement (Day and Winer, 2001). The measure is calculated separately for each province based on the average provincial unemployment rate in each year. The highest number of benefit weeks is 40 and is observed in Newfoundland, PEI, and New Brunswick from 1988 to 1989. The lowest number of benefit weeks is 14 and is in place in Ontario in 2000, Manitoba in 1998 to 2013, Saskatchewan in 1997 to 2013, Alberta in 1997 to 2013, and B.C. in 2005 to 2008.[10] The standard deviation is 7.4 weeks and the mean is 22.3 weeks, pointing to a moderate variation in values. This

[10] In line with common critiques of EI benefits, the measure shows that workers in the Maritime provinces receive a longer duration of benefits, compared with the Prairie and Western provinces (McPherson and Flores, 2012; Myatt, 1992).

measure of EI benefits is expected to have a positive impact on the rate of unemployment. As the duration of benefits increases, unemployment increases.

Second, the provincial real minimum wage rates ($Minw_{j,t}$) control the legal constraints affecting the provincial labour markets. The rates are measured in dollars per hour based on the legislated minimum wages in each province, adjusted for inflation. Despite its growth in nominal values, the real minimum wage has fluctuated only slightly. The highest real wage of $8.84 is recorded in Ontario in the second quarter of 2010, and the lowest of $5.07 is recorded in Newfoundland in the first quarter of 1991. The standard deviation is quite low at $0.84 and the mean is $6.64. At one-seventh of the mean, the standard deviation of the real minimum wage indicates that the spread is quite narrow. The minimum wage is expected to have a positive impact on the unemployment rate.

Lastly, two supply measures control for demographic changes in the labour market. Starting with the participation rate of older workers ($Opart_{j,t}$), the lowest rate is 14.1 percent and is recorded in Newfoundland in the first quarter of 1997. The highest participation rate is in Alberta in the third quarter of 2013 at 48.4 percent. The standard deviation is roughly one-quarter of the mean, indicating a slightly narrow distribution. When older workers are unemployed, they tend to be unemployed for longer periods of time. Therefore, an increase in the participation rate of older workers can have a positive impact on the rate of unemployment. At the same time, older workers tend to have lower incidence of unemployment. Therefore, the impact on unemployment depends on which effect dominates the panel data.

The participation rate of women ($Wpart_{j,t}$) has increased dramatically since the 1970s. The lowest rate is 43.9 percent and is recorded in the first quarter of 1989 in Newfoundland. The highest rate is 68.6 percent and is recorded in the second quarter of 2009 in Alberta. The standard deviation is roughly one-twelfth the size of the mean, pointing to a very narrow distribution. Because women have a higher likelihood to be unemployed, an increase in women's participation rate has a positive impact on the rate of unemployment.

6.3.4. Structural factors

To measure the impact of structural change on provincial unemployment, I construct a modified Lilien's index (Lilien, 1982). The index captures structural adjustments between industries by measuring dispersion in industry employment growth, such that,

$$\sigma = \left[\sum_{i=1}^{n} \frac{x_{i,t}}{X_t} \left(\Delta \log x_{i,t} - \Delta \log X_t \right)^2 \right]^{1/2}, \qquad (2)$$

where $x_{i,t}$ is employment in industry "*i*" and X_t is the level of aggregate employment in Canada (Gross, 1989). Therefore, structural changes, represented by the index, show the impact of industry employment variance on provincial unemployment rates. Because industries differ in their cyclical sensitivities, the index may also capture cyclical effects (Abraham and Katz, 1986). Therefore, it is important to use a measure of structural change that has been purged of cyclical effects (for examples see Gross, 1988, 1992; Myatt, 1996). Therefore, the index is computed with de-cyclicalized industrial employment.

Existing Canadian studies (Altonji and Ham, 1990; Neelin, 1987; Samson, 1985) construct structural change indices with eight to eleven broad industrial sectors.[11] The classification of sectors is important because the index may not detect employment changes concealed within the broad industry groupings. For example, employment growth in one industry can be offset by declines in another if both industries are within the same group. As a result, employment variance remains unchanged at the sectoral level. Therefore, the chosen sectors have to group industries that are likely to react to exogenous shocks in similar ways.

As of 1997, Statistics Canada offers employment information based on the North American Industry Classification System (NAICS), which aggregates the mining, quarrying, oil and gas employment with employment in agriculture, forestry, and fishing. Because Canada is a major energy and mining exporter, this aggregation may conceal

[11] Similarly, studies in the U.S. and Europe analyze variance using approximately the same number of broad sectors (Gross, 1992, 1989; Lilien, 1982).

important employment developments in the natural resource sector. Disaggregated data for the extractive sector is not available until 1987. Due to the considerable influence of the energy sector within the Canadian economy, it is important to construct an index sensitive to these employment changes. Therefore, the total sample is constrained based on the availability of this employment data to 1988Q2 to 2013Q3.[12] Because data for all other variables is available earlier, whenever lags are introduced in the model, the sample size does not change.

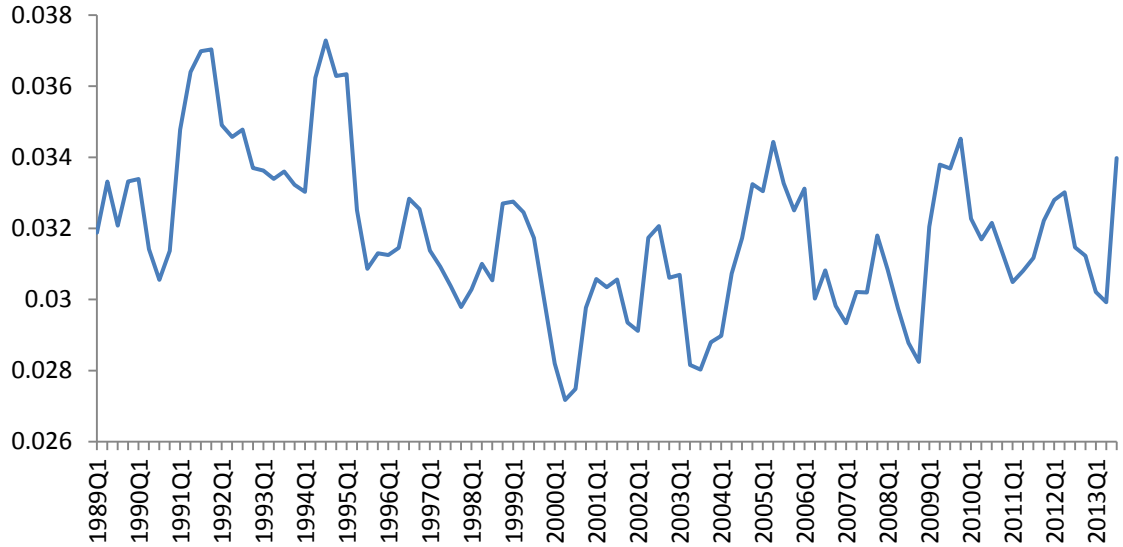
I chose to measure the Lilien index at the national level for two reasons. First, because the Canadian provinces specialize according to specific industries, structural change happens at the national level in Canada. Second, interacting the national variable with provincial dummies (D_j), allows the model to reveal a specific impact of structural change in each province. In accordance with previous Canadian studies, the ten broad sectors used in the construction of the Lilien index are:

1. Agriculture, forestry, fishing
2. Mining, quarrying, oil and gas
3. Construction and utilities
4. Manufacturing
5. Trade
6. Transportation and warehousing
7. Finance and insurance
8. Professional, scientific, and technical services
9. Government services, educational services, and health care
10. Other services

The lowest value of employment variance is observed in the first quarter of 2008, while the highest is in the second quarter of 1994. The standard deviation for the index is one-sixteenth of the mean, indicating that the spread is quite narrow. The expected sign for the index is positive. As structural change increases, the unemployment rate increases. Figure 9 presents the Lilien index. Because the index is sensitive to seasonal changes in employment, I graph the four-quarter moving average for illustration.

[12] Data is available from 1987Q1, but four quarters are lost when the sector employment data is purged of aggregate demand fluctuations. An additional observation is lost in the calculation of the index because employment data in the previous quarter is required to compute the variance. See Appendix B for details.

Figure 9 The Lilien index of structural change (moving average)



In order to isolate the impact of the 2008 recession on structural unemployment, I introduce a dummy variable (*D2008*) for the period following the recession (2008Q4 to 2013Q3). The dummy values follow the recession period by one quarter because the current model lags by one period. I create an interaction term between the Lilien index ($Lilien_t$) and the recession dummy (*D2008*), and make the effect province-specific (using D_j, Ontario as the reference). To summarize, the basic empirical specification for a fixed effects model is:

$$\begin{aligned} UR_{j,t} = {} & c_j + \beta_1 AD_{t-1} + \beta_2 Intr_{t-1} + \beta_3 \ln Poil_{t-1} + \sum_{j=1}^{9} \beta_{4,j} \ln Poil_{t-1} * D_j + \beta_5 Eiben_{j,t-1} \\ & + \beta_6 Minw_{j,t-1} + \beta_7 Lilien_t + \sum_{j=1}^{9} \beta_{8,j} Lilien * D_j + \beta_9 Lilien * D2008 \\ & + \sum_{j=1}^{9} \beta_{10,j} Lilien * D2008 * D_j + \beta_{11} Wpart_{j,t-1} + \beta_{12} Opart_{j,t-1} + \beta_{13} Seas1 \\ & + \beta_{14} Seas2 + \beta_{15} Seas3 + \varepsilon_{j,t}. \end{aligned} \tag{3}$$

To examine the possible presence of multicollinearity, I produce a table of simple correlation (Table 3). The highest simple correlation coefficients are between the participation rate of women and EI benefits (0.707), and the participation rate of women and the participation rate of older workers (0.686). The coefficients are not extremely high, but may lead to some collinearity. In the next section, I estimate the model and perform several robustness tests.

Table 1 Descriptive statistics of the explanatory variables

Variable	Mean	Min	Max	SD
AD_t	-0.002	-0.069	0.051	0.034
$Intr_t$	0.062	0.023	0.148	0.030
$Poil_t$	52.078	22.664	116.376	25.129
$Eiben_{j,t}$	22.289	14	40	7.413
$Minw_{j,t}$	6.640	5.068	8.839	0.843
$Lilien_t$	0.032	0.024	0.044	0.005
$Wpart_{j,t}$	0.591	0.439	0.686	0.048
$Opart_{j,t}$	0.284	0.141	0.484	0.070

Table 2 Summary of hypothesis tests

Name	Description	Hypothesis
AD_t	National GDP, purged of trend	H_0: $\beta_1 \geq 0$, H_A: $\beta_1 < 0$
$Intr_t$	Real rate of interest	H_0: $\beta_2 = 0$, H_A: $\beta_2 \neq 0$
$Poil_t$	Real price of oil in Canadian dollars, negative in Alberta, B.C., and Newfoundland, positive elsewhere	H_0: $\beta_3 \leq 0$, H_A: $\beta_3 > 0$, H_0: $\beta_3 \geq 0$, H_A: $\beta_3 < 0$
$Eiben_{j,t}$	Length of EI benefits	H_0: $\beta_4 \leq 0$, H_A: $\beta_4 > 0$
$Minw_{j,t}$	Provincial real minimum wage rates	H_0: $\beta_5 \leq 0$, H_A: $\beta_5 > 0$
$Lilien_{j,t}$	Lilien index of structural change	H_0: $\beta_6 \leq 0$, H_A: $\beta_6 > 0$
$Wpart_{j,t}$	Participation rate of women	H_0: $\beta_7 \leq 0$, H_A: $\beta_7 > 0$
$Opart_{j,t}$	Participation rate of older workers (55+)	H_0: $\beta_8 = 0$, H_A: $\beta_8 \neq 0$

Table 3 Simple correlation coefficients

	AD_t	$Eiben_{j,t}$	$Lilien_t$	$Poil_t$	$Opart_{j,t}$	$Wpart_{j,t}$	$Intr_t$	$Minw_{j,t}$
AD_t	**1**							
$Eiben_{j,t}$	-0.146	**1**						
$Lilien_t$	-0.179	-0.026	**1**					
$Poil_t$	0.111	-0.153	0.222	**1**				
$Opart_{j,t}$	0.040	-0.567	0.166	0.549	**1**			
$Wpart_{j,t}$	0.034	**-0.707**	0.016	0.004	**0.686**	**1**		
$Intr_t$	0.148	0.570	-0.036	3.4 e-05	-0.319	-0.596	**1**	
$Minw_{j,t}$	-0.105	-0.447	0.195	0.550	0.560	0.234	-0.240	**1**

7. Estimation

I begin by testing if the series is non-stationary. The Levin, Lin, and Chu, and the Breitung t-stat tests assume common unit root processes for all panels and reject the presence of a unit root at less than five and one percent, respectively. The next three tests assume individual unit root processes for each panel: Im, Pesaran and Shin; ADF-Fisher Chi-square; and PP-Fisher Chi-square. All three tests reject the presence of a unit root at less than one percent significance level. Therefore, I conclude that the series is stationary and there is no spurious correlation. Because there is no strong evidence of a unit root, I can estimate the model in levels. The results are presented in Table 4.

First, I run the basic model using Ordinary Least Squares (OLS) (Table 4, column 1). All the independent variables are lagged one quarter to enable their impacts to take effect. Using non-contemporaneous variables also limits potential endogeneity for the two supply variables, which are measured using labour force participation rates. The OLS results in Table 4, column 1 demonstrate that not all of the significant coefficients have the expected signs. One reason may be that there are time-invariant factors that are not taken into account. Therefore, I compare the OLS model with a province-specific fixed effects model in Table 4, column 2. The fixed effects model enables the provincial intercepts to vary and can therefore control unobserved differences between provinces such as lifestyle, industry mix, and culture. The Hausman fixed effects test confirms that significant differences exist between provinces that need to be taken into account.[13] The results show that specific amenities, such as cultural environment or climate, which exist in different provinces, do indeed matter.

[13] The Hausman test F-statistic is 5.203 with a p-value of less than one percent; thus, I reject the null hypothesis of equal intercepts at less than one percent level of significance.

Table 4 Provincial unemployment: Alternative methodologies

	1	2	3	4	5	6	7	8
	OLS	Fixed Effects	White Period	White Cross.	Fixed Effects	White Per.(9)	White Cros.(9)	Unemp 4 lags
ad(-1)	-0.126*** (9.129)	-0.121*** (8.861)	-0.121*** (4.353)	-0.121*** (4.516)	-0.097*** (8.448)	-0.097*** (5.723)	-0.097*** (4.252)	-0.060*** (5.307)
ln(poil(-1))	0.007*** (3.313)	0.013*** (3.889)	0.013*** (8.035)	0.013*** (3.648)	0.011*** (4.271)	0.011*** (8.865)	0.011*** (3.467)	0.009*** (3.844)
ln(poil(-1))*dnl	-0.004* (1.748)	-0.011** (2.419)	-0.011*** (4.210)	-0.011*** (2.504)	-0.010*** (2.779)	-0.010*** (4.249)	-0.010*** (2.493)	-0.009*** (2.934)
ln(poil(-1))*dpe	-0.007*** (3.560)	-0.007* (1.670)	-0.007*** (3.059)	-0.007 (1.228)	—	—	—	—
ln(poil(-1))*dns	-0.004* (1.903)	-0.004 (0.918)	-0.004** (1.828)	-0.004* (1.640)	-0.003 (0.917)	-0.003 (1.524)	-0.003 (1.421)	-0.003 (0.914)
ln(poil(-1))*dnb	-0.001 (0.350)	0.002 (0.464)	0.002 (1.073)	0.002 (0.547)	0.002 (0.656)	0.002 (1.263)	0.002 (0.689)	0.001 (0.216)
ln(poil(-1))*dqc	-0.005** (2.229)	-0.005 (1.196)	-0.005*** (3.019)	-0.005** (2.076)	-0.004 (1.148)	-0.004*** (2.789)	-0.004** (1.819)	-0.005 (1.527)
ln(poil(-1))*dmb	-0.004** (2.093)	-0.009** (2.039)	-0.009*** (4.149)	-0.009*** (4.043)	-0.009*** (2.625)	-0.009*** (3.983)	-0.009*** (4.839)	-0.004 (1.429)
ln(poil(-1))*dsk	-0.004* (1.772)	-0.008* (1.834)	-0.008*** (7.299)	-0.008*** (3.173)	-0.008** (2.321)	-0.008*** (7.258)	-0.008*** (3.597)	-0.007** (2.202)
ln(poil(-1))*dab	-0.004** (2.106)	-0.020*** (4.636)	-0.020*** (15.457)	-0.020*** (11.19)	-0.021*** (6.274)	-0.021*** (36.952)	-0.021*** (11.975)	-0.010*** (3.394)
ln(poil(-1))*dbc	-0.005** (2.414)	-0.020*** (4.585)	-0.020*** (14.530)	-0.020*** (8.408)	-0.020*** (5.892)	-0.020*** (12.689)	-0.020*** (9.034)	-0.009*** (3.155)
primert(-1)/100	-0.165*** (8.523)	-0.176*** (9.083)	-0.176*** (6.063)	-0.176*** (4.924)	-0.197*** (12.125)	-0.197*** (8.808)	-0.197*** (6.438)	-0.085*** (5.411)
ln(rlminwage(-1))	0.012* (1.699)	0.011 (0.007)	0.011 (0.901)	0.011 (1.382)	0.011* (1.889)	0.011 (0.811)	0.011 (1.619)	-0.001 (0.095)
ln(eiben(-1))	0.037*** (15.359)	0.037*** (15.564)	0.037*** (15.073)	0.037*** (10.499)	0.038*** (19.773)	0.038*** (18.139)	0.038*** (12.489)	0.025*** (11.442)

	1	2	3	4	5	6	7	8
	OLS	Fixed Effects	White Period	White Cross.	Fixed Effects	White Per.(9)	White Cros.(9)	Unemp 4 lags
lilien(-1)	0.308* (1.790)	0.592* (2.638)	0.592*** (3.352)	0.592*** (3.352)	0.741*** (4.154)	0.741*** (9.083)	0.741*** (4.136)	0.639*** (4.191)
lilien(-1)*dnl	1.793*** (7.298)	1.254*** (3.932)	1.254*** (4.366)	1.254*** (4.941)	1.001*** (3.946)	1.001*** (6.574)	1.001*** (4.361)	0.597*** (2.708)
lilien(-1)*dpe	2.266*** (9.690)	2.167*** (6.976)	2.167*** (46.267)	2.167*** (4.453)	—	—	—	—
lilien(-1)*dns	0.517** (2.182)	0.445 (1.399)	0.445*** (2.597)	0.445** (2.250)	0.397 (1.567)	0.397*** (2.488)	0.397** (2.097)	0.226 (1.040)
lilien(-1)*dnb	0.273 (1.140)	0.356 (1.115)	0.356 (0.902)	0.356 (1.121)	-0.002 (0.007)	-0.002 (0.010)	-0.002 (0.006)	-0.032 (0.145)
lilien(-1)*dqc	0.587** (2.498)	0.454 (1.424)	0.454* (1.641)	0.454*** (2.919)	0.207 (0.816)	0.207 (1.509)	0.207 (1.456)	-0.035 (0.162)
lilien(-1)*dmb	0.181 (0.772)	-0.098 (0.306)	-0.098 (0.559)	-0.098 (0.664)	-0.153 (0.603)	-0.153 (0.943)	-0.153 (1.101)	-0.184 (0.855)
lilien(-1)*dsk	0.165 (0.699)	-0.102 (0.320)	-0.102 (0.266)	-0.102 (0.527)	-0.447* (1.758)	-0.447*** (2.599)	-0.447*** (2.572)	-0.338 (1.558)
lilien(-1)*dab	0.689*** (2.967)	-0.195 (0.611)	-0.195 (0.707)	-0.195 (1.287)	-0.442* (1.744)	-0.442*** (3.300)	-0.442*** (2.634)	-0.380* (1.762)
lilien(-1)*dbc	0.431* (1.886)	-0.410 (1.325)	-0.410*** (19.635)	-0.410*** (3.004)	-0.397 (1.619)	-0.397*** (21.123)	-0.397*** (3.042)	-0.382* (1.823)
lilien(-1)*d2008	0.043 (0.440)	-0.088 (0.765)	-0.088 (1.505)	-0.088 (0.632)	-0.116 (1.264)	-0.116** (1.987)	-0.116 (0.913)	-0.009 (0.112)
lilien(-1)*d2008*dnl	-0.663*** (5.010)	-0.441*** (2.913)	-0.441*** (7.699)	-0.441*** (3.124)	-0.415*** (3.448)	-0.415*** (7.423)	-0.415*** (3.237)	-0.185* (1.773)
lilien(-1)*d2008*dpe	-0.293** (2.355)	-0.269* (1.796)	-0.269*** (28.305)	-0.269 (1.450)	—	—	—	—
lilien(-1)*d2008*dns	-0.031 (0.239)	0.017 (0.116)	0.017 (0.587)	0.017 (0.190)	0.027 (0.223)	0.027 (0.998)	0.027 (0.322)	0.040 (0.392)

	1	2	3	4	5	6	7	8
	OLS	**Fixed Effects**	**White Period**	**White Cross.**	**Fixed Effects**	**White Per.(9)**	**White Cros.(9)**	**Unemp 4 lags**
iilien(-1)*d2008*dnb	-0.122 (0.962)	-0.147 (0.982)	-0.147*** (4.689)	-0.147 (1.202)	-0.126 (1.062)	-0.126*** (5.294)	-0.126 (1.165)	-0.019 (0.186)
iilien(-1)*d2008*dqc	-0.286** (2.265)	-0.226 (1.499)	-0.226*** (6.479)	-0.226*** (2.863)	-0.194 (1.620)	-0.194*** (8.352)	-0.194*** (2.796)	-0.112 (1.094)
iilien(-1)*d2008*dmb	-0.111 (0.896)	0.013 (0.088)	0.013 (0.857)	0.013 (0.151)	0.020 (0.165)	0.020 (1.442)	0.020 (0.246)	0.051 (0.501)
iilien(-1)*d2008*dsk	-0.238* (1.918)	-0.103 (0.684)	-0.103*** (2.837)	-0.103 (1.221)	-0.074 (0.620)	-0.074*** (3.346)	-0.074 (0.991)	-0.031 (0.302)
iilien(-1)*d2008*dab	-0.054 (0.435)	0.309** (2.066)	0.309*** (15.745)	0.309*** (5.156)	0.322*** (2.714)	0.322*** (20.265)	0.322*** (5.059)	0.232** (2.288)
iilien(-1)*d2008*dbc	-0.084 (0.668)	0.267* (1.731)	0.267*** (4.162)	0.267*** (2.800)	0.278** (2.265)	0.278*** (3.932)	0.278*** (3.056)	0.196* (1.876)
parto(-1)/100	-0.121*** (5.752)	-0.116*** (5.396)	-0.116*** (4.023)	-0.116*** (3.793)	-0.086*** (4.585)	-0.086*** (3.922)	-0.086*** (3.090)	-0.083*** (4.921)
partw(-1)/100	-0.190*** (7.719)	-0.229*** (8.430)	-0.229*** (5.131)	-0.229*** (5.642)	-0.276*** (11.173)	-0.276*** (10.671)	-0.276*** (7.505)	-0.047* (1.863)
unemp(-1)	—	—	—	—	—	—	—	0.283*** (9.375)
unemp(-2)	—	—	—	—	—	—	—	-0.161*** (5.668)
unemp(-3)	—	—	—	—	—	—	—	0.010 (0.322)
unemp(-4)	—	—	—	—	—	—	—	0.353*** (12.221)
Observations	1010	1010	1010	1010	909	909	909	909
Adjusted R²	0.925	0.928	0.928	0.928	0.950	0.950	0.950	0.964
Log likelihood	3194.1	3218.1	3218.1	3218.1	3107.5	3107.5	3107.5	3255.7

Notes: Absolute t-values in parentheses. *, **, *** coefficients significant at 10, 5, and 1 percent, respectively. All estimations include fixed effects except for column 1.

Next, I evaluate the validity of the results by correcting for possible statistical shortcomings. I test for serial correlation in the error terms of the fixed effect estimation by running a lagged error term test (first order). The test indicates the presence of serial correlation in the panel data at less than one percent level of significance.[14] To correct for serial correlation, I use the White period coefficient covariance method, reproduced in Table 4, column 3. While serial correlation typically biases the estimates of the standard errors by underestimating their size, in panel data, a correction can occur in either direction. Therefore, I examine the results for large changes in the magnitude of t-values that alter the significance of the coefficients. Consistent with the presence of serial correlation, the coefficients of the following variables become highly significant: the price of oil in Nova Scotia, the price of oil in Quebec, the Lilien index in Nova Scotia, the Lilien index in B.C., and the interaction terms between the Lilien index and the 2008 recession in Quebec and Saskatchewan.

I also investigate whether there is potential heteroskedasticity. The results of the White cross-section covariance method are given in column 4. Because there is no test for heteroskedasticity within panel data, I compare the magnitude of the correction using the White period covariance method against the original fixed effects estimation in column 2. The White cross-section covariance method makes a significant correction in the standard errors for the coefficients of the price of oil in Quebec, the Lilien index in Nova Scotia, Quebec, and B.C., as well as the interaction term between the Lilien index and the 2008 recession in Quebec. Therefore, heteroskedasticity is likely present in the panel data. One possible source of variance in the error terms could come from province-specific effects not captured by the model. I graph the error terms of the fixed effects estimation to identify a potential source of heteroskedasticity.[15] PEI shows much higher variance in the error terms compared with the other provinces. Since PEI has a small population, the unemployment rate tends to fluctuate more, producing high

[14] I estimate the following specification: $\varepsilon_t = c + \rho\varepsilon_{t-1} + \mu_t$ (Studenmund, 2006). The null hypothesis is that there is no serial correlation and ρ equals zero. The test results show that ρ is positive and significant at less than one percent with a t-statistic of 8.140. Therefore, I reject the null hypothesis and conclude that there is serial correlation in the panel data.

[15] Figure A.3 in Appendix A presents the graph of the error terms.

variance not captured by the explanatory variables. Therefore, I omit PEI from the panel and estimate the fixed effects model using nine provinces (column 5).

I test for serial correlation once again by conducting the lagged error test and conclude that there is still serial correlation at less than one percent significance level.[16] Therefore, I run the estimation using White period robust standard errors (Table 4, column 6). The results strengthen the significance level of several province-specific coefficients, including the price of oil in Quebec, the Lilien index in Nova Scotia, and the interaction term between the Lilien index and the 2008 recession in Quebec.

Next, I run the estimation using the White cross-section covariance method to test if heteroskedasticity is still present in the panel with nine provinces (Table 4, column 7). The correction using White cross-section standard errors still indicates the presence of some heteroskedasticity. The method creates a similar correction to the White period covariance method in column 6 by strengthening the significance level of several coefficients. In addition, the coefficient for the real minimum wage collapses as a result of both corrections. The White period covariance method, however, corrects the significance level of three additional coefficients, compared to the White cross-section method. Specifically, the coefficient for the interaction term between the Lilien index and the 2008 recession dummy, and its province-specific effects in New Brunswick and Saskatchewan become highly significant. Therefore, the White period method produces a more substantial correction of the error terms. Moreover, the estimation using the White cross-section covariance method indicates a strong presence of serial correlation.[17] Because in time series data, serial correlation can potentially bias the estimation results more than heteroskedasticity, these test results further support the selection of the White period covariance method.

A likely source of serial correlation in unemployment studies is the impact of lagged effects of unemployment. As a result, many studies control for lagged effects by

[16] The lagged error term test indicates the presence of serial correlation based on a positive and significant ρ coefficient, with a t-statistic of 11.374 and an associated p-value of less than one percent.

[17] The lagged error term is positive and significant with an associated t-statistic of 11.374 and a p-value of less than one percent.

creating a dynamic model with lagged dependent variables included as explanatory variables (Neelin, 1987). Table 4, column 8 shows an estimation using four lags of the dependent variable. In theory, the impact of lagged effects of unemployment is positive and significant with diminishing effects over time. The estimation results, however, indicate that the second lag of the dependent variable has a negative sign, while the coefficient for the third lag is small in magnitude and has a low t-value. These results illustrate a likely presence of multicollinearity. In addition, the lagged error term test indicates that the dynamic model does not correct the presence of serial correlation.[18] Therefore, I discard the dynamic model and retain the results using the White period standard errors as the preferred specification (Table 4, column 6).

Using one of the White covariance methods allows me to correct the standard errors for either serial correlation or heteroskedasticity, but not both. This means that heteroskedasticity is still present in the preferred estimation. Based on the graph of the error terms (Figure A3 in Appendix A), the remaining variance could come from Newfoundland. Newfoundland represents a significant portion of the Canadian economy; therefore, I retain it in the panel. There are likely additional variables that could capture the high variance of the error terms. Due to time constraints, however, I retain the current results and use caution when interpreting coefficients that are only marginally significant.

Lastly, I test for robustness to changes in measures of two variables, the generosity of EI benefits and the real interest rate (Table 5). First, I substitute the measure of the length of EI benefits ($Eiben_{j,t}$) with a measure of the length of the qualifying period for EI ($Eiqual_{j,t}$) (column 2). The new measure is expected to have a negative sign because when the qualification period increases, the unemployment rate decreases. Second, I substitute the prime rate ($Primert_t$) with the long-term government bond rate ($Govbondrt_t$) (column 3). The new measure is expected to have the same, negative sign as the prime rate.

[18] The lagged error term is positive and significant, with a t-statistic of 7.392 and an associated p-value of less than one percent. Therefore, the model with four lags does not correct for serial correlation. Neelin (1987) suggests that a common number of lagged effects to include in a dynamic model analyzing unemployment is two years or eight lags, using quarterly data. A model with eight lags, however, does not correct serial correlation based on a lagged error term test with a t-statistic of 2.509 and an associated p-value of 0.012. In addition, the estimation using eight lags indicates heavy multicollinearity.

Table 5 Provincial unemployment: Alternative measures

	1	2	3
	White Period SE	**EI Qualifying Period**	**Gov't Bond Rate**
ad(-1)	-0.097***	-0.219***	-0.135***
	(5.723)	(8.231)	(7.427)
ln(poil(-1))	0.011***	0.009***	0.011***
	(8.865)	(7.317)	(8.464)
ln(poil(-1))*dnl	-0.010***	-0.008***	-0.010***
	(4.249)	(3.106)	(3.433)
ln(poil(-1))*dns	-0.003	-0.001	-0.002
	(1.524)	(0.627)	(0.867)
ln(poil(-1))*dnb	0.002	0.003*	0.003
	(1.263)	(1.679)	(1.363)
ln(poil(-1))*dqc	-0.004***	-0.002**	-0.004**
	(2.789)	(1.844)	(2.034)
ln(poil(-1))*dmb	-0.009***	-0.008***	-0.008***
	(3.983)	(3.615)	(2.987)
ln(poil(-1))*dsk	-0.008***	-0.005***	-0.008***
	(7.258)	(5.574)	(6.850)
ln(poil(-1))*dab	-0.021***	-0.022***	-0.020***
	(36.952)	(26.914)	(29.388)
ln(poil(-1))*dbc	-0.020***	-0.020***	-0.018***
	(12.689)	(15.016)	(9.905)
primert(-1)/100	-0.197***	-0.069***	—
	(8.808)	(2.558)	
ln(rlminwage(-1))	0.011	-0.010	0.004
	(0.811)	(0.756)	(0.275)
ln(eiben(-1))	0.038***	—	0.041***
	(18.139)		(19.325)
lilien(-1)	0.741***	0.869***	0.751***
	(9.083)	(12.059)	(9.756)
lilien(-1)*dnl	1.001***	0.798***	0.990***
	(6.574)	(4.622)	(6.237)
lilien(-1)*dns	0.397***	0.327**	0.390***
	(2.488)	(2.151)	(2.490)
lilien(-1)*dnb	-0.002	-0.041	0.003
	(0.010)	(0.239)	(0.019)
lilien(-1)*dqc	0.207	0.138	0.203
	(1.509)	(0.889)	(1.426)
lilien(-1)*dmb	-0.153	-0.150	-0.161
	(0.943)	(0.951)	(1.017)
lilien(-1)*dsk	-0.447***	-0.498***	-0.453***
	(2.599)	(2.892)	(2.665)

	1 White Period SE	2 EI Qualifying Period	3 Gov't Bond Rate
lilien(-1)*dab	-0.442*** (3.300)	-0.469*** (3.112)	-0.447*** (3.212)
lilien(-1)*dbc	-0.397*** (21.123)	-0.440*** (17.106)	-0.409*** (21.437)
lilien(-1)*d2008	-0.116** (1.987)	0.027 (0.270)	-0.153*** (3.316)
lilien(-1)*d2008*dnl	-0.415*** (7.423)	-0.515*** (11.051)	-0.365*** (5.233)
lilien(-1)*d2008*dns	0.027 (0.998)	-0.039 (1.200)	0.058 (1.623)
lilien(-1)*d2008*dnb	-0.126*** (5.294)	-0.192*** (7.703)	-0.099*** (3.338)
lilien(-1)*d2008*dqc	-0.194*** (8.352)	-0.323*** (9.786)	-0.202*** (8.831)
lilien(-1)*d2008*dmb	0.020 (1.442)	-0.051*** (2.697)	0.041*** (3.055)
lilien(-1)*d2008*dsk	-0.074*** (3.346)	-0.157*** (5.508)	-0.051* (1.815)
lilien(-1)*d2008*dab	0.322*** (20.265)	0.272*** (16.449)	0.340*** (17.633)
lilien(-1)*d2008*dbc	0.278*** (3.932)	0.136* (1.911)	0.243*** (3.102)
parto(-1)/100	-0.086*** (3.922)	-0.064*** (2.385)	-0.118*** (5.455)
partw(-1)/100	-0.276*** (10.671)	-0.278*** (9.851)	-0.257*** (7.837)
ln(eiqual(-1))	—	-0.040*** (7.959)	—
govbondrt(-1)/100	—	—	-0.308*** (5.853)
Observations	909	909	909
Adjusted R^2	0.950	0.935	0.948
Log likelihood	3107.5	2986.4	3087.5

Notes: Absolute t-values in parentheses. *, **, *** coefficients significant at 10, 5, and 1 percent, respectively. All estimations include fixed effects except for column 1.

Column 1 of Table 5 presents my chosen specification from Table 4, column 6. Overall, the results for both estimations using alternative measures remain stable (columns 2 and 3). The two measures are significant with the expected signs. Using the qualifying period for EI instead of the benefit duration, however, changes the magnitude and significance of several coefficients. The impact of the interaction term between the Lilien index and the 2008 recession becomes positive and collapses in significance. At the same time, the impact of the interaction term between the Lilien index and the 2008 recession in Manitoba becomes negative and highly significant. These results indicate a likely presence of multicollinearity between the new EI measure and the 2008 recession dummy, because the EI qualifying period for Manitoba remains unchanged between 1998 and 2013.

Using the government bond rate as the measure for the real rate of interest demonstrates stable results. Compared with the preferred estimation, only the coefficient for the interaction term between the Lilien index and the 2008 recession in Manitoba changes, and becomes highly significant at less than one percent. Overall, all coefficients retain the expected signs and there are few changes in significance levels. Nonetheless, the original model (Table 5, column 1) performs better in terms of explanatory power because its adjusted R^2 is highest at 0.950. Therefore, the original model remains as the preferred specification.

7.1. Results and discussion

Table 4, column 6 presents the final estimation. All three cyclical factors, the aggregate demand, the interest rate, and the price of oil have the expected signs and significantly affect provincial unemployment rates. For every one percent increase in aggregate demand, the unemployment rate decreases by 0.97 percentage points, holding everything else constant. The impact of the real interest rate is negative and significant at less than one percent, indicating that in Canada, capital is used primarily as a substitute for labour. For every one percent increase in the rate of interest, unemployment decreases by 0.197 percentage points.

The price of oil is also highly significant and has province-specific effects. For every one percent increase in the price of oil, the unemployment rate rises by 0.11 percentage points in Ontario, Nova Scotia, and New Brunswick. Using the Wald test, I interpret other significant province-specific impacts. The results indicate that the total impact of the price of oil is not significantly different from zero in Newfoundland and Manitoba. The expected sign in Newfoundland is negative due to oil production in the region; however, based on the estimation results, the effect of oil developments is not large enough to create a net negative impact on unemployment over the sample period. The impact in Quebec is positive and significant at less than one percent. For every one percent increase in the price of oil, the unemployment rate in Quebec increases by 0.07 percentage points. The impact in Saskatchewan is 0.03 percentage points; however, the significance level is lower at less than ten percent. Lastly, the impacts in Alberta and B.C. are negative and significant at less than one percent, consistent with the province-specific hypothesis tests outlined in Table 2. The Wald test also indicates that the magnitude of the two provincial effects is not statistically different. Therefore, for every one percent increase in the price of oil, the unemployment rates in Alberta and B.C. decrease by 0.1 percentage points.

Next, I discuss the impact of the two institutional variables. The impact of the real minimum wage on the unemployment rate is positive but not significant. Therefore, the provincial level of minimum wage does not appear to affect the unemployment rate over the sample period. The impact of EI benefits is positive and significant at less than one percent. The coefficient remains stable and highly significant across all the alternative

estimations, indicating that these results are extremely robust. Moreover, even when the length of EI benefits is replaced by a measure indicating the length of the qualifying period, the variable remains highly significant and shows a negative, expected sign. Therefore, consistent with previous studies (Fallahi and Rodriguez, 2011; Gross and Schmitt, 2012; Johnson and Kneebone, 1991; Keil and Symons, 1990; McPherson and Flores, 2012; Myatt, 1996; Myatt, 1992; and others), the generosity of EI benefits has a significant, positive impact on provincial unemployment rates. For a one percent increase in the length of benefits, provincial unemployment rates increase by 0.38 percentage points.

The two demographic variables are also highly significant. The impact of the participation rate of older workers is negative and significant at less than one percent. The results indicate that an older labour force lowers provincial unemployment rates. For every one percent increase in the participation rate of older workers, the unemployment rate decreases by 0.086 percentage points. The impact of the participation rate of women is significant, but shows an unexpected sign. Given that the sample is constrained to the period between 1988 and 2013, changes in women's participation rate did not play a major role in the labour market. This means that the measure is likely picking up the impact of another variable that is highly correlated with the participation rate of women. Due to time constraints, I retain the current measure to control for this unidentified effect; however, I do not interpret the coefficient.

Finally, I discuss the impact of the Lilien index of structural change. Based on Lilien's theory (1982), the structural component of the unemployment rate is not constant. Instead, the structural component changes based on the employment variance of major industries. Table 6 summarizes the marginal impact of structural change in each province computed using the Wald test. With one exception, all province-specific effects are significantly different from zero at less than one percent. The impact of the Lilien index in Saskatchewan, after the recession, is not significantly different from zero. Historically, Saskatchewan has had some of the lowest unemployment rates in Canada; the prevailing labour market conditions and the province's industrial mix have likely contributed to Saskatchewan's resilience after the recession. Overall, the marginal impact of structural change indicates the sensitivity of each province to a one percent increase in employment variance measured by the Lilien index. Therefore, when

structural change increases, provinces with larger marginal impacts experience larger increases in the structural components of their unemployment rates.

Table 6 Marginal impacts of structural change

	Before the 2008 recession	After the 2008 recession	Difference
Newfoundland	1.742	1.211	-0.531
Nova Scotia	1.137	1.021	-0.116
New Brunswick	0.741	0.499	-0.242
Quebec	0.741	0.431	-0.310
Ontario	0.741	0.625	-0.116
Manitoba	0.741	0.625	-0.116
Saskatchewan	0.294	0	-0.294
Alberta	0.299	0.505	**0.206**
British Columbia	0.343	0.505	**0.162**

Source: Author's calculations

Results indicate that 20 years prior to the 2008 recession, New Brunswick, Ontario, Quebec, and Manitoba experienced the same marginal impact of structural change. For every one percent increase in employment variance, the unemployment rate in these provinces increases by 0.741 percentage points. The impact in B.C. is about half the size of Central Canada, and is lower still in Alberta and Saskatchewan. Nova Scotia and especially Newfoundland exhibit much higher sensitivity to structural changes based on the magnitude of their coefficients. Following the 2008 recession, most provinces see a decrease in the marginal impact of structural change; however, Alberta and B.C. experience an increase, which implies that the two provinces have become more vulnerable to future structural changes. These results have important policy implications, especially given the recent speed of economic expansion in Western Canada.

Lastly, I discuss the changes in provincial structural unemployment after the 2008 recession (Table 7).[19] Overall, the results indicate that there was an increase in the structural component of unemployment for all ten provinces following the recession. In Newfoundland and Nova Scotia, the increases in structural unemployment are highest, at 3.2 and 2.7 percentage points, respectively. A higher structural component is not surprising in the Maritime provinces, given the historically high unemployment rates in the region compared to the rest of Canada. The structural component in New Brunswick, however, increased only by 1.3 percentage points, comparable with the rise in Alberta and B.C. Given that the total unemployment rate in New Brunswick remains high, other factors, such as the generosity of EI benefits, likely play a more important role in the province. Ontario and Manitoba saw an increase of 1.6 percentage points, just above the mean value for the provinces. The lowest increase is in Quebec at 1.1 percentage points, while Saskatchewan saw no increase because its marginal impact was not significantly different from zero.

Table 7 Structural unemployment changes after the 2008 recession

	Structural component (rate)
Newfoundland	0.032
Nova Scotia	0.027
New Brunswick	0.013
Quebec	0.011
Ontario	0.016
Manitoba	0.016
Saskatchewan	0.000
Alberta	0.013
British Columbia	0.013

Source: Author's calculations

[19] The structural component is calculated using the marginal impact of structural change in each province after the 2008 recession, multiplied by a percent change in the value of the index before and after the recession. The percent change in the index is computed based on a three-year average before the crisis, the 2005-2007 period, and after the crisis (the 2010-2013 period). The latter is computed using the 2009Q4-2013Q3 values based on data availability.

These findings are consistent with the graphical analysis of provincial unemployment rates in Section 4.2, which indicates that most provincial rates have plateaued several percentage points above their pre-recession levels. Changes in the marginal impacts, however, indicate that the industrial structure of most provinces has undergone positive changes following the recession, leading to declines in the marginal impacts of structural change. Therefore, while all provinces saw an increase in the structural component of unemployment after the recession, their sensitivity to future structural change has decreased. One of the potential explanations could be an increased diversification of provincial industrial structures following the recovery. Another explanation could be based on the behaviour of individual firms. Because the financial crisis of the 2008 recession represents a supply shock, firms could have undertaken adjustments that would make them more resilient to similar shocks in the future. Thus, while structural unemployment increases in the short-term, industries have become more immune to future structural shifts. Perhaps due to heavy reliance on the natural resource sector in Western Canada, the marginal impacts in Alberta and B.C. did not decrease. Accordingly, the positive changes that resulted elsewhere in Canada, did not take place in these two provinces. While the total marginal impact in these provinces is still lower than the Canadian average, future research needs to evaluate if the adverse effects following the recession indicate a potential long-term trend.

Finally, I compare my results with past empirical estimates of structural unemployment. Unfortunately, no Canadian studies have evaluated structural unemployment for the same period to allow for a direct comparison. Based on unemployment and vacancy data, however, Osberg and Lin (2000) estimate that roughly one-eighth of the Canadian unemployment rate in the 1990s, or one percentage point, could be attributed to a structural mismatch in skills. The study also finds that there was a significant decrease in structural unemployment during this period, as contrasted with the 1980s. To compare my results, I compute a weighted average of structural unemployment in Table 7 to obtain an increase of 1.291 percentage points at the national level.[20] Because the first decade of the 20th century was an unusual

[20] The weighted average is computed based on provincial labour force shares in 2013 (Statistics Canada, 2013).

expansionary period, the national increase in structural unemployment after the 2008 recession compares well to a range implied by the Osberg and Lin study of the 1990s. The period following the 2008 recession, however, is quite brief in the current estimation, and future research could use a longer sample period to validate these findings.

The results of the estimation indicate that, following the 2008 recession, persistence of unemployment in the Canadian provinces can be partially attributed to structural causes. These findings are significant because when structural unemployment rises, it lasts for long periods. Even after demand recovers, the skills or location of structurally unemployed workers does not match the available jobs. Therefore, in order to reduce the number of structurally unemployed workers, governments need to consider specific policy responses that are discussed in the next section.

8. Policy analysis

This chapter develops potential policy options to address the rise in structural unemployment following the 2008 recession. The policy objectives are divided into short-term and long-term. In this discussion, short-term is defined as three to five years, and long-term is defined as ten years and beyond. The short-term policy objective is to decrease the level of structural unemployment in each province by expediting reallocation of workers from declining to growing sectors. Reducing structural unemployment requires improvement in matching skills and vacancies in each province. When an economy is in full employment, the number of unemployed workers equals the number of vacancies (Kaufman, 1991). If aggregate demand recovers, but the number of unemployed workers still exceeds the number of vacancies, the gap between the two represents structural unemployment. Table 8 presents the number of unemployed persons and vacancies per province in 2013. A good indicator that a policy is achieving its short-term objective is a ten percent reduction in the number of structurally unemployed workers in each province per year, for a total of 113,030 workers annually.

Table 8 Provincial unemployment and vacancies in 2013

	Unemployed	Vacancies	Total gap	Share of the labour force	Annual goal (10% of the gap)
Newfoundland	30,000	1,800	28,200	10.73%	2,820
Prince Edward Island	9,600	700	8,900	10.63%	890
Nova Scotia	45,100	4,300	40,800	8.18%	4,080
New Brunswick	40,900	3,600	37,300	9.52%	3,730
Quebec	332,900	43,500	289,400	6.63%	28,940
Ontario	561,300	66,300	495,000	6.65%	49,500
Manitoba	35,800	9,500	26,300	3.93%	2,630
Saskatchewan	23,000	9,800	13,200	2.28%	1,320
Alberta	107,200	48,200	59,000	2.55%	5,900
British Columbia	162,400	30,200	132,200	5.35%	13,220
TOTAL	**1,348,200**	**217,900**	**1,130,300**	**5.92%**	**113,030**

Source: Statistics Canada (2014)

The long-term policy objective is to achieve equilibrium in the labour market, such that the demand and supply of labour are perfectly balanced, and only frictional unemployment remains. Based on a neo-classical model, an optimal allocation of labour exists in the long run. Under these conditions, the labour market can accommodate a shock through a perfect adjustment of labour. To achieve such level of efficiency, future policies need to not only facilitate better matching, but also anticipate and pre-empt future increases in structural unemployment.

The proposed policy options address the short-term objective and are evaluated using a set of five criteria: (a) efficiency, (b) budgetary impact, (c) equity, (d) administrative complexity, and (e) stakeholder acceptance. Outlining specific criteria and measures ensures a systematic evaluation of each policy option. Each criterion evaluates the options based on a predetermined measure, which is then assigned a score of one, two, or three. For qualitative measures, a score of one means that the alternative ranks poorly against the criterion, a score of two implies a neutral impact, and a score of three indicates that the policy ranks well against the criterion. I evaluate

quantitative measures based on a predefined reference level, and similarly, assign a score from one to three. The criteria have an equal weighting in the current evaluation. The highest total of scores determines the recommended option.

I will briefly describe each of the criteria and measures summarized in Table 9. The first criterion is the efficiency of each policy option. The measure evaluates how well a policy option improves matching skills and vacancies in provincial labour markets. The reference level is a ten percent annual reduction in the provincial unemployment-vacancy gap in Table 8, column 5 (113,030 workers). The second criterion, budgetary impact, examines a funding increase required to implement each option. The reference level is based on a temporary Strategic Training and Transition Fund (STT Fund), which provided $250 million annually, for two years, 2009 and 2010, to target displaced workers in regions and industries most affected by the downturn. I give a neutral score (two) for an annual investment of $45–55 million, which represents 18-22 percent of the reference level. A lower funding level is used because the unemployment rate has declined since the fund was originally implemented, and because policies required to address structural unemployment are generally longer-term. Beyond reducing unemployment, additional benefits of each policy option include decreased reliance on government services and improved productivity of the affected workers. In addition, improved self-reliance has other indirect benefits, such as crime reduction and health improvements.

The third criterion is equity and is estimated with a qualitative measure that evaluates impacts on vulnerable groups. The federal government recognizes several groups that are underrepresented in the labour market who may face additional barriers at finding employment. These include recent immigrants, people with disabilities, youth, low-skilled workers, and Aboriginal people (ESDC, 2014). Therefore, this measure evaluates if policy options displace access to active labour market programs for individuals with additional employment barriers.

The fourth criterion is administrative complexity. I assign two qualitative measures for this criterion: the first one estimates the extent of legislative changes required, and the second one evaluates the level of inter-governmental cooperation required. A policy that necessitates inter-governmental coordination is harder to

implement than a policy that can be altered by a single government agency. Similarly, a policy that requires legislative changes is more difficult to execute than a policy requiring no change. The average score of the two measures is used so that the administrative complexity criterion has equal weighting.

Lastly, the fifth criterion is stakeholder acceptance. The primary stakeholders in implementing potential policy options are the workers affected by these policies.[21] I evaluate this criterion based on the expected impact of each policy option and existing media coverage of similar policies implemented elsewhere.[22] Another important stakeholder is employers, and several types of active labour market policies necessitate their direct involvement. Existing literature, however, suggests that policies involving employers, such as employment incentives and supported employment, are not significantly effective in reducing unemployment (Cart et al., 2010; OECD, 2005; Nie and Struby, 2011). Therefore, I do not include them here and instead, focus on policies involving workers only.

[21] There may be some overlap between this criterion and equity because vulnerable groups, such as older and low-skilled workers, are more likely to be unemployed. Nonetheless, structurally unemployed workers belong to all groups. Generally, support for vulnerable groups is provided through separate funding agreements, and the equity criterion assesses the potential impact on the programs specific to those groups. Because the delivery of all active labour market policies is carried out through the same employment offices at the provincial level, increased services for structurally unemployed workers may displace services provided to vulnerable groups. This effect is distinct from the level of acceptance captured by the stakeholder acceptance criterion.

[22] While federal and provincial governments are also important stakeholders, their cooperation is already estimated in the feasibility criterion.

Table 9 Criteria and measures

Criteria	Definition	Measure	Score
Efficiency	A quantitative measure that estimates the effectiveness of policy options at reducing the gap number of unemployed workers.	Less than an 8% reduction in the gap number of unemployed workers	(1)
		An annual 8-12% reduction in the number of unemployed workers	(2)
		More than a 12% reduction in the number of unemployed workers	(3)
Budgetary impact	A quantitative measure that evaluates the cost of implementing each policy option with respect to a given reference level.	More than $55 million per year (>22% of the reference level)	(1)
		$45–55 million per year (18-22% of the reference level)	(2)
		No change or less than $45 million (<18% of the reference level)	(3)
Equity	A qualitative measure that measures the expected impact on vulnerable groups.	Displaces participation by vulnerable groups	(1)
		Provides equitable access to vulnerable groups and structurally unemployed workers	(2)
		Favours access by vulnerable groups	(3)
Administrative complexity (average of the two measures is used for tabulation)	A qualitative measure that evaluates the level of administrative complexity based on expected legislative and program changes needed to implement a policy.	Requires legislative changes	(1)
		No legislative changes required, but substantial policy and program changes required	(2)
		No legislative changes required, with minor program modifications	(3)
	A qualitative measure that assesses the extent of inter-governmental cooperation required.	Inter-governmental coordination required	(1)
		One level of government, with ministerial coordination	(2)
		One level of government, no ministerial coordination	(3)
Stakeholder acceptance	A qualitative measure that estimates the appropriateness of the proposed policy changes for the affected workers.	Not acceptable, policy will face significant opposition	(1)
		Moderately acceptable, may face some opposition	(2)
		Highest level of acceptance, satisfies all concerns	(3)

8.1. Policy options

In this section, I identify three policy options that could reduce structural unemployment in the Canadian provinces. The policy options are not mutually exclusive and some combinations will be considered for the final policy recommendation. These options are developed based on the results of my empirical research and an extensive literature review. Generally, studies evaluating the effects of structural unemployment argue that following an economic recovery, support needs to shift away from passive labour market policies, such as EI benefits, to active labour market policies, such as retraining (OECD, 2012; Nie and Struby, 2011; Sneessens, 1995). Structurally unemployed workers possess skills, experience, or specialized backgrounds that are no longer needed in the labour market. Therefore, it is not surprising that these workers require additional assistance to be able to fully benefit from improved labour market conditions.

As discussed in section 3.1, structural unemployment can also arise when unemployed workers do not reside in areas where demand for their skills exists. Because Canada is geographically vast and economically diverse, these mismatches may also be an important source of unemployment. A common policy response to geographic mismatches is relocation subsidies aimed at increasing worker mobility, for example the the Atlantic Groundfish Strategy mobility grants. Previous research, however, suggests that these policies do not induce a marginal increase in worker relocations. At the same time, many studies indicate that relocation decisions are complex and hard to influence, especially because the majority of households today have dual earners (Harpell, 1984; Valletta, 2013). Therefore, wage signals may serve as the best mechanism for facilitating geographic adjustments over the long run. The proposed policy options, then, address unemployment that arises due to a mismatch in skills.

Before I present the proposed policy options, I briefly describe the status quo. The federal government provides funding to provinces to deliver active labour market policies through several types of training agreements (ESDC, 2014). Labour Market Agreements provide support to unemployed persons not eligible for EI, including groups underrepresented in the labour market and employed low-skilled workers. Labour Market Agreements for Persons with Disabilities offers training and workplace support for

persons who face employment barriers due to disabilities. The Targeted Initiative for Older Workers is a cost-shared initiative with the provincial governments that provides programming for unemployed workers aged 55 to 64. Finally, Labour Market Development Agreements (LMDAs) provide support for workers eligible for EI benefits. These agreements are commonly known as EI Part II and represent $1.95 billion in annual spending by the federal government. In the two fiscal years following the 2008 recession, the federal government invested an additional $500 million through the STT Fund on employment programs for workers affected by the downturn (ESDC, 2013).

8.1.1. Policy option 1: Increased access to training

Because structurally unemployed workers do not have the skills employers want, there is considerable rationale for retraining programs that could improve their employability. For example, if structural changes lead to a decline in specific occupational skills, affected workers require retraining in order to shift to industries with high labour demand. Therefore, the first policy option is to increase access to training by allocating additional funding for LMDA programs. Under EI Part II, programs primarily focus on access to short-term vocational training for the unemployed. These programs, however, may have limited success. Past studies show that training is most beneficial when participants obtain a credential or certification, and programs last for roughly one year (OECD, 2005). For example, Germany grants access to retraining programs that provide up to two years of education towards a new certification or vocational designation (Jacobson et al., 2004).[23] These investments go far beyond the basic level of training provided under the current LMDAs.

Why is training important? When evaluating potential workers, employers analyze the level of human capital each worker brings based on their existing skills, experience, or a combination of the two (Kaufman, 1991). Because skills of structurally unemployed workers are not needed in the market, their lack of experience poses a

[23] Several other European countries have instituted intervention programs specifically to retrain workers in sectors experiencing a decline (Nie and Sturby, 2011). These programs provide a much higher level of training compared to basic vocational programs that exist in Canada. These policies actually grant access to technical development and skills required to advance workers' careers.

catch-22 dilemma. Workers cannot get the experience they need to enter a growing industry because they do not have the skills or experience in that industry. In that sense, training serves as a crucial first step in enabling structurally unemployed workers' initial entry into new employment opportunities. Therefore, the first option recommends a long-term investment into further training opportunities for structurally unemployed workers, with a strong focus on certification or credential attainment.

8.1.2. Policy option 2: Mandatory assessments

The nature of structural unemployment requires targeted policy responses (OECD, 2005). Therefore, identifying these types of workers is important in order to create effective policy responses. The International Labour Office defines the term "displaced workers" as individuals who have experienced a permanent and involuntary job separation as a result of structural changes (Hansen, 2009). For these workers, there is no likelihood of recall by their previous employer and little chance of re-employment in their pre-displacement industry. These workers often experience re-employment difficulties and a long-term decline in earnings, because they lose the benefits of their job-specific and industry-specific skills (Jacobson et al., 1993).

Two crucial elements are needed in order to identify structurally unemployed workers and provide timely access to support programs. First, local employment offices need to understand the characteristics of structurally unemployed workers based on regional labour market conditions. Currently, a lack of comprehensive data on provincial vacancies poses challenges for accurately identifying sectors and occupations in decline. Access to quality information is a major factor in the success of any labour market policies, and long-term investments into data gathering are required to ensure effectiveness (ALMPI, 2009). Provincial ministries of labour, however, do produce regular reports on labour market conditions that identify at-risk industries and occupations in their region, which can be used in the interim.[24] Another important characteristic of displaced workers is the reason for their job separation, which often includes a partial or complete plant closure, or a substantial layoff (Morissette et al., 2007).

[24] For example, see the BC Labour Market Outlook (WorkBC, 2013).

Second, structurally unemployed workers need to access one of the employment offices in their area to be identified. This is a critical step, especially because workers themselves may not recognize that they are structurally unemployed and that their skills are obsolete. For example, when production processes change in response to structural shocks, vacancies posted in workers' former industries may have very different skill requirements. Therefore, these workers are no longer eligible for these employment opportunities and face substantial reemployment difficulties elsewhere. As a result, many structurally unemployed workers become discouraged and exit the labour force without ever accessing existing labour market programs that could have helped them.

At the moment, individuals receiving EI benefits are not required to undergo an individual assessment at any point in time, and access to active labour market policies is at the discretion of the unemployed. As mentioned earlier, when workers do not understand the nature of their reemployment difficulties, waiting for them to voluntarily access services poses a substantial barrier to the effectiveness of existing programs. Another important issue is the timing of intervention programs. Past research suggests that after six months of unemployment, employers begin to question the quality of unemployed workers, further decreasing their reemployment chances (Kaufman, 1991; OECD, 2005). Moreover, if workers are unemployed for structural reasons, their chances of reemployment do not change over time.

Policy option two is based on the experience of the Restart program instituted in the U.K. In response to rising long-term unemployment in the late 1980s, the program implemented mandatory assessment interviews with all unemployed workers who were collecting benefits for six months. The interviews took place at local employment offices and lasted 15 to 20 minutes.[25] The interview allowed employment counsellors to assess the claimant's employment history, assist with job search strategies, and offer advice on training. In that sense, the interview served as a gateway to job search assistance and retraining. Attendance at the interviews was mandatory and failure to comply resulted in a reduction or suspension of benefits. This was a crucial design feature of the program because assessment interviews were not enforced previously, resulting in low compliance rates (Dolton and O'Neill, 2002).

[25] If the individual remained unemployed, further interviews were held every six months.

The U.S. Congress enacted similar provisions for extended unemployment insurance benefits in March 2012. All states are now required to provide in-person reemployment and eligibility assessments to individuals establishing a new claim under the Emergency Unemployment Compensation. Because in the U.S. regular unemployment benefits are six and a half months in duration, the mandatory assessments are instituted at the same point as the Restart program, when individuals apply for extended benefits. An additional assessment is required to increase the duration of benefits further (Lancaster, 2013).

Option two proposes mandatory assessments for long-term EI claimants implemented six months into an active claim. The provinces would be responsible for carrying out assessments through their existing labour market programs, and additional funding for assessments would be provided through LMDAs. Repeated failure to comply with an assessment would result in a suspension of benefit payments until proof of attendance is submitted to Service Canada. Any cost savings resulting from reductions in benefit spending would remain in the EI Fund and could be channelled towards other active measures. The main goal of the assessments is for the local employment offices to identify the nature of unemployment difficulties for the long-term unemployed. Based on the barriers an individual faces, employment agencies can refer clients to further services, as needed. If individuals are identified as structurally unemployed, they would be placed on priority lists to be fast-tracked for retraining programs. This policy option can be implemented alone to increase the effectiveness of existing programs delivered through EI Part II, or in tandem with option one. I evaluate both alternatives.

8.1.3. Policy option 3: EI monitoring and enforcement

While the primary focus of my study is unemployment resulting from structural causes, estimation results reveal a significant negative impact from the generosity of EI benefits. The results indicate that for every one percent increase in the length of EI benefits, the unemployment rate increases by 0.38 percentage points. These findings are consistent with previous studies, which suggest that a higher generosity of EI benefits is responsible for the persistence of provincial unemployment across Canada (for examples, see Fallahi and Rodriguez, 2011; Gross and Schmitt, 2012; Johnson and Kneebone, 1991; Keil and Symons, 1990; McPherson and Flores, 2012; Myatt, 1996;

Myatt, 1992). The negative effects of EI on unemployment likely operate by reducing the intensity of job search among the unemployed workers receiving more benefits (Riddell, 2009). In the case of the structurally unemployed, this effect is especially detrimental because the longer the period of unemployment, the more likely the workers' skills are to expire. As a result, policies that affect frictional unemployment and increase its length also contribute to structural unemployment.

Most unemployment insurance programs in the OECD countries provide benefits conditional on specific job-search requirements. There is considerable evidence that job-search monitoring and stricter sanctions can significantly improve employment outcomes of insurance claimants, offsetting some of the negative effects associated with a longer benefit duration (Boone et al., 2007; Fredriksson and Holmlund, 2006; Hillmann and Hohenleitner, 2012; Lalive et al., 2005). For example, in Australia and the U.K., benefit recipients are required to prove their job-search activity at least every two weeks. Yet among the OECD countries, Canada ranks 9th out of 36 in terms of job-search monitoring intensity and 11th according to the strictness of sanctions (Venn, 2012). While EI claimants must confirm their availability for work, evidence of job-search is only required upon request.

A key eligibility requirement for EI is that individuals are actively looking for work. Option three proposes to increase job-search monitoring and enforcement in order to ensure that claimants maintain their work search efforts. In 2012, the federal government clarified what is considered as "reasonable job search" by listing sample activities and asking claimants to document their job-search efforts daily for the duration of their claim (Service Canada, 2014a). No specific provisions, however, were introduced for the minimum number of applications, the frequency of reporting, or the associated sanctions. Currently, EI sanctions are enforced for declining a reasonable job offer and refusing to participate in active labour market policies (Venn, 2012). Additionally, claimants can be disqualified from benefits for one to six weeks, if they fail to follow-up on a job referral.

The Canada Employment Insurance Commission (CEIC), an organization partially responsible for managing EI, already has the legislative power to impose penalties, issue warnings, and prosecute individuals for program abuse (Service

Canada, 2014b). Therefore, implementing this option does not require a policy change, but an increase in monitoring of existing policies. In line with similar provisions implemented elsewhere, a warning letter would be issued for individuals who cannot prove their job-search requirement, followed by monetary sanctions for those who continue to be out of compliance.

8.2. Evaluation of policy options

This section evaluates the proposed policy options based on the criteria and measures outlined earlier. Evaluation of policy options against the five criteria is based on past studies and results of the current estimation. For all measures, a score of one, two, or three, represents a ranking of low, medium, or high, respectively. Table 10 provides a summary of the policy evaluation. I do not consider the status quo as one of the potential policy options because, at the time of writing, the unemployment rates of all provinces remain higher than their pre-recession levels.

Table 10 Evaluation summary

Criteria	Option 1 Higher access to training	Option 2 Mandatory assessments	Option 3 EI monitoring & enforcement	Option 4 Combination of 1 and 2
Efficiency	2	2	2	3
Budgetary impact	2	3	2	1
Equity	3	1	2	2
Administrative complexity	1.5	1.5	2.5	1.5
Stakeholder acceptance	3	2	1	3
TOTAL	**11.5**	**9.5**	**9.5**	**10.5**

8.2.1. Analysis of option 1: Increased access to training

Training programs provide workers with specific skills to prepare them for occupations and industries experiencing high demand. Obtaining new skills allows structurally unemployed workers to ease their transition into new employment opportunities.

Efficiency: Over the years, some studies have questioned the effectiveness of training programs. In Canada, past training programs providing adjustment assistance have been limited in duration and focus. Examples include the Program for Older Worker Adjustment, the Atlantic Groundfish Strategy, and the Pacific Fisheries Adjustment and Restructuring Program. While empirical evaluations of such programs do not exist to date, results from administrative data are disappointing, likely due to the low quality and short duration of such programs (Riddell, 2009). Studies in the U.S., however, suggest that active labour market policies that focus on displaced workers have better outcomes, compared to programs aimed at underrepresented groups. Evaluations of the American programs suggest that successful initiatives require intensive interventions and training delivered through community colleges (Jacobson et al., 1993). Using administrative data, these studies illustrate that a one-year equivalent in community college courses significantly improves reemployment opportunities and wages of displaced workers.[26]

In a recent meta-analysis of active labour market policies, Card et al. (2010) conclude that training programs yield significant positive impacts after two years and beyond, while their impact in the short-term appears ineffective. Nie and Struby (2011) provide an empirical estimate of training programs' effectiveness based on panel data from 20 OECD countries. Their results indicate that increasing training expenditures per unemployed worker by one percent of GDP per capita reduces the unemployment rate by 0.2 percentage points per year. Based on the 2013 unemployment rate and the number of unemployed workers, a 0.2 percentage point reduction is equal to 38,520 workers exiting unemployment. To achieve a ten percent annual reduction (113,030 workers), spending on training as GDP per capita would have to increase by roughly three percent. Consequently, the policy score for effectiveness is two, or on target. The effectiveness and cost of this policy option are linked. Therefore, I calculate the cost increase required to achieve this goal.

Budgetary impact: I calculate the program cost based on 2011 figures, the latest data available from the OECD. Based on Canada's total spending on training in 2011 ($1.721 billion), the number of unemployed in the same year (1,393,100) and per capita

[26] The type of retraining is significant, as quantitative and technical programs produce better returns to future earnings.

GDP of $46,229, increasing training expenditures per unemployed worker by three percent of GDP per capita is equivalent to a spending increase of $52 million (OECD, 2013; Statistics Canada, 2013). Therefore, the cost of the program is set to ensure an annual reduction of ten percent in the gap number of unemployed workers, and is roughly 21 percent of the STT Fund's value. Therefore, I assign a score of two for budgetary impact.

Equity: Because this policy option proposes an increase in spending on training programs, structurally unemployed workers will not displace access to training and services by vulnerable groups. In addition, there is substantial overlap between structurally unemployed and vulnerable workers, as previous studies have emphasized the asymmetric effects of structural changes on low-skilled workers (for example, Sneessens, 1995; Spence and Hlatshwayo, 2011). Therefore, increased spending on training also increases access for some vulnerable groups, and the equity score for this policy option is three.

Administrative complexity: Overall, increasing funding to EI Part II does not pose any administrative challenges and does not require legislative changes. Ensuring that new training programs have a strong focus on certification and credential attainment, however, requires some cooperation from the provinces, which currently enjoy a high level of flexibility in how this funding is spent. Therefore, implementing this policy option may require additional provisions within the LMDAs. I assign a score of two for the program changes required and a score of one for inter-governmental cooperation, for a combined score of 1.5.

Stakeholder acceptance: Lastly, increasing the availability of training ensures a high level of acceptance from workers, and thus, the policy is assigned a score of three. For example, media coverage of German training schemes has been highly favourable, also indicating a high level of cooperation among labour unions in the design of training programs ("The importance of quality in workplace training", 1990; "A success story called training", 1988; "Unemployment in Germany", 1985).

8.2.2. Analysis of option 2: Mandatory assessments

Accurately identifying structurally unemployed workers is paramount to provide timely and targeted assistance.

Efficiency: I estimate the effectiveness of this policy option based on a semi-experimental study conducted in the U.K. This study evaluates mandatory interviews for people unemployed for six months, with the control group receiving the same treatment at a twelve-month point. Dolton and O'Neil (2002) estimate that the short-term impact of the interviews represents a ten percent reduction in the number of unemployed workers, as compared to the control group. While this advantage narrows when the control group undergoes the same assessments at a twelve-month point, performing the interviews sooner also leads to a long-term reduction in the unemployment rate of the first group. The long-term reduction is six percentage points lower than the control group and this effect persists even three years after the initial assessment.

Most of the short-term impact results from the threat associated with the new tighter eligibility requirements. After receiving interview notices, claimants either increase their search efforts, accept existing job offers, or withdraw from the program. The overall effectiveness of the policy, however, is attributed to the role of the interviews in referring unemployed workers towards further services. The study concludes that the Restart program reduced the number of unemployed workers by ten percent in the first 12 months of the program.[27] Thus, this policy option aligns well with the short-term objective and scores two for effectiveness.

Budgetary impact: The estimated cost of this option is based on per-interview costs of the Restart program. Converted from British pounds and adjusted for inflation, an

[27] On the one hand, the results reported are likely an underestimate because they are measured in relation to a control group, who eventually received the same benefits. On the other hand, the program may simply move up the priority of people who undergo assessments, which means that the benefits are overstated. Nonetheless, aggregate time-series studies of unemployment rates in the U.K. suggest that the impact of the program is statistically significant at the national level. While there is some evidence that the long-term impact of the program may be more favourable than ten percent, due to shortcomings in the study design, the long-term impact cannot be accurately assigned to the program alone. Therefore, the overall impact of the program is estimated at ten percentage points for the purpose of my study.

estimated cost of each interview per person is CAN $49.18.[28] In order to estimate program costs, I produce Table 11, which summarizes the number of people unemployed for over six months in each province. Based on these figures, the total number of interviews that would have to be conducted if this policy option was instituted in 2013 is 286,300. The total cost of the program is $14.1 million and represents 5.6 percent of the reference level.

Table 11 Number of long-term unemployed workers in 2013

	26 weeks or more	Estimated Assessment Costs
Newfoundland	4,600	$226,228.00
Prince Edward Island	1,500	$73,770.00
Nova Scotia	8,800	$432,784.00
New Brunswick	7,400	$363,932.00
Quebec	72,000	$3,540,960.00
Ontario	137,000	$6,737,660.00
Manitoba	5,500	$270,490.00
Saskatchewan	2,500	$122,950.00
Alberta	14,800	$727,864.00
British Columbia	32,200	$1,583,596.00
TOTAL	**286,300**	**$14,080,234.00**

Source: Statistics Canada (2014) and author's calculations[29]

Lastly, having timely and accurate labour market information is essential for the long-term effectiveness of this policy option because it allows for the accurate identification of structurally unemployed workers. According to the Advisory Panel on Labour Market Information (APLMI), there is a strong need to expand the coverage and quality of labour market information through a dedicated job vacancy survey (APLMI, 2009). The panel estimates the annual cost of the jobs vacancy survey at $8 million, bringing the total cost of this policy option to $22.1 million or 8.8 percent of the reference level. Therefore, I assign a score of three for the budgetary impact of this policy option.

[28] The cost per interview was £15 in 1989. Converted from British pounds using an average noon spot rate in 1989 (one pound to CDN $1.94) and adjusted for inflation using the Consumer Price Index (CPI)f, the cost equals $49.18 (Statistics Canada, 2013).

[29] 2012 is the latest year the data is available on the number of unemployed workers according to the duration of unemployment (Statistics Canada, 2013).

Equity: The mandatory interviews would be implemented for all unemployed workers receiving EI benefits for six months or more. One of the primary goals of this policy is to identify the structurally unemployed and direct them towards further services. Without additional funding for training, structurally unemployed workers will likely displace some of the participation by vulnerable groups. Therefore, I assign a score of one for this policy option.

Administrative complexity: While administering assessments does not require legislative changes, it does require the provinces to buy into the initiative because they would be carrying out these mandatory assessments and referrals. Delivery of active labour market policies is carried out by provincial labour ministries and non-government organizations who bid for tender to deliver these services. Therefore, disseminating labour market information and providing more concrete guidelines for referrals will require additional coordination on behalf of the provinces. Therefore, I assign a score of two for the first measure because it requires substantial procedural changes. Given the inter-governmental coordination required, however, the policy scores one on the second measure, for an average score of 1.5.

Stakeholder acceptance: While this policy option does not affect the length of EI benefits, it does put additional requirements on the unemployed workers receiving those benefits. Therefore, this option will likely face some opposition and I assign a score of two. In the U.K., during the implementation of the Restart program, there was some opposition to assessments from unemployment pressure groups and unions, who saw the program as an increased form of “policing” the unemployed claimants (“Restart 'failing To help jobless'”, 1987; “Restart 'will channel claimants towards employment training'”, 1988; “Stricter tests 'will cut jobless figures by 40,000'”, 1988).

8.2.3. Analysis of option 3: Monitoring and sanctions for EI claimants

Based on the results of the estimation, increasing the length of EI benefits has significant negative effects on unemployment. While my study is concerned with structural changes, a longer length of EI benefits may reduce the job finding efforts of the unemployed workers, and increase the likelihood of long-term and structural unemployment. Past studies suggest that monitoring compliance with eligibility

requirements may decrease the duration of unemployment more efficiently than reductions in unemployment insurance benefits. For example, Lalive et al. (2005) find that a significant increase in the unemployment outflow results when warnings and sanctions are issued for individuals who do not comply with the job-search requirement. Moreover, increasing the monitoring and warning rates increases the outflow of all job seekers, not just those who are eventually sanctioned.

Therefore, this policy effectively increases people's cost of unemployment and creates better incentives to find work more quickly. Changing labour market institutions affects the frictional rate of unemployment; however, decreasing the duration of unemployment also reduces the likelihood that the skills of unemployed workers expire over time, which in turn weakens the link between frictional and structural unemployment. In addition, if structurally unemployed workers increase their job-search efforts as a result of this policy, they are more likely to realize that their skills are obsolete and may seek retraining.

Efficiency: By definition, when the average duration of unemployment increases, the outflow decreases. Prior to the 2008 recession, the average duration of unemployment in Canada was 15.4 weeks in 2007 (Statistics Canada, 2013). The duration increased to 21.2 weeks in 2013, consistent with an increase in structural unemployment found in the estimation. The exact length resulting from structural causes, however, is hard to pin point because a portion of the increase also stems from cyclical causes. Analyzing the monitoring and enforcement of unemployment benefits in Switzerland, Lalive et al. (2005) find that increasing the warning rate by one standard deviation reduces the duration of unemployment by one week for all job seekers. Because Canada currently does not monitor compliance, the initial impact of the policy would be larger than the marginal impact found in the Swiss study. I presume a two-week decline in the average duration of unemployment resulting from implementing this policy option.

Given that the average duration of unemployment equals the level of unemployment, divided by the outflow, Table 12 shows that decreasing the average duration of benefits in 2013 by two weeks would reduce the number of unemployed

workers in Canada by roughly 131,215.[30] Because only a portion of this decline will reduce structural unemployment, the effectiveness of this policy at reducing the current level of structural unemployment is less than eight percent. Nonetheless, this option has considerable future benefits because it lowers the probability of individuals becoming structurally unemployed in the future. Therefore, I assign a neutral score of two for both the short- and long-term effects.

Table 12 Effects of EI monitoring on provincial unemployment

	2013 Unemployment duration(weeks)	2013 Unemployment level	2013 Weekly outflow	Unemployment level with EI monitoring	Unemployment level change due to monitoring
Newfoundland	16.7	30,000	1,796	26,407	3,593
Prince Edward Island	15.5	9,600	619	8,361	1,239
Nova Scotia	19.3	45,100	2,337	40,426	4,674
New Brunswick	18.6	40,900	2,199	36,502	4,398
Quebec	24.1	332,900	13,813	305,273	27,627
Ontario	21.8	561,300	25,748	509,805	51,495
Manitoba	17.8	35,800	2,011	31,778	4,022
Saskatchewan	14.4	23,000	1,597	19,806	3,194
Alberta	14.1	107,200	7,603	91,994	15,206
British Columbia	20.6	162,400	7,883	146,633	15,767
TOTAL	**21.1**	**1,348,200**	**65,606**	**1,216,985**	**131,215**

Source: Statistics Canada (2014)

Budgetary impact: While this policy reduces the overall cost of EI by sanctioning individuals who are out of compliance, it does increase program costs because it requires additional staff to increase monitoring. Because EI recipients are not currently monitored, the cost of implementing this option is difficult to estimate. Therefore, I assign a neutral score of two for budgetary impact.

[30] The study also finds that imposing sanctions further reduces the duration of unemployment by three weeks, compared to individuals who did not receive sanctions. Applying these results in Canada would require an estimated rate of monetary sanctions that would be imposed as a result of increased monitoring. While such an estimation is beyond the scope of my study, these effects indicate that the benefits of this policy are even greater than the impact of monitoring and warnings alone.

Equity: Enforcing eligibility requirements for EI benefits does not inherently discriminate against vulnerable groups because all workers can maintain their access to benefits, as long as they continue to search for work. The policy, however, does not increase access to resources for vulnerable groups, so I assign a score of two.

Administrative complexity: This policy option does not require additional legislative changes because the provisions for monitoring and sanctions already exist under the Employment Insurance Act (1996). Substantive program changes are necessary, however, to begin monitoring the job-search efforts of EI claimants and this policy scores two on the first measure. No cooperation between the federal and provincial governments is required to implement EI monitoring and I assign a score of three for the second measure, for an average score of 2.5 for this criterion.

Stakeholder acceptance: Increasing monitoring and sanctions for regular EI benefits will likely face substantial opposition from workers and labour organizations because the proposed monitoring of claimants is even more extensive than under option two. I assign a score of one for stakeholder acceptance.

8.2.4. Analysis of options 1 and 2, combined

The combination of options one and two may create more favourable results. In a meta-analysis evaluating all major types of active labour market policies, Card et al. (2010) conclude that to be effective, policies need to be well-targeted and comprehensive in their level of support. A crucial element of this option is the ability of employment offices to accurately identify at-risk industries and occupations in order to encourage retraining towards high demand fields. Therefore, implementing the new job vacancy survey, as recommended by the APLMI (2009), is essential. In order to maximize the effectiveness of the two policies, a phased approach may be most effective. The federal government could increase funding for training programs in the immediate term and implement mandatory assessments for EI claimants following the creation of the job vacancy survey.

Efficiency: Based on previous research (Card et al., 2010; OECD, 2005), ensuring the accurate targeting of policies increases their effectiveness. Therefore, the

combination of the two programs is predicted to yield better results than training alone. The combined policy option would increase training efficiency in the long-term by better addressing the needs of structurally unemployed workers. Though targeted training alone is unlikely to increase policy effectiveness above 12 percent, the threat effect that results from mandatory interviews would create additional declines in the unemployment rate in the short-term. The combined short-term and long-term effects would likely further increase the effectiveness of this policy option, and I assign a score of three for the combined option.

Budgetary impact: The total cost of the two programs is $74 million or 30 percent of the reference level. Therefore, I assign a score of one for the budgetary impact of this policy option. In the long-run, the cost of the training program may decline as a result of better targeting.

Equity: Identifying structurally unemployed workers, while enhancing training programs targeted at those workers, should compensate for the displacement of vulnerable groups under option two alone. I assign a score of three for the combination of the two policies.

Administrative complexity: Though the implementation of the two policies does not require legislative changes, substantial program changes are needed. The combined option scores two for the first measure of administrative complexity. This option will also necessitate considerable cooperation between the provincial and federal governments, scoring one on the second measure, for a total score of 1.5.

Stakeholder acceptance: Option two alone would face potential opposition from workers because it imposes additional sanctions on EI beneficiaries. Implementing mandatory assessments in order to provide access to higher-cost training programs, however, may offset some of the opposition to option two alone. I conservatively assign a score of two for the combined option.

8.2.5. Policy recommendation

Based on the analysis of the proposed policy options, increasing funding for training creates the most favourable results; however, none of the options are clearly

dominant in the scores. While a combination of training and mandatory assessments is the most effective at reducing the current level of structural unemployment, increased costs and lower stakeholder acceptance reduce its overall ranking. Doubling the weight of the efficiency criterion does not produce a clear winner, as increased funding for training and the combination of options one and two tie for the first place. Doubling the weight of the administrative complexity criterion, however, once again puts training in the lead. Given the sensitivity analysis, increased funding for training continues to be the leading option because it remains one of the dominant policies in each instance.

Canada lags behind many OECD countries in terms of spending on active labour market policies and ranks 14th out of 30 countries in spending on training (OECD, 2013). Countries such Germany, Finland, Austria, and France, that have higher spending on training, speed up labour market adjustments in response to structural shocks. In fact, creating comprehensive training programs focused on credential attainment tends to be the policy of choice to address structural unemployment among the OECD countries. The current analysis also shows that policies that oversee the intensity and effectiveness of job-search activities are very relevant. Since the threat of these policies creates additional cost savings for governments by decreasing misuse, there may be considerable rationale for instituting such programs. In the long-term, successfully implementing these policies would help decrease the current level of unemployment and ease future labour market adjustments.

Over the years, many studies have concluded that active labour market policies, such as training, achieve positive outcomes, while passive income replacement programs have adverse effects in the labour market. The effectiveness of active labour market policies increases following an economic recovery. Therefore, increasing funding for training programs now is especially timely.

9. Conclusion

Five years after the 2008 recession, the unemployment rates of most Canadian provinces have not returned to their pre-recession levels. Similarly, the number of unemployed workers remains high and 1.4 million Canadians continued to search for work in October 2013. My capstone fills a considerable research gap by evaluating the composition of unemployment after the 2008 recession and shedding light on the recent labour market conditions within each province. The current lack of empirical work evaluating Canadian unemployment after the recession may be partially attributed to the lack of quality vacancy data and a short sample period following the recession. Future work should attempt to validate the current findings and confirm the provincial sensitivity to future structural shocks.

While my study confirms the rise in structural unemployment after the recession, a detailed regional analysis is needed to understand what industries and occupations are on the decline in each province. Understanding the exact nature of structural changes will help identify the effected industries and workers in order to create better targeted policy responses. I also acknowledge that my study did not address how structural shifts are geographically distributed within each province. Because both primary and manufacturing industries tend to be concentrated in specific regions, structural changes can produce large declines in the demand for labour that may not be offset by other industries in the same region. In a vast country such as Canada, geographic mismatches may have long-term economic implications because they prevent the full adjustment of the labour market. Therefore, these limitations should be kept in mind when interpreting the information presented in this study.

All types of unemployment generate substantial personal and social costs; however, long-term or structural unemployment produces special challenges as it affects individuals' lifetime earnings and increases the likelihood of becoming discouraged and exiting the labour force. In this study, I illustrate that the persistence in provincial

unemployment rates following the 2008 recession is partially attributed to structural causes. These findings have direct policy implications because decreasing the level of structural unemployment requires shifting from passive to active labour market policies. Effective policies need to accelerate labour market adjustments that result from structural shocks by reallocating workers from industries with low, to industries with high employment demand. I consider several policy options to address the current level of structural unemployment. Obtaining new skills remains crucial in order for these workers to achieve success in the labour market; however, ensuring that the job-search of all unemployed workers remains active and effective also plays a key role in preventing future structural unemployment.

Lastly, policies that influence the current level of unemployment need to be reinforced with measures that increase the overall level of human capital. There is a vast body of literature that suggests that higher education levels improve individuals' ability to adjust to changing labour market conditions. Given Canada's increased exposure to external economic shocks, such as the 2008 recession, training and education remain crucial because these investments increase the resilience of Canadian workers to future structural change.

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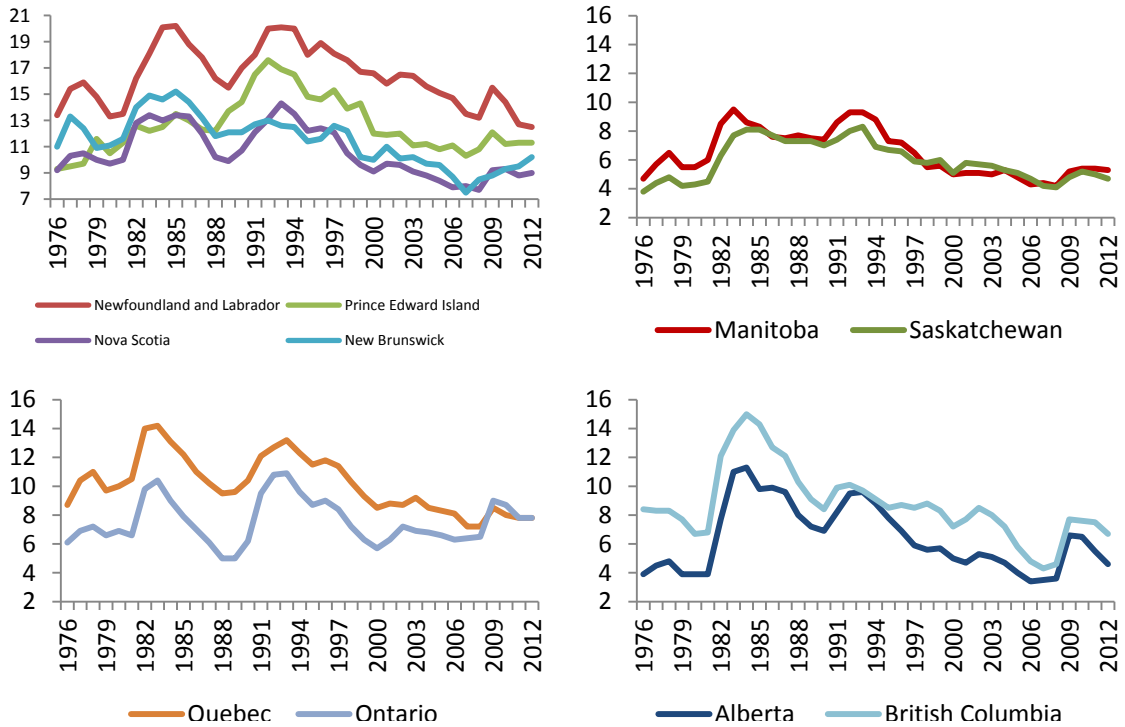
Appendices

Appendix A: Additional figures

Figure A.1 Provincial Unemployment Rates 1976-2012



Source: Statistics Canada, 2013

Figure A.2 Graphs of the dependent variable

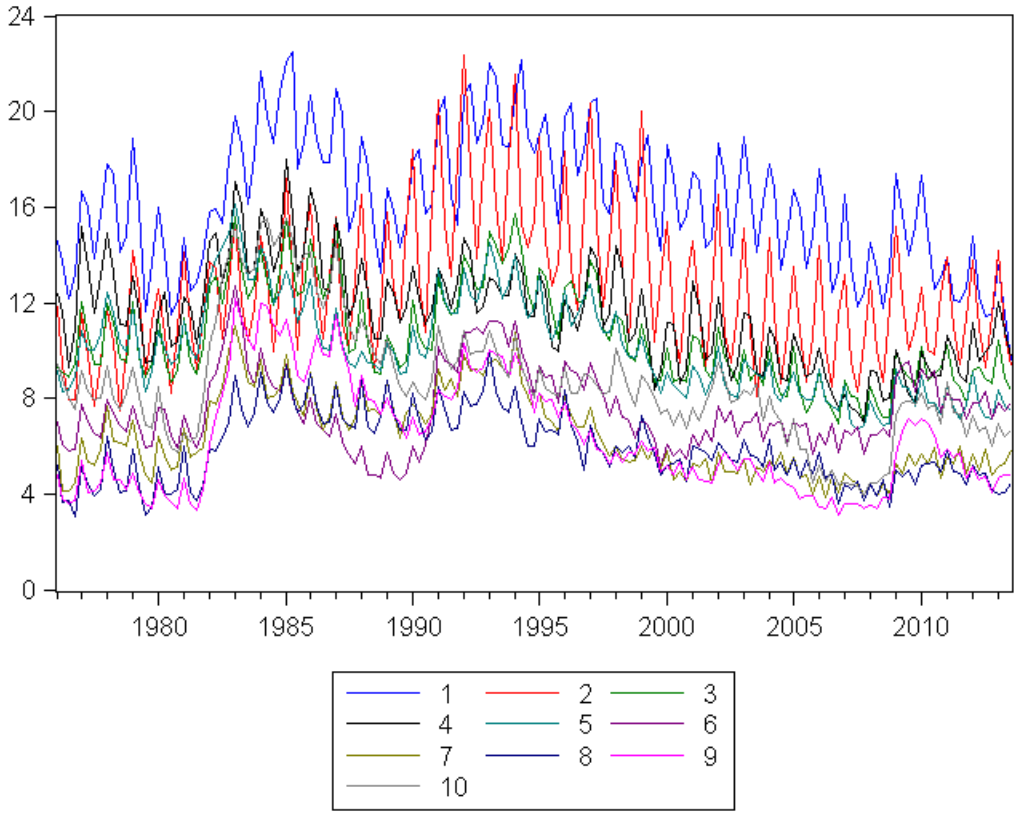
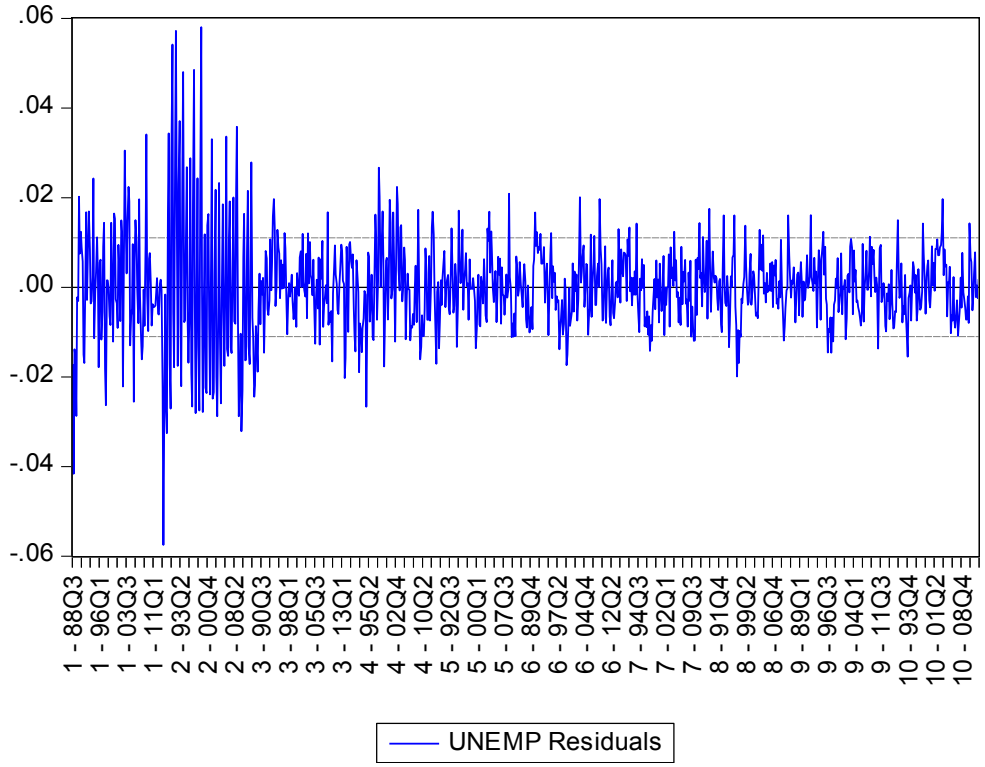


Figure A.3 Graph of the error terms



Appendix B: Variable definitions and calculations

Dependent variable

$UR_{j,t}$ Provincial unemployment rates for ages 15 years and over, monthly data January 1976 – September 2013 converted to quarterly data using an average of the three months (Statistics Canada 2013, Table 282-0001).

Independent variables

AD_t Aggregate demand is calculated as de-trended quarterly national GDP at constant 2007 prices, expenditure-based using the following procedure:

1. CANSIM data for Quarterly Gross Domestic Product (GDP) at nominal prices is used (dollars x 1,000,000, expenditure-based, unadjusted for seasonality). Data from CANSIM Table 380-0064 for GDP values between 1981Q1-2013Q3 is supplemented with Table 380-0002 for GDP values between 1976Q1 and 1980Q4. Ratios between the two series are calculated:

   1981Q1=0.981 (values from Table 380-0002/ Table 380-0064)
   1981Q2=0.983
   1981Q3=0.983
   1981Q4=0.986

   Finally, GDP values for 1976Q1 to 1980Q4 (Table 380-0002) are divided by a weighted average of the four ratios (0.983308569) to calculate the final observations.

2. Similarly, quarterly GDP price index data from CANSIM Table 380-0066 (2007=100) for 1981Q1 to 2013Q3 is supplemented with data from Table 380-0003 (2002=100) for 1976Q1 and 1980Q4. Ratios between the two series are computed as follows:

1981Q1=1.203 (2002 index / 2007 index)
1981Q2=1.205
1981Q3=1.203
1981Q4=1.206

Because the four ratios are not significantly different, index values for 1976Q1 to 1980Q4 (Table 380-0002) are divided by the ratio for 1981Q1 (1.203) to calculate the final observations.

3. Nominal GDP values are divided by the GDP price index, times 100, in order to compute the real GDP values.

4. National aggregate demand, purged of trend and seasonal variations was calculated based on the residual term of the following estimation between 1976Q1 and 2013Q3:

$$\ln GDP_t = c + \beta_1 Time + \beta_2 Time^2 + \beta_3 SEAS_1 + \beta_4 SEAS_2 + \beta_5 SEAS_3 + \varepsilon_t$$

The results of the estimation are presented in Table A.I.1 below.

Table A.2.1 Estimation of the national GDP trend: 1976Q1-2013Q3

	β_1	β_2	$Adj\ R^2$
Canada	0.007***	-3.22E-06**	0.988
	(29.246)	(2.107)	

D_j Province specific dummies such that DNS=Nova Scotia, DPE=Prince Edward Island, DNB=New Brunswick, DQC=Quebec, DMB=Manitoba, DSK=Saskatchewan, DAB=Alberta, DBC=British Columbia, and Ontario as the reference case.

D_t Dummy with value 1 between 2008Q4 and 2009Q3 and 0 otherwise, capturing the onset of the 2008-recession. The dummy values follow the actual 2008-recession period by one quarter because the current model is lagged one period.

$Eiben_{j,t}$ Maximum length of EI benefits in weeks for an individual with a minimum qualifying requirement. The variable is specific to each province and is computed by Day and Winer (2001) annually from 1976 to 1996. EI benefits are based on a moving average of past unemployment rates in a given region. From 1997 to 2013, author's calculations based on the same definition, provincial annual unemployment rates, and data from Service Canada (2013). The 2013 calculations are based on the average unemployment rates in each province in the first three quarters of the year.

Extended duration of EI regular benefits was implemented effective March 1, 2009 until September 11, 2010 for all active claims during that period. This policy was part of fiscal stimulus measures initiated in response to the 2008 recession. Calculations for this period are based on data from Service Canada (2010) and the same definition as Day and Winer (2001). Values when a policy change occurred mid-period are calculated as a weighted average of the periods with regular and extended benefits.

$Eiqual_{j,t}$ Minimum number of weeks of insurable employment necessary to qualify for EI benefits in each province. Effective August 1977, the number of hours of insurable employment became specific to each province. Variable entrance requirement were based on a moving average of regional unemployment rates. From 1981 to 1996, the variable is computed annually in weeks by Day and Winer (2001). From 1997 to 2013, own calculations based on the same definition, provincial annual unemployment rates, and data from Service Canada (2013a). The 2013 calculations are based on the average unemployment rates in each province in the first three quarters of the year.

The EI qualifying requirements were not affected by the extended duration of EI regular benefits measures implemented as a response to

the 2008 recession.

$Govgondrt_t$ Government of Canada marketable bonds, average yield for 5 to 10 years (Statistics Canada 2013, Table 176-0043). The yields refer to direct debt payable in Canadian dollars, excluding extendable issues and Canada Savings Bonds, calculated from the last Wednesday mid-market closing prices.

$Lilien_t$ Dispersion of the growth rates of ten broad national industry sectors, calculated as in (2) with employment figures corrected for cyclical variations as follows:

$Y'_{i,t} = \ln(Y_{i,t}) - AD_{t-1} - AD_{t-2} - AD_{t-3} - AD_{t-4}$ when a following regression is run:

$$Y_{i,t} = c_i + \beta_1 time + \beta_2 time^2 + AD_{t-1} + AD_{t-2} + AD_{t-3} + AD_{t-4} + seas_1 + seas_2 + seas_3 + e_{i,t}$$

$Minw_{j,t}$ Monthly provincial minimum wages in nominal rates January 1976 – September 2013 converted to quarterly data using an average of the three months. When a rate change occurred mid-month, the value for that month is calculated based on a weighted average of days with the old and the new rate (Minimum Wage Database, 2013).

Nominal wages are divided by the provincial Consumer Price Index (Table 326-0020, 2002=100), times 100, to calculate the real minimum wage values for each province. Monthly indices are converted into quarterly values using an average of three months for data between October 1978 and September 2013.

$Opart_{j,t}$ Provincial participation rates of older workers (55+), monthly data January 1976 – September 2013 converted to quarterly data using an average of the three months (Statistics Canada 2013, Table 282-0001).

$Poil_t$ Real price of oil in Canadian dollars. Nominal price of crude petroleum in US dollars based on free market commodity prices, average of U.K. Brent (light), Dubai (medium) and Texas (heavy), equally weighted (US$/barrel) (UNCTAD, 2013), multiplied by the average noon spot rate against the US$ to convert to Canadian dollars. The price is divided by the implicit GDP price index for Canada, times 100, in order to compute the real price of oil. The GDP price index is computed the same as AD_t (Statistics Canada 2013, Table 380-0066, Table 380-0003). The calculation of this variable is the same as in Gross and Schmitt (2012).

$Primert_t$ Chartered bank administered interest rates for prime business between January 1976 and September 2013, converted from monthly to quarterly data using a three-month average (Statistics Canada 2013, Table 176-0043). The most typical of interest rates (percent) offered by major chartered banks, calculated from the last Wednesday.

$SEAS1,$ $SEAS2,$ $SEAS3$ Seasonal dummies, such that SEAS1=1 for the first quarter and 0 for everything else, SEAS2=1 for the second quarter and 0 for everything else, SEAS3=1 for the third quarter and 0 for everything else, and the fourth quarter is the reference case.

$Wpart_{j,t}$ Provincial participation rates of women (15+), monthly data January 1976 – September 2013 converted to quarterly data using an average of the three months (Statistics Canada 2013, Table 282-0001).