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Abstract

This paper presents further evidence on the importance of sectoral shifts by examining unemployment fluctuations in the regions of Canada over the period 1976-2011. Sectoral shifts or shocks are measured following Lilien's methodology and a dispersion index variable is constructed and treated in association with unemployment rate. The empirical research is conducted using OLS procedures, models from GARCH family and Impulse Response Functions (IRF's) as provided by VAR representations. Results from the OLS regressions, either with or without monetary, fiscal and other exogenous variables, in their majority give support in favor of the sectoral shifts hypothesis. Similar facts emerge from the rest processes undertaken implying that a strong and positive relationship exists between the dispersion index and unemployment rate. Comprehensively, it is stated that reallocation proved to play a significant role in determining the movements of unemployment rate across time.

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1. Introduction

Unemployment rate had always been a matter that attracted special attention from various researchers. The measurement of this rate and prediction of unemployment movements is an important field of study and many theories are developed in order to provide documented answers. According to many Real Business Cycle theories, fluctuations in unemployment rate are attributed to 'sectoral shocks'. The term sectoral shocks refer to the disturbances observed in unemployment levels due to a continuous labor reallocation that takes place between the different sectors of an economy. Laid-off workers as long as those workers that prefer to change job, tend to move from decling to growing sectors, bringing about a continuous labor reallocation. The fact that labor adjusts slowly to sectoral shifts and is very sensitive to changes, results in a time-varying natural unemployment rate, revealing how sectoral shocks or shifts affect unemployment's behavior and its levels. The impact that sectoral shocks have on unemployment is commonly known as the 'sectoral shifts hypothesis'.

The first attempt to measure and model sectoral shifts was made by Lilien nearly three decades in the past 1982 for the United States economy. Lilien introduces the term of dispersion index (σ) which is constructed as a weighted standard deviation of observed sectoral employment growth rates. To be more specific, this first index consists of an 18-industry composition as an indication for the reallocative process. An aggregate unemployment equation is employed and methodology adopted is a simple regression of unemployment rate, as the dependent variable, towards dispersion index mentioned above in addition to other variables of monetary and fiscal policy that are considered to have an effect in the dependent variable. Results are supportive to sectoral shifts hypothesis since a strong positive relationship between dispersion index and unemployment is detected. The validity or the rejection of sectoral shifts proposition was investigated by many subsequent researchers, ending up in a growing literature covering this field of study. Each of them make innovations and proposes a variety of otherwise similar or different aspects compared to Lilien. However, those differences arise due to the fact that every study may use alternative methodology, may differ in the sample period, the frequency of observations and the ground (area-country) tested.

The main objective of this essay is to study and analyze sectoral shifts hypothesis for the Canadian economy not only on its whole but across its regions too. Adopting Lilien's 'tools' in measuring dispersion index and choosing additional variables that are believed to influence unemployment rate, we give our point of view in explaining variation in unemployment rate through sectoral shifts hypothesis. Previous studies for Canada, in majority, support the hypothesis by declaring the existence of a positive relationship between dispersion and unemployment and this fact motivates us to confirm it or not. The rest of the paper is organized as follows. Chapter 2 describes sectoral shifts hypothesis framework and explains analytically which is the exact relation between sectoral shocks and unemployment. Chapter 3 provides a detailed presentation of the existing literature and the different empirical results of each researcher. Chapter 4 is covered by data information while Chapter 5 technically analyses methodology. Empirical results are discussed in Chapter 6 and concluding remarks are mentioned in Chapter 7.

2. Sectoral Shifts Hypothesis framework

A rich literature in macroeconomics deals with the question whether fluctuations in the unemployment rate are caused by sectoral reallocation shocks or by aggregate demand shocks. In early business cycle theories, it is commonly assumed that fluctuations in unemployment rate are caused by aggregate disturbances and in particular, by aggregate demand movements. To be more specific, new-Keynesians and their models tend to emphasize that only aggregate shocks can induce business cycles. On the contrary, many Real Business Cycles (RBC) theories attribute unemployment primarily to sectoral shocks that are propagated through imperfect labor demand adjustments. Thus, in a large class of RBC models, sectoral shocks are considered to be the driving force of economic fluctuations and the main determinant of the variation in unemployment rate.

Firstly advocated by Lilien in 1982, sectoral shifts of labor demand, or commonly known as the sectoral shifts hypothesis, can be described as the process of labor reallocation in response to the shifting pattern of employment demand which results in fluctuations of unemployment rate and in cyclical unemployment. Shocks between sectors of economy, shift labor demand from declining to expanding sectors and bring about laid-off workers who must go through the job-search process in order to be employed again in a different sector. But in most cases, this process is likely to be time-consuming and protracted due to the time needed for job search, creation of new occupations in expanding sectors, limited labor mobility and reallocation plus retraining of workers. Since labor adjusts slowly to shifts of employment demand and firms need time to adapt the size of their labor force, it then follows that a certain positive level of unemployment will always exist even when demand is high. This unemployment rate resulting from this search activity is what will be called from now on the 'natural' or 'frictional' unemployment rate which does not remain constant but itself varies over time as the quantity of required labor reallocation within the economy changes. Variation of this natural rate, which is brought about by the slow adjustment of labor to shifts of employment demand, is the matter under investigation. Thus, large sectoral shifts between sectors of the economy contribute to unemployment increases or, in other words, changes in the natural rate of unemployment because of sectoral reallocation must be taken into account in the computation of the unemployment rate.

The estimation of the unemployment rate and its fluctuations due to sectoral shifts provided by Lilien (1982), consists of the aggregate unemployment equation, where the dependent variable is unemployment and is modeled as a function of expected and unexpected money growth, previous values of unemployment rate, interest rates differentials and of the dispersion measure (σ). Lilien proxies employment dispersion index by a weighted standard deviation of observed sectoral employment growth rates about aggregate employment growth, and this index acts as a variable explaining movements in the rate of unemployment. His results concerning the U.S. economy show that there is a strong positive relationship between unemployment rate and the dispersion in observed employment growth rates across sectors. He also proves the validity of the sectoral shifts hypothesis and the magnitude that has on the unemployment rate determination.

However, subsequent studies contradict Lilien's methodology and the application of the dispersion index on the grounds that it relies on aggregate demand disturbances which have an uneven effect on sectoral employment. To be more specific, Abraham and Katz (1986) argue that movements in Lilien's dispersion measure do not necessarily reflect variation in the pace of labor reallocation and that, when the dispersion index is purged of the influence of aggregate demand shocks can justify only a small part of the observed fluctuations of unemployment. Moreover, McCallum (1987) supports the Keynesians' (monetarists) and not Lilien's view because his analysis show that aggregate demand (monetary variables) is the prime determinant of the movements of unemployment rate and that sectoral shifts play a secondary role in relation to aggregate demand. In addition, Neelin (1987) asserts that only exogenous shifts, rather than endogenous or total shifts, across regions have a significantly positive effect on the fluctuations of the unemployment rate. Also, Davis (1987) claims that Lilien fails to take into account the possibility of the stage-of-business-cycle effect on the sectoral shifts hypothesis. Furthermore, Brainard and Cutler (1993) and Fortin and Araar (1997) find Lilien's dispersion index insignificant in the regression analysis and develop a different dispersion measure based on stock market data in order to capture sectoral shifts. More recently, Sakata's (2002) research suggests that the most important is to examine not only Lilien's pure hypothesis, but to examine this hypothesis for different cohorts, and that sometimes the findings for the aggregate unemployment may be deceptive.

From the above we understand that sectoral shifts hypothesis has both adherents and opponents. The very early studies start from the field of North America. Most researches analyze the U.S. and Canadian economy employing pre and post war data in order to detect the influence of labor reallocation to unemployment rate that took place during these two different periods. Some of them take into account the whole economic conditions of the country but others take data from different regions of the country to make a more accurate and analytical work. Moreover, many researches study U.S and Canada together because it is true that the two economies interact and present a high degree of integration. On the basis that results for America are controversial and no one can clearly state whether sectoral shocks are responsible for the high levels of unemployment for specific time horizons, subsequent researchers extend their analysis further and for countries all over the world. In this essay, we study the impact of sectoral shifts on aggregate unemployment for the regions of Canada and it would be very informative to provide firstly some piece of the existing literature for Canada, United States, European areas and the U.K. in addition to Japan.

3. Literature Review

David Lilien's (1982) hypothesis that sectoral shifts in employment demand are responsible for fluctuations in aggregate unemployment has triggered a great deal of theoretical consideration and empirical evaluation, the outcome of which has provided both support for, and criticism of this proposition. The examination of unemployment rate data, as evidence for variation in the pace of labor reallocation, is an important aspect of business cycles. Therefore, shifting factors in addition to the role of allocative disturbances in aggregate economic fluctuations are considered to have been an important source of cyclical unemployment, and this is the reason that attracted special attention in the business cycle literature.

In his "provocative" paper, Lilien (1982) asserts that labor reallocation resulting from sectoral shocks or shifts of labor demand can generate significant fluctuations in unemployment rate. To demonstrate this, he finds a relationship between the reallocation of labor demand across sectors and the aggregate unemployment rate through the impact that reallocation has on the aggregate layoff rate. For this purpose, a dispersion measure (σ) is constructed to capture the effect of changes in the distribution of sectoral shocks on aggregate rates of layoffs and more directly on aggregate unemployment. Aggregate layoffs are approximated by a linear function of the mean and dispersion of employment growth rates across industries, assuming identical mean for all firms. From the time that the mean acts for the effect that both aggregate monetary and non-monetary disturbances have on each sector's employment growth rate, Lilien's induction of identical mean denotes that aggregate shocks have the same impact on all sectors. Also, an aggregate unemployment equation in the tradition of Barro (1977) is estimated, where unemployment is modeled as a function of expected and unexpected money growth, previous values of unemployment rate, swings of interest rates and of the dispersion measure (σ). Obviously, the inclusion of this measure distinguishes the Lilien approach from previous models. In addition, the natural rate is defined as the level of unemployment without taking into account the unanticipated monetary policy and the random disturbances, but only the past history of the dispersion. Lilien's empirical findings indicate that the sectoral reallocation can indeed be much influential to aggregate unemployment levels in a substantive dimension. Moreover, Lilien proves that a strong positive relationship between the dispersion in observed employment growth rates across sectors and unemployment exists and, for the period under study, shows that the natural rate of unemployment, fluctuates considerably a lot and it tracks the movements of the aggregate unemployment rate reasonably well. A last but not least finding is the fact that the variation in natural rate may spell out "over half" of the deviations of the aggregate unemployment rate.

Abraham and Katz (1986) argue that when industries differ in their sensitivity to aggregate shocks, Lilien's empirical measure of dispersion can be correlated with the aggregate unemployment rate even in the absence of sectoral shifts. Positive correlation may exist even if there are differences in industry trend growth rates provided that these differences are not important. They present a new perspective, that information on job vacancies can be used to distinguish between the pure sectoral shift hypothesis and the pure aggregate demand hypothesis. In order to capture the job vacancy rate they use as a proxy the number of vacant jobs as described by the Help Wanted index for the U.S and Britain. According to their pure sectoral scenario, there is a positive correlation between σ and unemployment (U) as long as between σ and V, where V is constructed to represent the job vacancy rate. On the other hand, pure aggregate demand scenario implies again a positive relation of σ and unemployment (U), but an inverse relationship between σ and V because strong demand reduces the unemployed people thus raises the number of vacant jobs and the opposite. Holding fixed the characteristics of the economy, an increase in unemployment rate caused by a negative shock may lead to decrease in the job vacancy rate. On the contrary, if there are changes in the structural characteristics, an increase in the unemployment caused by an increase in dispersion of employment growth rates should be accompanied by an increase in the job vacancy. Thus, the behavior of job vacancies plays an important role in the correlation. The fact that σ moves in the opposite direction suggests that aggregate demand fluctuations, not sectoral shifts, are responsible for the positive relationship between σ and U. They also argue that for the creation of the dispersion index both monetary and non-monetary aggregate effects on employment growth rates must be purged. Their empirical findings contradict Lilien's results on the basis that the exclusion of aggregate monetary and non-monetary effects leads to an insignificant value of the dispersion index in the long run horizon and that variation in natural rate is much smaller compared to what Lilien detects and presents.

Following Lilien's previous work, Samson (1985) studies Canadian unemployment for the period 1957-1983 and points out that shocks to the economy, and in particular to a small open economy, can induce significant variation to the unemployment rate. Due to the fact that real shocks necessitate a continuous reallocation of labor from declining to expanding sectors, an increase in unemployment rate is unavoidable. To testify this, an equation describing the component of monetary policy is firstly approximated. Then, this part is incorporated to the main unemployment equation and the dispersion-of-employment variable as long as lagged values of unemployment are added to the regression. Both monetary policy (especially its lagged values) and the dispersion measure seem to have a significant and relative stable impact on unemployment rate. Interestingly, the new element introduced here is the fact that Canada and the United States are highly integrated economies as far as their levels of production and trade is concerned; as a result, there may be observed a transmission of the business cycle from the much larger economy to the smaller one. From the equations that include both economies, it becomes apparent that the U.S business cycle is transmitted in Canada through sectoral shifts in employment demand and cause fluctuations in aggregate Canadian unemployment.

Another research for the consideration of the intersectional shifts hypothesis is that of McCallum's (1987). He attempts to explain fluctuations of both the Canadian unemployment rate and the Canada-U.S unemployment gap over the postwar period. Unemployment rate is extracted and calculated through reduced form equations using variables of labor market, sectoral shifts, aggregate demand and the unexplained component of the unemployment rate, in order to determine which of them causes the most fluctuations of unemployment. To specify the sectoral shift variable, he not only relies on Lilien-type dispersion indexes but he also presents specific events and shocks as sources of these shifts such as, changes in oil prices, labor reallocation in durable manufacturing or smokestack industries and the relative world prices that Canada resource sector experiences. Results support the "monetarists" and not Lilien's view because analysis show that aggregate demand (monetary variables) is the prime determinant of the movements of unemployment rate and that intersectional shift hypothesis variable, although identified, play a secondary role in relation to aggregate demand.

A further study on Canadian unemployment is documented by Neelin (1987) who at a first stage decomposes Lilien's shift measure into parts explained and unexplained (exogenous) by aggregate activity and then adds them into the unemployment equation. Neelin's departure from previous works is that sectors are defined by using data about the actual frontiers to mobility between industries and regions. Hence, sectors are determined in three different ways: those across industries, those across regions and those across both industries and regions. Moreover, another three sectoral shift indices are set up using observed, predicted and residual employment growth rates. Results from regressions show that, when unemployment equation is estimated using total variance of industry employment growth rates, sectoral switching does influence unemployment. But, when using variance divided into the two parts mentioned above, only the part of the shift measure explained by aggregate activity seems to have significant effect on unemployment equation. It is also cited that, only exogenous (unexplained) shifts rather than explained or total shifts, as measured by the variance *across regions*, do have a significantly positive effect on the fluctuations of the unemployment rate, while exogenous (unexplained) shifts , as measured by the variance of employment *across industries*, do not seem to have an important influence.

Loungani (1986) , influenced by Hamilton's (1983) previous work which shows that oil prices Granger-cause unemployment, conducts an analysis incorporating the oil price variable into the unemployment equation. Although Lilien-type dispersion measures are adopted, the point of his innovation is that he decomposes dispersion index into two sections: on the one hand he constructs a dispersion index caused by the changes (shocks) in oil prices and on the other he measures the residuals dispersion. By this separation, it is indicative that if there are no shocks in the world oil market, the process of labor force switching can be accomplished without generating notable rates of unemployment, thus, reallocative shocks alone are not a major source of the variation in unemployment. Using data over the period 1947-1982, and more specifically focusing on the 1950's and 1970's when there have been dramatic increases in oil prices, the importance of the oil prices movements into calculating unemployment rate in addition to the positive correlation between the two is demonstrated. In the end, there are claims that when the relative price of oil is stable or held fixed, Lilien-type dispersion measures have no residual explanatory power for the variation in unemployment rate.

Davis (1987) stimulates further research directed towards realizing the outcomes of sectoral (distributional) shocks and the importance of fluctuations in labor reallocation. Research's main corollary is that increases (decreases) in unemployment rates coincide with increases (decreases) in the flow rate of "persons into or out of the unemployment pool". What is more, the direction of labor reallocation is explored by regressing unemployment on Lilien-type dispersion measures, unanticipated monetary policy and other proxies of financial variables in addition to variables proxying previous values of labor switching. There is also strong evidence that unemployment's response to a reallocation shock depends on *past patterns* of labor reallocation. It is underlined that, due to the influence of those patterns, it is reasonable to expect that an unfavorable disturbance would increase unemployment relatively more than a favorable one. In general, support is given to sectoral shifts view but argues that the relationship between unemployment and dispersion is not independent of the stage of the business cycle; Davis introduces the "stage-of-business-cycle" effect in the relationship which implies that movements across sectors induce a certain amount of foregone production and if this amount associated with unemployment is procyclical, then there would be incentives for less measured unemployment during expansions and more during recessions. A final point to state is that, in order to determine variations in economy it is necessary to take into account the correlation and interaction between allocative and aggregate shocks.

In favor of the sectoral shift hypothesis, Mills, Pelloni and Zervoyianni (1995) further examine unemployment fluctuations in the United States for the period 1960-1991 extending previous research and using a more recent sample. They test not only Lilien's original hypothesis but also Davis' stage-of-business-cycle effect as described previously. In more technical terms, stage-of-business-cycle effect is moderated by firstly detrending the logarithmic value of real GNP and the residuals of this process are used as a proxy for the business cycle. It occurs that dispersion does influence unemployment rate and that expected money growth as long as exports have a negative short run effect on the natural rate with the exception of the change in interest rates, which although initially seem to have a negative relation, eventually influence positively unemployment, perhaps due to working capital costs of firms.

Results confirm sectoral shifts proposition for the U.S even when dispersion measure is “purged of” the unemployment equation.

Mills, Pelloni and Zervoyianni (1996 and 1997) extend their analysis focusing for the first time on United Kingdom data. In their 1996 paper, the dispersion index is purged of both aggregate and real shocks in order to overcome the problem of ‘observational equivalence’ that sectoral shifts field faces. Studying period 1976-1991, find out that the dispersion proxy has an important positive effect on the UK unemployment. This fact continues to affect unemployment rate even when the dispersion index is replaced by a variant purged of aggregate effects, a result that is in contrast to other studies which typically support that the purged index has an insignificant impact on the behavior of unemployment. Furthermore, their 1997 paper presents estimates using annual data for the UK again but for a more wide range from 1958-1992. Variables that affect unemployment are divided into two categories: those that influence permanently or temporarily the unemployment rate and those that bring about fluctuations around it. Model is enriched with new factors that tend to develop fluctuations of employment, by introducing the variables of union power - as measured by industrial disputes per year- , changes in raw material prices, unemployment benefits and cuts (shocks) in real government expenditure. Overall, it becomes apparent that the unexpected monetary policy has the largest impact on unemployment rate in addition to the high significance of the variables of union power and unemployment benefits.

Samson (1990) again attempts to investigate the behavior of unemployment rates giving additional empirical evidence of seven industrialized countries over the post-war period. These countries are Canada, United States, France Germany, Italy, Japan and the United Kingdom. For the beginning, a money growth equation (reaction function) is presented from which both anticipated and unanticipated components are derived and these ‘derivatives’ are incorporated into the unemployment equation in order to measure the effects of aggregate demand. Moreover, the monetary equation includes previous values of unemployment so as to notice the possible existence of counter cyclical policies, lagged monetary variables showing the continuity in monetary policy and a balance of payments variable standing for government’s reaction to Current Account. Then, the residuals from this equation are used to construct the dispersion variable. For all seven countries the neutrality of anticipated monetary policy is established, giving support to previous studies that handle and perform models only with unanticipated variables. As far as the U.S and the Canadian data is concerned, previous results from her 1985 paper are confirmed explaining that there exists a high level of integration between the two, and that the U.S has much influence on the Canadian unemployment rate, with the opposite not true. It also appears that sectoral shifts hypothesis does not hold for the U.S and that the dispersion variable has a low explanatory power in understanding what causes unemployment. On the other hand, fluctuations in the Canadian unemployment rate are mainly caused by sectoral shifts and a possible explanation for this is the fact that, in the structure of the Canadian economy, it takes long time on average for a laid-off worker to find a new job. For the European countries plus Japan, it is demonstrated that there is a high degree of responsiveness of unemployment rate to sectoral switching, with the exception of Italy. This exception is attributed to the different structure of the Italian economy and to a possible discontinuity in some of the data for this country.

Further evidence is provided by Van Ours and Van der Tak (1992) who conduct an empirical analysis for the Nederland's over the period 1971-1987. They examine a small sample period because they want to exclude sixties when a structural break in the performance of the Dutch labor market took place. Also, the unanticipated monetary growth variable is excluded from the (Lilien-type) unemployment equation due to no significance. Considering their results, an explanation for the correlation between the dispersion index and unemployment is given. Since aggregate demand and labor reallocation (sectoral shifts) are correlated and sectoral shifts and unemployment are correlated too, then it follows that there exists a positive relationship between dispersion in aggregate demand and unemployment. On the contrary, it appears to be a negative correlation between dispersion and number of vacancies.

Brainard and Cutler (1993) develop a new measure of reallocation disturbances, termed "cross-section volatility", based on the variance of firms' stock market excess returns for the postwar period in the United States. To be more specific, series are constructed from the sectoral dispersion in stock market returns i.e., a weighted standard deviation of industry stock returns, in order to capture sectoral shocks. This path is chosen because the Capital Asset Pricing Model (CAPM) provides an adequate method for separating cyclical and reallocation movements in stock prices. After proving that excess returns can predict increases in employment across sectors of an economy, the relationship among cross-section volatility and unemployment is further studied. Indeed, they point out that there exists a positive correlation between the two. Interpreting their findings, it is stated that, although cross-section volatility has impact on unemployment, the magnitude of this response is not large, implying that only very large shocks would be needed to account for the increases in unemployment especially during recessions.

In accordance with the methodology of Brainard and Cutler (1993), Fortin and Araar (1997) in their study apply a stock price dispersion index to Canadian data in order to assess the importance of sectoral shocks on the unemployment rate. Explaining the reason for choosing this index, it emerges that a stock market dispersion index performs better than Lilien's index and provides an indication (signal) for the required reallocation of capital and labor. Reduced-forms models for measuring unemployment are estimated witnessing that sectoral dispersion of stock prices has a significant effect on unemployment rates. However, the contribution of this variable to explain volatility in unemployment rates is rather small when associated with important recessions such as for the periods 1981-82 and 1990-92. Furthermore, a discrimination is made between sectoral shocks and aggregate activity in order to decide which has the greater impact; data show that aggregate activity disturbances give a better explanation for the swings in unemployment. On the whole, there is a doubt about the sectoral shifts explanation for the short run variation of the unemployment in Canada and attribute this mainly to aggregate demand shocks.

Moreover, Loungani and Trehan (1997) influenced by Black's (1987) proposition that, "periods of greater dispersion in stock returns should be followed by increases in unemployment", incorporate a stock market-based measure of sectoral shocks in a Vector Autoregressive (VAR) to examine the role these shocks play in explaining the behavior of the unemployment rate and its duration. Authors choose this kind of dispersion measure because it gives an "early signal of shocks that affect sectors differently" (Black 1995) which means that an increase in stock market dispersion, due to for example the arrival of news, will be followed by a change in output mix which necessitates labor reallocation and finally will lead to an increase in unemployment rate. In addition to the stock market price dispersion index and unemployment, three other variables are employed: real GDP, fed funds and the S&P500 index. Empirical evidence for U.S. for the period 1971-1995 shows that sectoral shocks explain a significant proportion of the variation in the unemployment rate and especially the long duration unemployment rate. As long as the other shocks (such as shocks to monetary policy, expenditures, and oil prices) are concerned they find that they can also affect the unemployment rate. Overall, it is illustrated that sectoral shifts, as measured by the stock market index, explain a significant proportion of the variation in the unemployment rate.

More recently, Sakata (2002) explores the validity of the sectoral shifts hypothesis for Japan over the period 1973 to 1999 using quarterly data. This sample period is of great interest since it involves data from both before and after the collapse of the bubble economy, revealing the structural change in the Japanese labor market. Sakata employs two proxy variables to measure sectoral shifts: a Lilien-type index and a purged dispersion index which incorporates the criticism of Abraham and Katz (1986). A remarkable difference from previous studies is that he not only provides an analysis for aggregate unemployment but he separates male from female unemployment levels. Empirical evidence for Japan confirms a short-term relationship between sectoral switching and unemployment, but, this does not stand true in the long-run. However, another important point to refer to is that, when the dispersion measure interacts with the stage-of-business-cycle effects, a positive relationship is developed between sectoral labor changes and unemployment's volatility. Since the gender difference proves to be a serious matter in the Japanese labor market, Sakata finds out that, for the case of male unemployment there is a significant short-run impact of sectoral shifts, while for females there is no impact at all. Finally, stage-of-business-cycle effects are reported for both gender groups.

A further study is that of Shin's (1997) who attempts to explore unemployment behavior through reallocation that takes place intersectoral and intrasectoral. By this means that intersectoral shocks premise resource reallocation across sectors, while intrasectoral shocks premise reallocation within sectors. The main difference, as he points out, between these shocks is that the former require higher adjustment costs than the latter. In order to derive proxies for these shocks, he operates with data that calculate returns on capital in manufacturing industries. Evidence shows that unemployment is more susceptible to intrasectoral shocks rather than intersectoral shocks. However, as a conclusion, intersectoral disturbances can explain aggregate unemployment levels better than intrasectoral disturbances, despite the fact that the importance degree of intrasectoral shocks is greater. A final but important observation is that differences in labor mobility across sectors in comparison to those within a sector can be the clues in analyzing the mechanism through which intersectoral rather than intrasectoral disturbances are transmitted to the so often superior levels of unemployment**.**

Worth mentioning the case of the Italian labour market which Garonna and Sica (2000) study. It is characteristic, like in most European countries, a cyclical responsiveness of the service sector related with firing and manufacturing costs. This provides an explanation for the negative relationship between sectoral shifts and unemployment in Italy during the post-war period. Empirical results confirm that Lilien's sectoral shifts hypothesis is valid but with the opposite sign. Thus, given the structural features of the Italian labour market, they come to the rather 'peculiar' conclusion that a possible fall in intersectoral or interregional shifts can lead to the increase of unemployment rate in Italy, or in other words, labor reallocation in Italy can reduce unemployment, rather than increase it. Also, it is proposed that new hires, the emergence of new sectors, the expansion in existing sectors, sectoral shifts and regional mobility can maintain unemployment rate down.

Reicher (2011) compares the aggregate impacts that sectoral shifts have in the U.S. and German unemployment. Data for the U.S. comprise output and unemployment of 14 sectors from which 5 big sectors after 1960 are constructed. German data include GDP and unemployment for 5 sectors after 1991. Using a stochastic volatility model, Bayesian methods and Markov Chain Monte Carlo algorithm it is shown that reallocation shocks do not affect unemployment rate for both U.S and Germany and that the business cycle is less persistent in the United States than in Germany. Finally, the construction sector for the U.S and manufacturing plus mining sector for Germany proves to play an important role in reallocative dynamics.

A very recent and pioneering work concerning the relationship between job reallocation component and its volatility is provided by Liu (2013). Although there is limited knowledge about the driving force that causes excess job reallocation, the motive for examining job reallocation arise from the fact that reallocation influences the restructuring activities of firms over the business cycle. Thus, a dynamic latent factor model is developed using data from fifty United States in addition to the District of Columbia. This model decomposes the excess allocation into national, regional and state-specific component for undertaking a thorough investigation. Labor allocation disturbances, as expressed by the three components, indeed are found to play dominant role in driving job reallocation and explain fluctuations to some extent. Briefly, the national allocation component tracks better excess job reallocation movements (variance) in small businesses across regions compared to the state-specific component which explains better this phenomenon for larger business. However, the regional reallocation factor reflects only a small fraction of the excess reallocation volatility.

A summary of the literature is provided in Table 1 where the methodology used and the main results are presented.

Table 1 : Summary of Literature Review

Author(s)	Data employed - Sample period	Methodology	Empirical results
Lilien (1982)	U.S annual data 1948-1980	OLS estimation. Proxy σ (dispersion measure) is constructed using common 11-industry composition.	Sectoral shifts hypothesis has significant effect on unemployment rate. Positive relationship between dispersion measure (σ) and unemployment. Natural rate and its variation explain well the variation of the aggregate unemployment.
Abraham and Katz (1986)	U.S annual data 1949-1980 U.K annual data 1961-1981	OLS models for unemployment and 'help wanted index' as the dependent variables. Proxy constructed using common 11-industry composition.	Discrimination between the pure sectoral shift and the pure aggregate demand hypothesis using information on job vacancies. Aggregate demand fluctuations, not sectoral shifts, are responsible for the positive relationship between σ and unemployment. Unemployment equation purged of aggregate monetary and non-monetary effects show that σ has no significant long-run effect on the unemployment rate. Fluctuations of natural rate much smaller than Lilien's findings.
Samson (1985)	Canadian annual data 1954-1983	OLS methodology. Proxy constructed using common 11-canadian industry composition.	Lagged monetary values and dispersion measure have significant impact on unemployment. Due to high integration between U.S and Canadian economy, U.S business cycle is transmitted in Canada through sectoral shifts in employment demand and cause fluctuations in Canadian unemployment.

Table 1 (cont'd) : Summary of Literature Review			
Author(s)	**Data for equations - Sample period**	**Methodology**	**Empirical results**
McCallum (1987)	U.S. and Canadian annual data 1954-1985	OLS in simple form and OLS regressions of unemployment gap between the 2 countries.	Aggregate demand is the prime determinant of the movements of unemployment rate. Sectoral shifts hypothesis valid but plays a secondary role in relation to aggregate demand.
Neelin (1987)	Canadian annual data 1961-1983	OLS methodology. Proxy constructed using 45 sectors defined across industries, across regions and across both.	Sectoral shifts in general influence unemployment. Only exogenous (unexplained) shifts measured by the variance *across regions*, have a significantly positive effect on the fluctuations of the unemployment rate.
Loungani (1986)	U.S. quarterly data 1947-1982	OLS methodology. Proxy constructed using 28 industries and a proxy that captures shocks in oil prices.	If there are no shocks in the world oil market, sectoral shifts hypothesis has no significant effect on unemployment.
Davis (1987)	U.S annual data 1924-1985	OLS regressions and Lilien-type proxy.	Past patterns of labor reallocation influence unemployment. "Stage-of-business-cycle" effect reported that causes less measured unemployment during expansions and more during recessions.

Table 1 (cont'd) : Summary of Literature Review			
Author(s)	**Data for equations - Sample period**	**Methodology**	**Empirical results**
Mills, Pelloni and Zervoyianni (1995)	U.S quarterly data 1960-1991	OLS regressions. Proxy constructed using 30 industries.	Sectoral shifts hypothesis valid even without the dispersion measure. Expected money growth and exports have a negative short-run effect on natural rate and interest rates a positive impact.
Mills, Pelloni and Zervoyianni (1996)	U.K quarterly data 1976-1991	OLS methodology. Proxy constructed using 25 industries	Dispersion measure has important positive effect on the UK unemployment.
Mills ,Pelloni and Zervoyianni (1997)	U.K annual data 1958-1992	OLS methodology.	Not labor reallocation but unexpected monetary policy, union power and unemployment benefits have the largest impact on unemployment rate.
Samson (1990)	Canadian annual data 1957-1984 French & German annual data 1958-1981 Italian annual data 1957-1981 Japaneese annual data 1960-1982 U.K. annual data 1958-1982 U.S. annual data 1951-1984	OLS methodology.	High integration between U.S. and Canada with the U.S. unemployment affecting the Canadian. Labor reallocation has effect on unemployment in Canada but not in the U.S. Japan and all European countries, except Italy, support the sectoral shifts hypothesis.

Table 1 (cont'd) : Summary of Literature Review			
Author(s)	**Data for equations - Sample period**	**Methodology**	**Empirical results**
Van Ours and Van der Tak (1992)	Dutch annual data 1971-1987	OLS methodology.	Positive relationship between dispersion in aggregate demand and unemployment. On the contrary, negative correlation between dispersion and number of vacancies.
Brainard and Cutler (1993)	U.S. quarterly data 1948.1-1991.2	OLS methodology. Proxy of sectoral dispersion in stock market returns. (cross section volatility)	Positive correlation between cross-section volatility and unemployment. For this correlation to be strong very large shocks are needed.
Fortin and Araar (1997)	Canadian quarterly data 1972-1990	OLS methodology. Proxy of stock price dispersion index (as Brainard & Cutler).	Sectoral shifts hypothesis not valid since short-term volatility in the Canadian unemployment is due to aggregate demand shocks and not to labor reallocation.
Loungani and Trehan (1997)	U.S. quarterly data 1971-1995	VAR estimations. Proxy of stock price dispersion index.	Sectoral shifts, as measured by the stock market index, explain fluctuation in the unemployment rate and are the main determinants of the unemployment duration.

Table 1 (cont'd) : Summary of Literature Review

Author(s)	Data for equations - Sample period	Methodology	Empirical results
Sakata (2002)	Japanese quarterly data 1973-1999 Japanese half-year data 1973-1998	OLS methodology. Lilien-type index and a purged dispersion index. Separation between male and female unemployment.	Sectoral shifts affect unemployment only in the short-run. When the dispersion measure is interacted with stage-of-business-cycle effects unemployment is positively correlated with sectoral shifts. Significant impact of sectoral shifts only on male unemployment rate.
Shin (1997)	U.S. data two sample periods :1972-1991 and 1961-1991 both annual	OLS methodology. Proxies of inter- and intrasectoral shocks.	Intersectoral shocks explain aggregate unemployment better than intrasectoral shocks. Intersectoral shocks which require the movement of workers across industries have a greater effect on unemployment.
Garonna and Sica (2000)	Italian annual data 1951-1994	OLS methodology.	Sectoral shifts hypothesis is valid but with the opposite sign. Negative relationship between sectoral shifts and unemployment in Italy due to the structural features of the Italian labor market.

Table 1 (cont'd) : Summary of Literature Review			
Author(s)	**Data for equations - Sample period**	**Methodology**	**Empirical results**
Reicher (2011)	U.S data from 1960 Western Germany data after 1991	Stochastic volatility model Bayesian methods and Markov Chain Monte Carlo algorithm Proxy constructed using 14 industries for both countries and this proxy collapses to 5 big sectors	Reallocation disturbances have no significant impact on unemployment for both U.S. and Germany. What is more, a limited persistence of reallocation effect on the U.S. business cycle is indicated and the role of construction sector for the U.S and manufacturing plus mining sector for Germany is highlighted as a consequence in reallocation process.
Liu (2013)	U.S. (regional) plus District of Columbia annual data 1977-2009	Variance decompositions. Model decomposes the excess allocation into national, regional and state-specific factors.	National and state-specific reallocation components play an important role in explaining the excess job reallocation variance. Regional factor contributes to a smaller fraction of the excess volatility.

4. Data

In our effort to investigate the sectoral shifts hypothesis for Canada and its regions we collect data from the Statistics Canada database as long as data are available on the Organization for Economic Co-operation and Development (OECD). Since our analysis includes regions of Canada, it is worth mentioning geographically these areas which are: Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, Quebec and Saskatchewan. For the rest of Northwest Territories in addition to Nunavut and Yukon, no information is available and there are also of no significance, given their limited population.

The sample period covers nearly four decades; monthly observations run from January 1976 to December 2011, giving 432 data points for the simple regressions and 4320 data points for the panel analysis of the ten regions. To be more specific, monthly observations for employment and unemployment both in rates and in thousands employees are used. Moreover, since we concentrate on Lilien's dispersion measure which is a weighted standard deviation of observed sectoral employment growth rates about aggregate employment growth, we construct this proxy by taking numbers of employed people in each sector of Canada and in each sector of each region. For the creation of this dispersion proxy, we undertake an 18-Canadian industry composition, but this process is described more analytically in the methodology section which follows. The confirmation of the sectoral shifts hypothesis implies that the *dispersion index* would be statistically significant meaning that job reallocation strongly affects unemployment. Furthermore, we incorporate in our study some more independent variables which we believe that may have an influence on unemployment rates and strengthen sectoral shifts hypothesis. In short, these variables are: *money supply index M2, interest rates, exchange rates, deficit to GDP ratio, energy price index and immigration levels* for Canada. A more extensive discussion for the choice of those variables is done in the paragraph that follows.

In order to capture the impact of monetary policy, data are included as described by *money supply* measure M2 which represents money and close substitutes for money. Governments and their policies play a major part in 'fueling' certain sectors of the economy. For example, a restrictive monetary policy, which is expressed by little money in circulation, can lead to higher levels of unemployment and this is the reason for expecting a negative relationship between the monetary variable and unemployment. In addition, since *interest rates* may indirectly affect monetary policy and subsequently unemployment, we use short term interests which we chose to be drawn from the 1-3 year Government of Canada marketable bond. We expect to find a positive sign between interest rates and unemployment because high rates make unemployed workers more likely to cease searching, as the returns from finding a job with significant rents are lower. Thus, if interest rates go up, the present value of future wages is lower and workers are not willing to stay in their current job. However, there is, on the other hand, another interpretation for the case of high interest rates; if they are high, job seekers want to take a job, since their returns from investing their wage may be high and this fact implies that high interest rates reduces unemployment (opposite signs). Also, the role of *exchange rates* between Canada and the United States is investigated through regression equations because these two economies are considered to be high integrated. The variable of exchange rates is given by units of Canadian dollars per unit of U.S dollar (USD/CAD). Appreciation of the domestic currency can lead to fall in net exports, reduction in demand and output and as consequence workers permanently or temporary may lose their jobs (positive relationhip). Additionally, for the inspection of fiscal's policy possible impact on unemployment, we embody in our analysis the variable of *deficit as a percentage of Gross Domestic Product (GDP)*. The inclusion of this variable is done because deficit to GDP ratio is a very important indicator for a country and its economy and it is usually provided in national accounts annually so we convert it into monthly observations for the period needed. For this variable we expect to find a negative coefficient, because in cases of crisis, governments spend large amounts of money to save the banking system from collapse and this drives the country to a huge increase in deficit. As far as *energy* is concerned, we keep in our minds how much influence have international energy markets on employment and in times of crisis may cause serious problems in industries; higher energy prices increase the production costs for firms and can end up in fired people. Last but not least, *immigration levels* for Canada and its regions are used as a regressor in order to valuate if it plays an important role in influencing labor force and as a consequence unemployment rate. It is controversial if immigration is a problem, but for our analysis we admit that illegal immigrants constitute a cheaper workforce, employees prefer them in order to avoid taxation and other charges and this corruption cycle results in higher levels of unemployment.

4.1 Descriptive Statistics of the data

Before proceeding to empirical results, a very interesting part is the representation of the descriptive statistics provided by the program histograms which give an overall depiction of our time series data and their variability. The Figures 1-8 reveal that unemployment rates for Canada and all regions have much volatility. High levels of unemployment are identified for all areas during 1982-1984 and for the most of them during 1991-1994.

Figure 1: Unemployment rates in Canada and regions

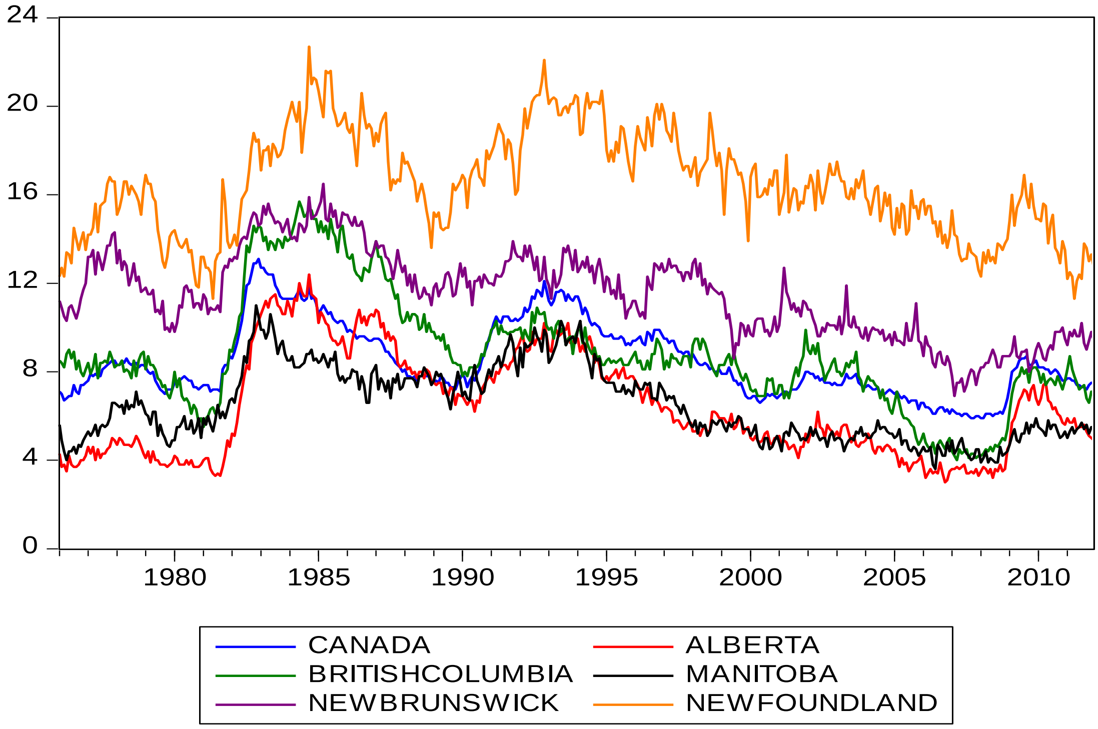
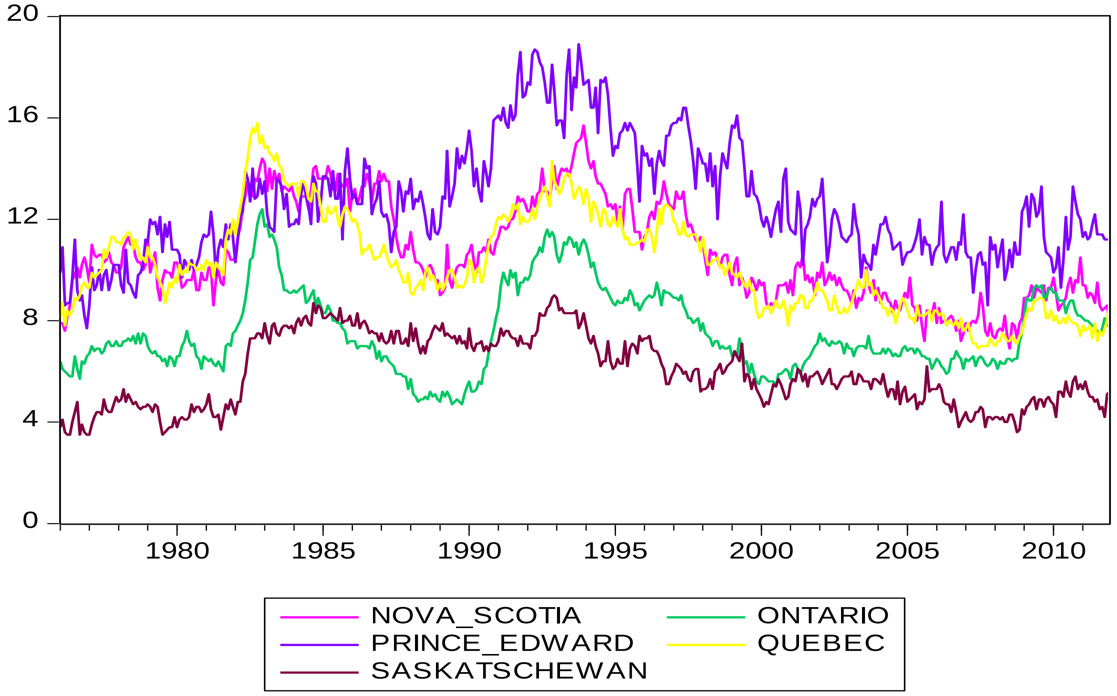


Figure 2 : Unemployment rates in regions (the rest regions)



The same conclusion about much volatility comes out from the graphs of deficit to GDP ratio, money supply, energy index, interest and exchange rates as long as immigration. Those facts are also confirmed by the Augmented Dickey-Fuller and Philips-Perron tests for stationarity (Appendix, Table A) and all variables are stationary only in their first differences. However, for our aim, we treat all variables as being stationary.

Figure 3 : Deficit to GDP ratio

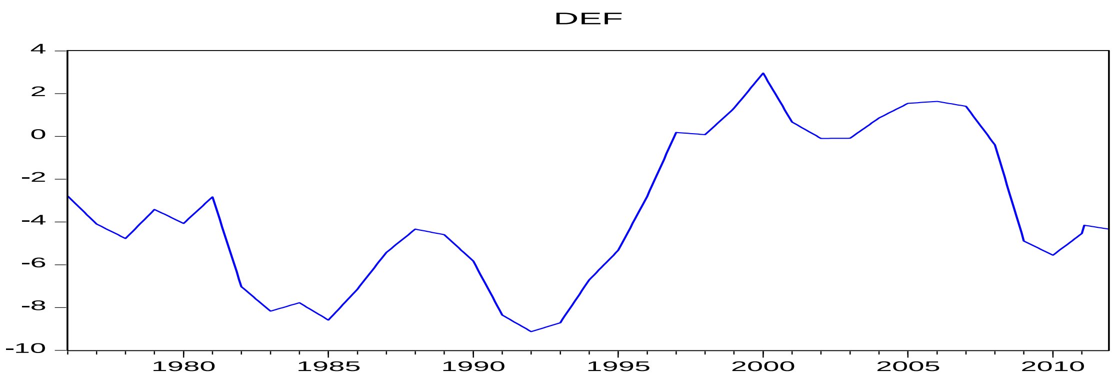


Figure 4 : Money supply M2

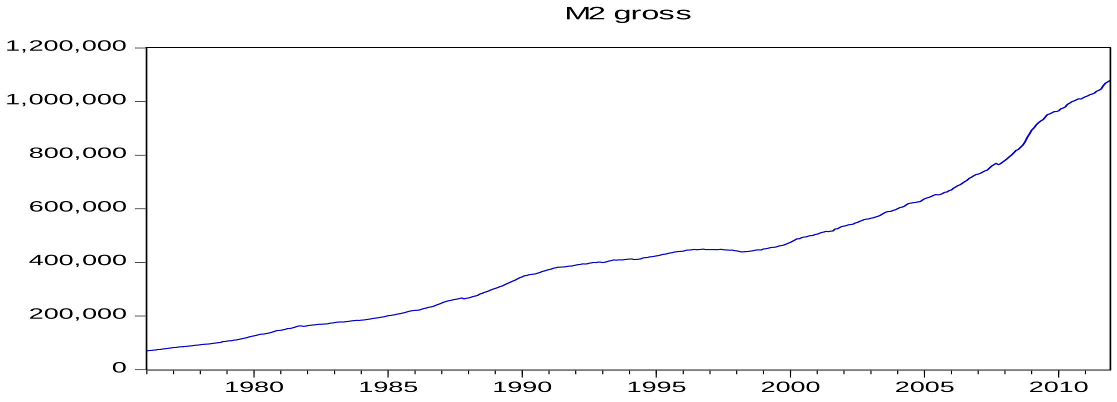


Figure 5 : Energy Price Index

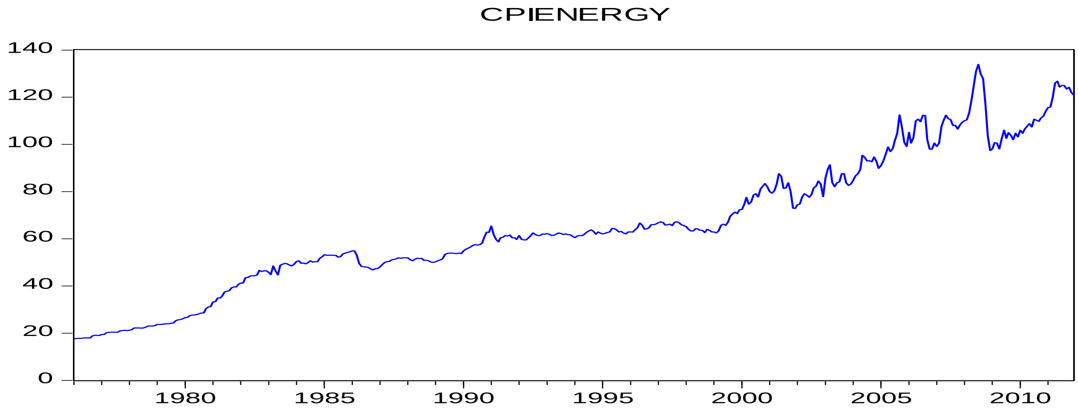


Figure 6 : Short-term interest rate (1-3 years Government bond)

Figure 7 : Exchange rates (Canada-U.S.)

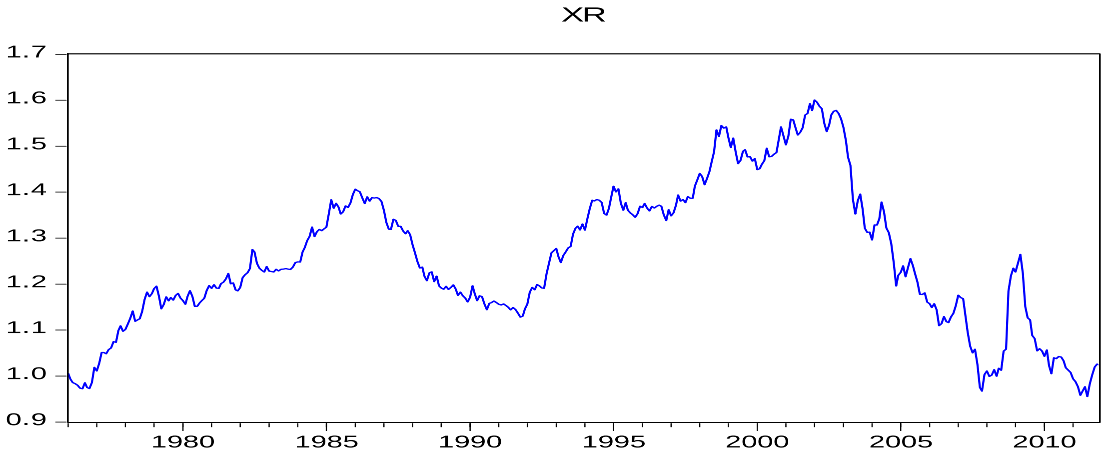
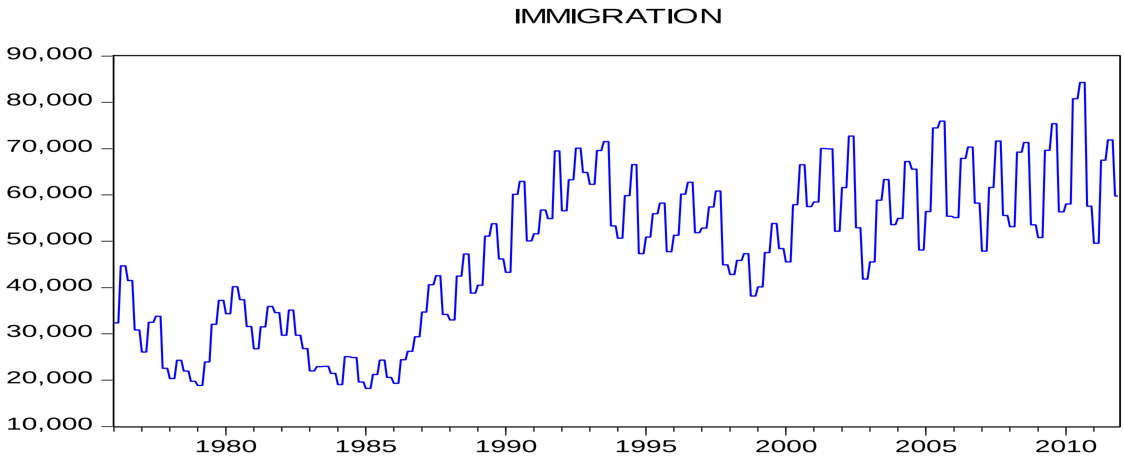


Figure 8 : Immigration rates in Canada



More compactly, all important descriptive statistics are presented in Tables 2 and 3 that follow. Mean and Standard Deviation are computed using the standard formulae:

$$\bar{y} = \sum_{t=1}^{T} y_t / T \quad \text{and} \quad s_y = \sqrt{\sum_{t=1}^{T} (y_t - \bar{y})^2 / (T-1)} \quad \text{respectively.}$$

Skewness is a measure of the asymmetry of the probability distribution of random variables; if skewness is a positive number implies that the right tail of the distribution is fatter than the left tail or, in other words, positive values around mean tend to occur more often than large negative ones. In our data this is true for all variables except of immigration. Another important indicator is kurtosis. For normal distribution kurtosis is equal to 3 and higher kurtosis means that more of the variance is the result of infrequent extreme deviations, as opposed to frequent modestly sized deviations. Here, when kurtosis is lower than 3, the distribution is platykurtic and when greater than 3 is leptokurtic. As far as Jarque–Bera is concerned, in statistics this test is a goodness-of-fit test of whether sample data have the skewness and kurtosis matching a normal distribution. For normal distribution Jarque-Bera is close to 5.14. The non existence of normality is also indicated by Probability where the null hypothesis for normal distribution is strongly rejected as Prob is 0.000.

Table 2 : Descriptive Statistics for Unemployment rates in Canada and regions

	Canada	**Alberta**	**British Columbia**	**Manitoba**	**New Brunswick**	**Newfoundland and Labrator**
Mean	8.495	6.445	8.795	6.481	11.513	16.502
St.Deviation	1.662	2.363	2.571	1.666	1.973	2.346
Skewness	0.696	0.538	0.705	0.501	0.064	0.099
Kurtosis	2.610	2.122	3.360	2.187	2.303	2.267
Jarque-Bera	37.613	34.707	38.128	29.292	9.035	10.376
Prob	0.000	0.000	0.000	0.000	0.000	0.005
	Nova Scotia	**Ontario**	**Prince Edward**	**Quebec**	**Saskatchewan**	
Mean	10.656	7.548	12.641	10.220	5.970	
St.Deviation	1.935	1.634	2.282	1.964	1.410	
Skewness	0.362	0.708	0.635	0.455	0.165	
Kurtosis	2.070	2.901	2.839	2.407	1.821	
Jarque-Bera	25.009	36.284	29.575	20.058	27.005	
Prob	0.000	0.000	0.000	0.000	0.000	

Table 3 : Descriptive Statistics for variables-regressors (Canada)

	Deficit to GDP ratio	M2	Energy price Index	Interest rate (1-3 year government bond)	Exchange rate	Immigration
Mean	-3.535	42672	65.555	7.076	1.255	47716.67
St.Deviation	3.459	257435	27.864	3.763	0.157	16489.81
Skewness	0.175	0.702	0.321	0.435	0.172	-0.119
Kurtosis	1.778	2.819	2.458	2.722	2.318	2.033
Jarque-Bera	29.084	36.127	12.710	15.024	10.504	2.0332
Prob	0.000	0.000	0.000	0.000	0.000	0.005

4.2 Modeling Sectoral Shifts

The approach taken by Lilien (1982) and subsequent researchers is to investigate the significance of the dispersion of employment as variable explaining movements in the rate of unemployment. For empirical purposes, Lilien represents employment dispersion by a weighted standard deviation of observed sectoral employment growth rates about aggregate employment growth. In our study we distinguish 18 sectors. These sectors are shown in Table 4 below.

Table 4 : Canadian sectors

sector 1	Goods-producing sector	sector 10	Finance insurance real estate and leasing
sector 2	Agriculture	sector 11	Professional, Scientific and technical Services
sector 3	Forestry, Fishing, Mining quarrying, Oil and gas	sector 12	Business building and other support Services
sector 4	Utilities	sector 13	Educational Services
sector 5	Construction	sector 14	Health care and Social Assistance
sector 6	Manufacturing	sector 15	Information culture and recreation
sector 7	Services-producing sector	sector 16	Accommodation and Food Services
sector 8	Trade	sector 17	Other Services
sector 9	Transportation and warehousing	sector 18	Public Administration

The dispersion measure, whose job is to capture the effect of sectoral shifts in employment demand, is constructed according to the following 18-industry decomposition of aggregate employment type:

$$\sigma_t = \left[\sum_{i=1}^{18} \left(e_{it} / E_t \right) \left(\Delta \log e_{it} - \Delta \log E_t \right)^2 \right]^{1/2}$$

where e_{it} is employment in industry-sector i , with i summing up to total 18 sectors and E_t represents aggregate employment.

It is of great interest to examine the relationship between employment dispersion and unemployment more clearly, and, for this reason, we plot the dispersion index in accordance with the national (aggregate for Canada) and regional unemployment rate. Figure 9 demonstrates the strongly countercyclical behavior of the dispersion series and we expect that the movements of unemployment rate and dispersion are of the same sign. Interpreting Lilien's dispersion measure as an indicator of the reallocative process, we can conclude that during recessions, such as years 1982-1984 and 1991-1994 where unemployment rates are higher there is less reallocation since the peaks during these periods are smaller. For now, however, as the figures display, we contend, that the dispersion index is a poor indicator of the level of sectoral shifting because it cannot capture the permanence of changes in employment between different sectors. For some periods although, there exists a positive relationship, with high unemployment rates associated with high levels of dispersion and vice versa. This stands true during year 2009 for aggregate Canada, Alberta, British Columbia Ontario and Quebec where we can observe much volatility in dispersion measure accompanied by the expansion of unemployment rates. For Ontario this happens during 1982 and more recently during 2009 and for Newfoundland and Labrador in year 1992.

For the needs of our analysis we employ a typical Barro-type (1977) unemployment equation in which the rate of unemployment is modeled as a function of unanticipated and anticipated money growth, plus a variety of other variables, including past lag of the unemployment rate itself. Thus, the simple regression equation consists of:

(i) the dispersion index σ_t as described previously,

(ii) the fiscal policy component as denoted by the deficit to GDP ratio (DEF_t)

(iii) the monetary policy components as illustrated through the difference of logarithmic values of money supply index M2 (DMR_t) as long as the series of interest (IR_t) and exchange rates (XR_t),

(iv) the difference of logarithms of energy price index ($CPIE_t$),

(v) the immigration numbers for Canada ($IMMIGR_t$) and

(vi) past values of unemployment rates, and to be more specific, unemployment rate observed in the previous period (UN_{t-1}).

Since we define all variables as stationary, the following specification is considered as the baseline unemployment equation, where unemployment is the dependent variable:

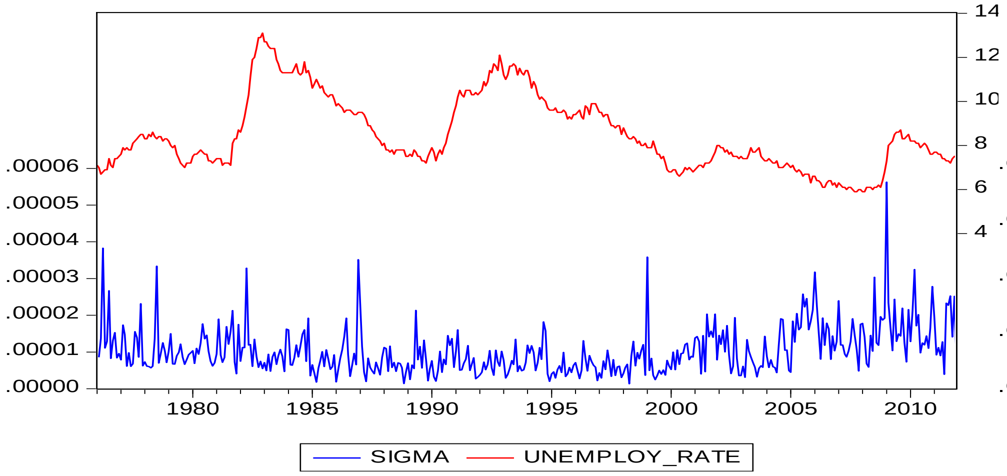
$$UN_t = \beta_0 + \beta_1\sigma_t + \beta_2 DEF_t + \beta_3 DMR_t + \beta_4 CPIE_t + \beta_5 IR_t + \\ + \beta_6 XR_t + \beta_7 IMMIGR_t + \beta_8 UN_{t-1} + e_t \qquad \textbf{(1)}$$

5. Methodology

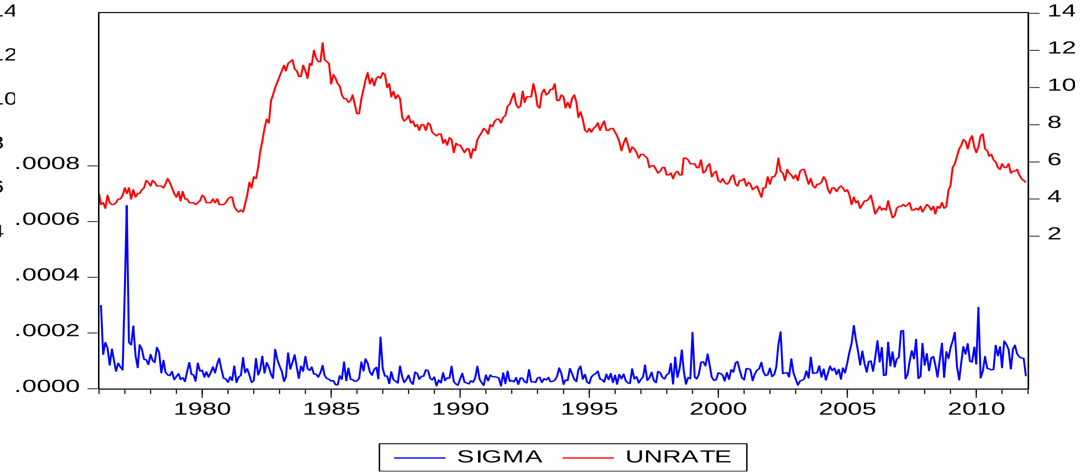
Linear approximations using the method of Ordinary Least Squares (OLS) are made for aggregate Canada (not for each region) so as to recognize which of variables included in (1) are statistically significant and as a consequence may influence unemployment rate. To check for the consistency of our results we employ the Ramsey reset test for the coefficients and diagnostic tests in the regression residuals which are the Breusch-Godfrey Serial Correlation LM test and heteroskedasticity ARCH LM test. In the presence heteroskedasticity we correct by estimating GARCH models too. In addition, a simple way to search for a possible linear interdependence among variables is by using a Vector Autoregression Estimate (VAR) which focuses whether the previous values (lags) of the one variable can affect the other variable or not. Thus, we illustrate a VAR representation treating unemployment rate, dispersion index, deficit to GDP ratio, money supply and interest rates as endogenous, whereas

Figure 9 Representation of unemployment rates in accordance with dispersion for Canada and regions

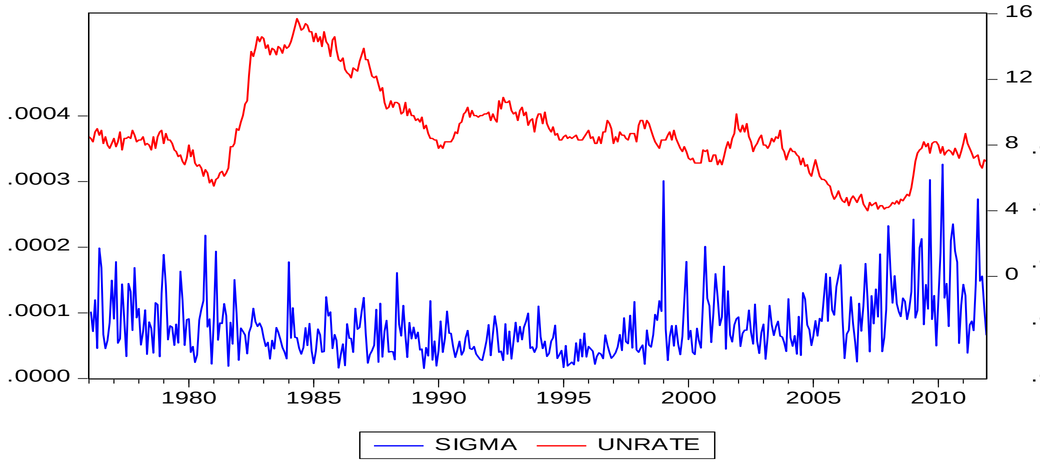
Canada



Alberta



British Columbia



Manitoba

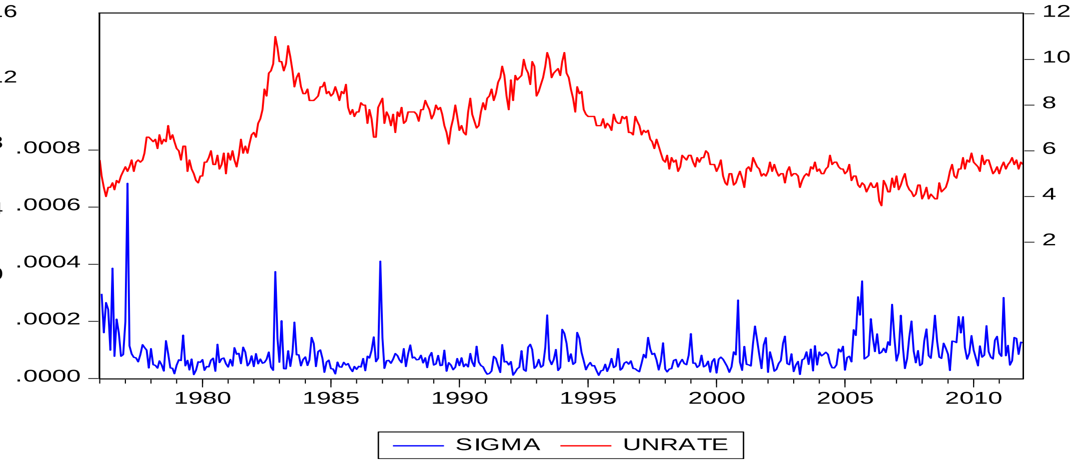


Figure 9 (cont'd) Representation of unemployment rates in accordance with dispersion for Canada and regions

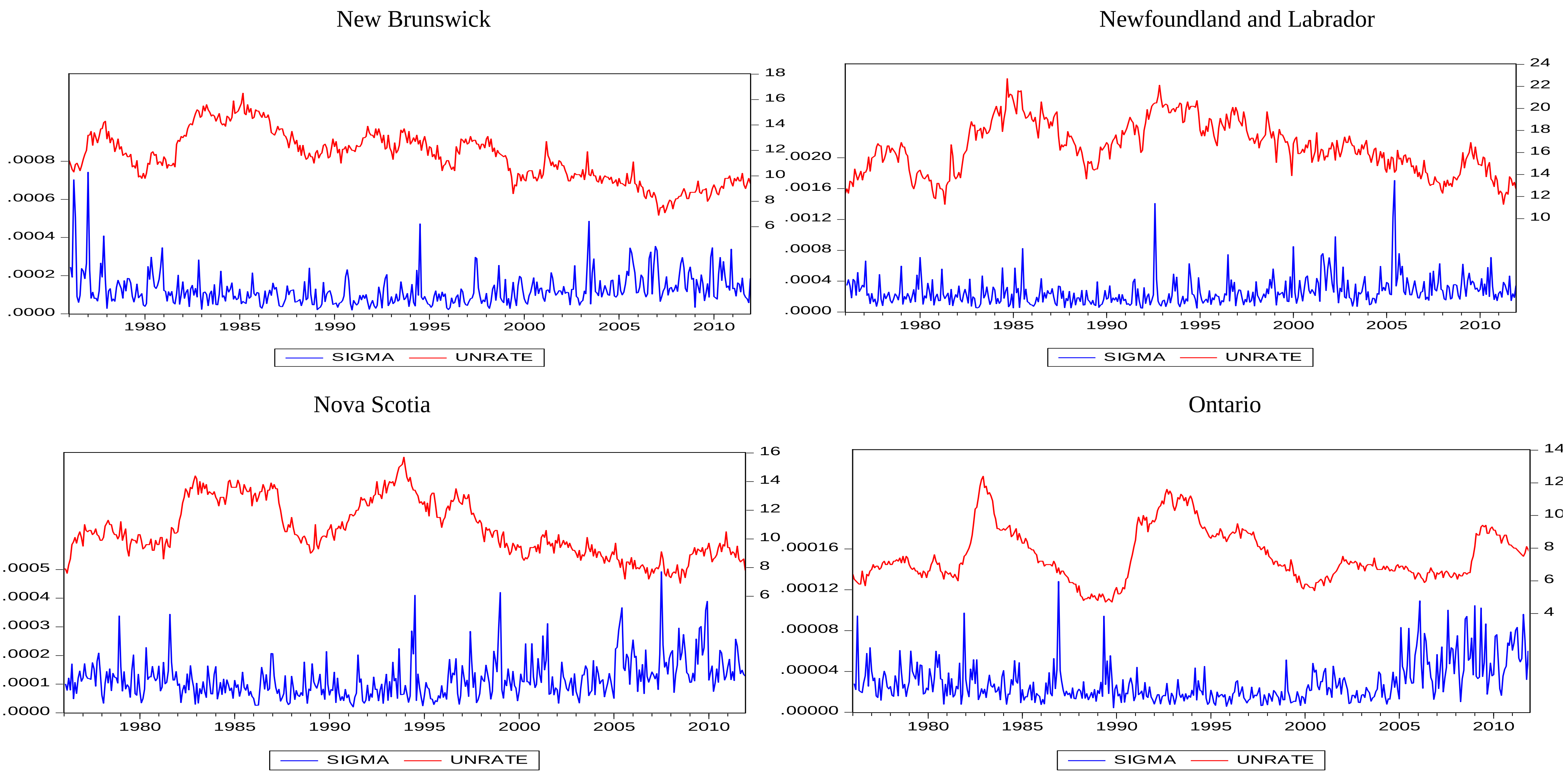
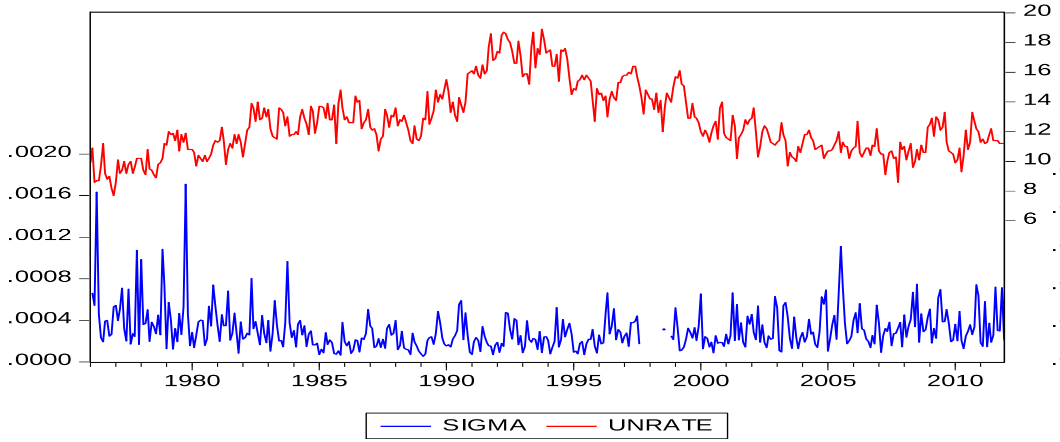
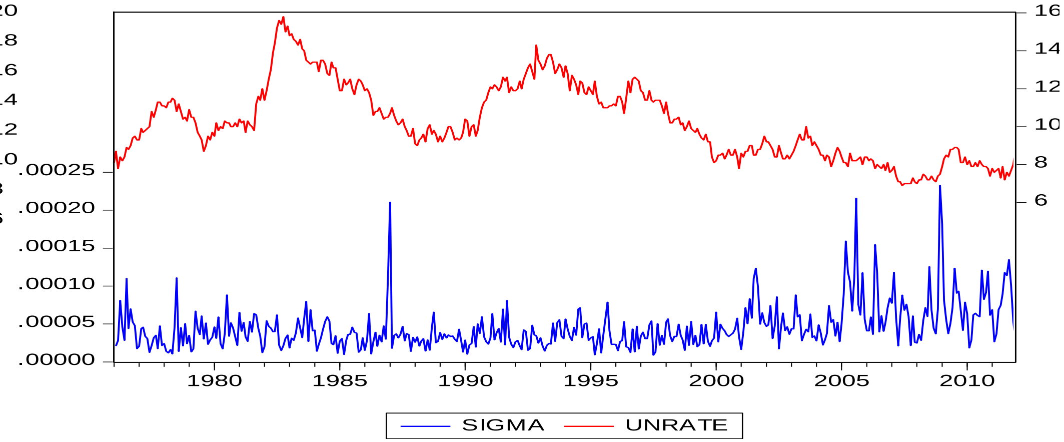


Figure 9 (cont'd) Representation of unemployment rates in accordance with dispersion for Canada and regions

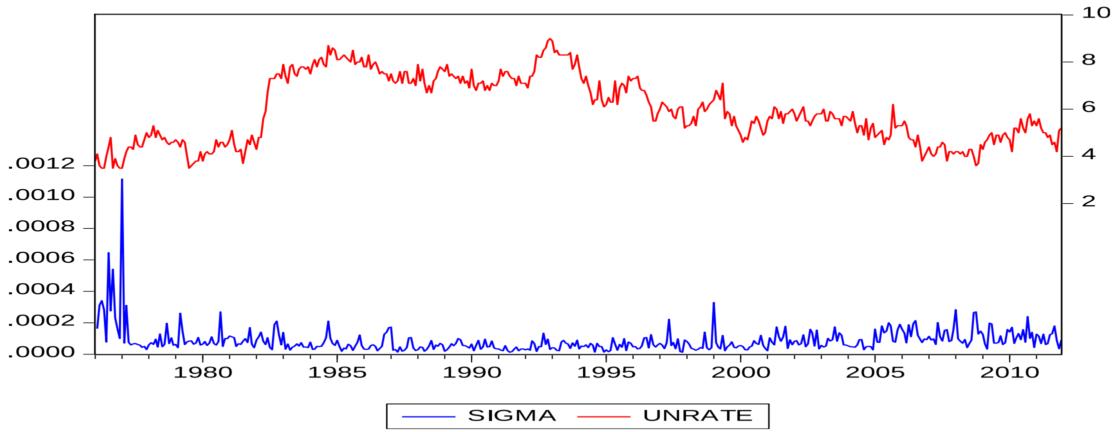
Prince Edward Island



Quebec



Saskatchewan



energy price index as exogenous and we address if there exists a long run relationship between unemployment and the rest variables. In addition, we move onto Impulse Response Functions (IRFs) for modeling variables' reactions due to impulses or shocks.

Apart from the simple OLS estimation, we also proceed further into a *panel data* analysis once we want to study not only Canada but its regions too. Panel data (or cross-sectional time-series data) is a dataset in which the behavior of entities is observed across time and combines a time series dimension with a cross section dimension; for our purpose there are data on the ten regions of Canada followed over *t* time periods. The reason for dealing with panel data is the fact that this methodology provides the researcher with a large number of data points, increasing the degrees of freedom and limiting the co-linearity between regressors. Another benefit is that it can capture the complexity of different entities (regions) better than a single cross-section or time series analysis and lead to more accurate estimations. Panel data formula can also isolate and measure the specific effects that characterize the sample and in overall it enhances efficiency of results. Econometrically, the very general formula we may follow is as described in the linear equation:

$$y_{it} = a_{it} x_{it} + \varepsilon_{it} \quad \textbf{(2)}$$

where y_{it} is the dependent variable, a_{it} is a k×1 vector of parameters to be estimated on the explanatory variables, and x_{it} is an 1×k vector of observations on the explanatory variables, with time $t = 1, \ldots, T$ and $i = 1, \ldots, N$ accounting for the regions. Because this form is too general, it is necessary to make the assumption that coefficient a_{it} is constant across time *t* and constant for all regions *i*, thus we present it as a without an indicator; disturbance term ε_{it} is assumed to be independent and identically distributed over regions and time, with mean zero and variance σ^2_{ε}. Relying on equation (2) we can distinguish between two classes of panel estimation approaches that can be employed in financial research and are: the *fixed effects* models (FEM) and *random effects* models (REM). In fixed effects models, all coefficients a that represent the effects of a change in variable x_{it} are constant both cross-sectionally and over time, but the average level for the one region may be different from that of the other region. Furthermore, types of fixed effects models decompose disturbance term ε_{it} into ω_i plus an error term v_{it} , i.e $\varepsilon_{it} = \omega_i + v_{it}$, and substituting this equality into (2) we result in a fixed effects model that can be represented by the formula:

$$y_{it} = \omega_i + a\ x_{it} + v_{it} \qquad \text{(FE Model)} \quad \textbf{(2.1)}$$

with ω_i indicating the specific effect for each region. An alternative to the fixed effects model described above is the random effects model, which is also known as the error components model. Commonly with fixed effects, the relationships between the explanatory and explained variables assumed to be the same both cross-sectionally and diachronically. However, the difference is that under the random effects model, the disturbance term is analyzed into parts consisting of: a common or 'global' intercept term c , plus a random variable μ_i and the remainder disturbance v_{it}, that varies over time and regions capturing everything that is left unexplained about the dependent variable y_{it}. The random variable μ_i, which measures the individual specific effect, varies cross-sectionally but is constant over time and also indicates the random deviation of each region's intercept term from the 'global' intercept term c . In other words, the random error μ_i is heterogeneity specific to a cross-sectional unit—in this case, region and is constant temporally. The final form of the random effects model after substituting $\varepsilon_{it} = c + \mu_i + v_{it}$ is:

$$y_{it} = c\ + a\ x_{it} + \mu_i + v_{it} \qquad \text{(RE Model)} \quad \textbf{(2.2)}$$

Note that this framework requires the assumptions that the new cross-sectional error term μ_i has zero mean, is independent of the individual observation error term v_{it}, has constant variance σ^2_ε and is independent of the explanatory variables x_{it}. It is worth mentioning that Greene (2003) calls the random effects model as a regression with a random constant term. In more specific terms and taking into account the explanatory variables discussed above, we rewrite the two forms of the panel data equations as:

$$\begin{aligned} UN_{it} = \omega_i + a_1\sigma_{it} + a_2 DEF_{it} + a_3 DMR_{it} + a_4 CPIE_{it} + a_5 IR_{it} + \\ + a_6 XR_{it} + a_7 IMMIGR_{it} + a_8 UN_{it-1} + v_{it} \end{aligned} \qquad \textbf{(2.1')}$$

$$UN_{it} = c + \mu_i + a_1\sigma_{it} + a_2 DEF_{it} + a_3 DMR_{it} + a_4 CPIE_{it} + a_5 IR_{it} + \\ + a_6 XR_{it} + a_7 IMMIGR_{it} + a_8 UN_{it-1} + v_{it} \quad \textbf{(2.2')}$$

where (2.1') describes fixed effects model and (2.2') the random effects model with v_{it} ~ IID.

We further apply in our panel data estimation the Hausman test in order to decide which of the two models perform better. Hausman test is useful to all hypothesis testing problems and tests the hypothesis that error components are not correlated with explanatory variables. In short, this test takes two different estimators that are available, the first of which, let us say b_1 is efficient under the null hypothesis, however inconsistent under the alternative, while the other estimator b_0 is consistent under both hypotheses, possibly without attaining efficiency under any hypothesis. If null is rejected, estimation with random effects will be biased and inconsistent. In practice, Hausman test for k parameters is:

$$H = (b_1 - b_0)'\left[Var(b_1 - b_0)\right]^{-1}(b_1 - b_0) \sim \chi_k^2$$

with Var standing for the variance of the difference between the two estimators. Following the rule of thumb, if *p*-value of Hausman statistic is greater than 0.1 or 0.05, depending on the preferred interval, then the random effects model 'passes' the Hausman test and should be used as more appropriated in comparison with the fixed effects model.

Implementing the specifications mentioned above we can now proceed to the discussion of our results.

6. Empirical Results

We start our empirical analysis by regressing unemployment rates on variables that are considered to have an influence on them and specifically these variables are of fiscal and monetary policy mentioned above, as long as exogenous variables expressed by the energy price index and immigration. Table 5 below, presents three OLS models which illustrate values and significance of variables included. The first model, which does not take into account previous history of unemployment rates and is of the following form,

$$UN_t = \beta_0 + \beta_1\sigma_t + \beta_2 DEF_t + \beta_3 DMR_t + \beta_4 CPIE_t + \beta_5 IR_t + \beta_6 XR_t + \beta_7 IMMIGR_t \qquad (\mathbf{3a})$$

highlights the importance of almost all variables for levels of confidence up to 1%. Dispersion index variable, deficit to GDP ratio, monetary policy, interest rates and immigration rates are extremely significant, with *p*-values zero or close to zero, having a negative effect on unemployment rate, since their coefficient values are of the opposite sign. The negative relationship between unemployment and deficit to GDP, monetary policy and interest rates is almost expected but it is not reasonable to support that an increase in sectoral reallocation, as expressed by dispersion measure σ_t, can lead to reduced unemployment. In addition to this, the extremely high coefficient (15866) is rather unlikely to correspond to reality. Exchange rates are also an important factor influencing unemployment by 3.877 percentage points and moves in the same direction as expected. However, there is no effect for an effect of energy price index on unemployment.

In the second OLS estimation, we take into account the magnitude of lagged values of unemployment on current unemployment, thus we incorporate one lag in the regression as shown in the equation 3b below:

$$UN_t = \beta_0 + \beta_1\sigma_t + \beta_2 DEF_t + \beta_3 DMR_t + \beta_4 CPIE_t + \beta_5 IR_t + \beta_6 XR_t + \beta_7 IMMIGR_t + \beta_8 UN_{t-1} \quad (3\mathbf{b})$$

The possibility of including further lags was examined, but none proved to be statistically significant. With the exception of monetary policy variable and energy index, all other variables retain their importance for confidence level 5%. To be more specific, dispersion index affects positively and strongly and variables of interest and exchange rates as long as immigration have a slight impact of 0.0096, 0.1801 and 0.0000015 respectively. Unemployment of previous period (month) influences positively current value by an amount of 0.9538, meaning that an increase by one percentage point per month would increase next month's unemployment rate by a proportion of almost 0.95%. In addition, with the inclusion of lagged unemployment in the second model, the overall fit of the equation is better than the earlier one since *R* –squared increases from 78% to 98% and Ramsey test indicates a better specification.

Furthermore, we make an attempt to investigate results that emerge if we drop out the insignificant variables estimated in Eq.3b. For this purpose, we exclude monetary policy and energy index from the regression with the rest remaining as previously getting equation 3c as described by the relationship :

$$UN_t = \beta_0 + \beta_1\sigma_t + \beta_2 DEF_t + \beta_5 IR_t + \beta_6 XR_t + \beta_7 IMMIGR_t + \beta_8 UN_{t-1} \quad (3\mathbf{c})$$

Again all variables retain their significance and the fit of equation does not deteriorate. Discussing about the Akaike information criterion, this statistic is performed to see if the inclusion of an additional variable is justifiable statistically. The equation with the lowest Akaike is preferred and, in accordance with the largest Log Likelihood, we consider the third model to be the more appropriate in describing the field that we study. Furthermore, Ramsey Reset tests for model specification and normality, with the very small values indicating misspecification; estimated equations 3b and 3c pass this normality test. However, Breusch-Godfrey which tests for serial autocorrelation results in a not surprising fact given the autocorrelated nature of the unemployment. On the whole, our estimations provide compelling evidence for the existence of the sectoral shifts hypothesis since coefficient values of dispersion index are highly significant revealing the magnitude that this variable has on unemployment's behavior.

Extending our analysis, we transform the dependent variable into its logarithmic difference and following the same path as done for equations 3a, 3b and 3c we estimate respectively equations 3a',3b' and 3c' in which the only difference is that now the left-hand variable is the Δlog unemployment. Table 6 displays the results and it is clear that dispersion index again is of great importance and positively correlated with unemployment levels. Although Log Likelihood and information criteria improve in comparison to results of Table 5, we end up with low *R*-squared values and a 'penalty' of weak specification.

In the presence of heteroskedasticity, the OLS coefficients are still unbiased, but the standard errors and confidence intervals estimated by conventional procedures are rather narrow. To overcome this weakness, we model variance volatility through GARCH models by assuming that the error term is not constant but varies over time, i.e. $\varepsilon_t \sim N(0, h_t)$. The term h_t is the conditional heteroskedasticity constructed as

Table 5 : OLS estimations

Dependent variable : Unemployment									
	Equation 3a			Equation 3b (with lagged Unemployment)			Equation 3c		
Variable	*Coefficient*	*t-stat.*	*Prob.*	*Coefficient*	*t-stat.*	*Prob.*	*Coefficient*	*t-stat.*	*Prob.*
c	4.0417*	8.5112	0.0000	-0.0890	-0.6629	0.5077	-0.1746	-1.4637	0.1440
Dispersion (σ_t)	-15866.77*	-2.5615	0.0108	5382.953*	3.3055	0.0010	5226.884*	3.2178	0.0014
Deficit/GDP (DEF_t)	-0.4307*	-30.498	0.0000	-0.0237*	-3.6783	0.0003	-0.0215*	-3.4720	0.0006
Money (DMR_t)	-75.2247*	-9.0660	0.0000	-3.2668	-1.3928	0.1644	-	-	-
Energy Index ($CPIE_t$)	1.7779	1.1166	0.2648	0.0137	0.0332	0.9735	-	-	-
Interest Rate (IR_t)	-0.0741*	-4.7908	0.0000	0.0096**	2.3155	0.0211	0.0092**	2.2528	0.0248
Exchange Rate (XR_t)	3.8773*	13.6942	0.0000	0.1801**	2.0523	0.0408	0.1819**	2.0874	0.0374
Immigration ($IMMIGR_t$)	-1.63E-05*	-5.2787	0.0000	1.45E-06	1.7371	0.0831	1.78E-06**	2.2278	0.0264
Unemployment(-1)	-	-	-	0.9538*	76.686	0.0000	0.9607*	84.4486	0.0000
	R-squared 0.7826 Akaike info criterion 2.3641 Schwarz info criterion 2.4396 Log Likelihood -501.4836 F-statistic 217.6404 Ramsey RESET Prob. 0.0000			R-squared 0.9854 Akaike info criterion -0.3349 Schwarz info criterion -0.2500 Log Likelihood 81.1754 F-statistic 3572.669 Ramsey RESET Prob. 0.5941			R-squared 0.9853 Akaike info criterion -0.3396 Schwarz info criterion -0.2736 Log Likelihood 80.1864 F-statistic 4763.895 Ramsey RESET Prob. 0.5827		

* indicates significance at 0.01 or 1% level

** indicates significance at 0.05 or 5% level

Table 6 : OLS estimations

Dependent variable : Δlog(Unemployment)									
	Equation 3a'			**Equation 3b' (with lagged Unemployment)**			**Equation 3c'**		
Variable	*Coefficient*	*t-stat.*	*Prob.*	*Coefficient*	*t-stat.*	*Prob.*	*Coefficient*	*t-stat.*	*Prob.*
c	-0.0360*	-2.5169	0.0122	-0.0107	-0.7007	0.4838	-0.0062	-0.5400	0.5895
Dispersion (σ_t)	792.135*	4.2430	0.0000	662.118*	3.5598	0.0004	628.7442*	3.3868	0.0008
Deficit/GDP (DEF_t)	-0.0006	-1.5863	0.1134	-0.0032*	-4.2994	0.0000	-0.0031*	-4.4582	0.0000
Money (DMR_t)	0.1117	0.4470	0.6551	-0.3284	-1.2262	0.2208	-	-	-
Energy Index ($CPIE_t$)	-0.0087	-0.1818	0.8558	0.0021	0.0437	0.9651	-	-	-
Interest Rate (IR_t)	0.0013*	2.8193	0.0050	0.0008	1.6909	0.0916	0.0002	0.6944	0.4878
Exchange Rate (XR_t)	0.0033	0.3930	0.6945	0.2597*	2.5909	0.0099	0.0272*	2.7330	0.0065
Immigration ($IMMIGR_t$)	2.39E-07*	2.5572	0.0109	1.30E-07	1.3605	0.1744	-	-	-
Unemployment(-1)	-	-	-	-0.0058*	-4.1081	0.0000	-0.0055*	-4.3472	0.0000
	R-squared 0.0763 Akaike info criterion -4.6396 Schwarz info criterion -4.5642 Log Likelihood 1007.852 F-statistic 4.9960 Ramsey RESET Prob. 0.0000 ARCH LM test Prob. 0.1948			R-squared 0.1118 Akaike info criterion -4.6742 Schwarz info criterion -4.5893 Log Likelihood 1016.302 F-statistic 6.6451 Ramsey RESET Prob. 0.0000 ARCH LM test Prob. 0.0768			R-squared 0.1020 Akaike info criterion -4.6771 Schwarz info criterion -4.6205 Log Likelihood 1013.918 F-statistic 9.6547 Ramsey RESET Prob. 0.0002 ARCH LM test Prob. 0.0369		

* indicates significance at 0.01 or 1% level

$h_t = a_0 + a_1\varepsilon_{t-1}^2 + \beta h_{t-1}$ and all values are shown on Table 7. As we can see, the *GARCH I* model does not support sectoral shifts view because dispersion coefficient is not statistically significant even in a 10% confidence level. Only lagged unemployment and exchange rates seem to have a positive effect on current unemployment by 0.9447 and 0.1924 percentage points respectively. Deficit to GDP ratio continues to address its negative influence at about 0.0235. Besides this model, we also estimate a *GARCH II* where all right hand side variables are included in variance equation too. Results confirm that not only sectoral shifting determines unemployment but also past history of unemployment. Moreover, trying to isolate only significant variables, we estimate a third *GARCH III* model which includes only the variables that unemployment is sensitive to. The positive sensitivity refers to dispersion index, exchange rates and lagged unemployment with values 1977, 0.1891 and 0.9492 correspondingly, while a negative relation is detected between deficit to GDP and unemployment. For all the above GARCH models we confirm that the sum of conditional heteroskedasticity coefficients $a_1 + \beta$ does not exceed unity meaning that shocks to the conditional variance will be highly persistent. It is worth having a look at Akaike and Schwarz info criteria with the lower values implying a better specification of our modeling.

Furthermore, we motivate the empirical measure of sectoral reallocation into using a Vector Autoreggressive Representation (VAR) in order to examine how well we can explain movements in the aggregate unemployment rate. Using variables of dispersion, deficit to GDP ratio, monetary policy and interest rates as endogenous and treating energy price index as exogenous while choosing the appropriate lag structure for the VAR representation, we are able to estimate the exact VAR structure and the Impulse Response functions (IRF's) as illustrated in Table B (Appendix) and Figure 10 respectively. Impulse response refers to the reaction of unemployment rate in response to changes or, as it is usually called, to shocks or disturbances. The first panel of Figure 10 shows the reaction of unemployment due to a sectoral shifts shock along with the associated standard error bands; it increases initially after the shock and it takes about 25 periods -in our case months- for unemployment rate to return to its 'steady state' level. By this term we mean the level where the economy is in

Table 7 : GARCH estimations

	GARCH I				*GARCH II*				*GARCH III*		
Variable	*Coefficient*	*z-stat.*	*Prob.*		*Coefficient*	*z-stat.*	*Prob.*		*Coefficient*	*z-stat.*	*Prob.*
c	0.0999	0.8426	0.3994		0.0006	0.0052	0.9958		0.0781	0.9200	0.3576
Dispersion	2092.909	1.5397	0.1236		5382.953*	4.0624	0.0000		1977.679***	1.4186	0.1060
Deficit/GDP	-0.0235*	-4.1265	0.0000		-0.0198*	-3.6190	0.0003		-0.0221*	-4.9660	0.0000
DMR	-2.2398	-1.0524	0.2926		-3.2570	-1.4569	0.1451		-	-	-
Energy Index	-0.0468	-0.1403	0.8884		-0.0206	-0.0703	0.9440		-	-	-
Interest Rate	0.0004	0.1240	0.9013		0.0045	1.2244	0.2208		-	-	-
Exchange Rate	0.1924*	2.4287	0.0151		0.1872*	2.6297	0.0085		0.1891*	2.4624	0.0138
Immigration	2.52E-07	0.3203	0.7487		2.41E-07	0.3189	0.7498		-	-	-
Unemployment(-1)	0.9447*	79.856	0.0000		0.9527*	83.7735	0.0000		0.9492*	92.332	0.0000
Variance regressors											
α_0	0.0045	1.8252	0.0680		-0.0042	-0.5109	0.6094		-0.0084	-0.8576	0.3911
α_1	0.1613	2.6349	0.0084		0.0994	1.8747	0.0608		0.1190	2.1279	0.0333
β	0.7261	7.0291	0.0000		0.7181	7.1862	0.000		0.6853	4.5586	0.0000
Dispersion	-	-	-		4.15E-05	2.54E-07	1.0000		194.9905	0.9843	0.3250
Deficit/GDP	-	-	-		-0.0002	-0.7294	0.4655		-0.0008	-1.5994	0.1097
DMR	-	-	-		-0.0691	-0.2868	0.7742		-	-	-
Energy Index	-	-	-		-0.1621	-2.9054	0.0037		-	-	-
Interest Rate	-	-	-		0.0009	2.720	0.0065		-	-	-
Exchange Rate	-	-	-		-0.0012	-0.3491	0.7270		0.0088	1.1807	0.2377
Immigration	-	-	-		1.35E-07	1.9838	0.0473		-	-	-
	Akaike info criterion -0.4437 Schwarz info criterion -0.3211				Akaike info criterion -0.4444 Schwarz info criterion -0.2558				Akaike info criterion -0.4599 Schwarz info criterion -0.3466		

* indicates significance at 0.01 or 1% level

*** indicates significance at 0.1 or 10% level equilibrium and unemployment reaches its stable rate. The opposite movement for unemployment is observed when a shock in deficit to GDP, a monetary shock, and a shock in interest rates is taking place, with the difference that unemployment need more than 50, 35 and 10 months respectively, to come back to its proper level. The either short or long time needed for the return reveals the duration and the impact that every shock has on unemployment or, in other words, the long duration implies the 'sensitivity' of unemployment to each shock. Overall, we could mention that the above discussion of IRF's results are consistent with Davis's position that not only reallocation shocks, as captured by the dispersion index, is responsible for unemployment variation and, this variation is likely to be associated with not only one particular variable but with many other factors.

Another useful econometric technique which enhances our research is panel data analysis. Due to the fact that we want to test the hypothesis for the regions of Canada, panel data allows us to conduct a multidimensional analysis not only across time but also across regions. Table 8 summarizes the results of both fixed and random effects models where again we treat unemployment as the dependent variable and the rest as the regressors. We run two fixed-effects models with the difference that in the first we do not take into account the cyclical behavior of unemployment whereas in the second, previous month unemployment is incorporated. The same path is followed for the random effects models, too. Fixed effects model without lagged unemployment features almost all variables as statistically significant leaving out energy index. However, the fit of the regression, giving a value of 87%, is not very good in qualifying our conclusions. On the other hand, when we employ one lag, overall fit improves noticeably and increases to 98% although many variables lose their significance. To be more specific, dispersion index does not affect unemployment anymore, thus rejecting the sectoral shifts hypothesis, while lagged unemployment reaches upper significant levels with a coefficient of 0.9124. As mentioned aboved, we follow a similar approach for the random effects model. When lagged unemployment is excluded, the fit is weak (at 57%) albeit illustrating the significance of most variables. In the random effects model where lagged unemployment is captured, only dispersion index retains its significance with the advantage of a higher *R*-squared. At this point, Haussman test is employed to evaluate the significance between the estimators of fixed and random effects models. Provided the value of

Figure 10 : Impulse Response Functions

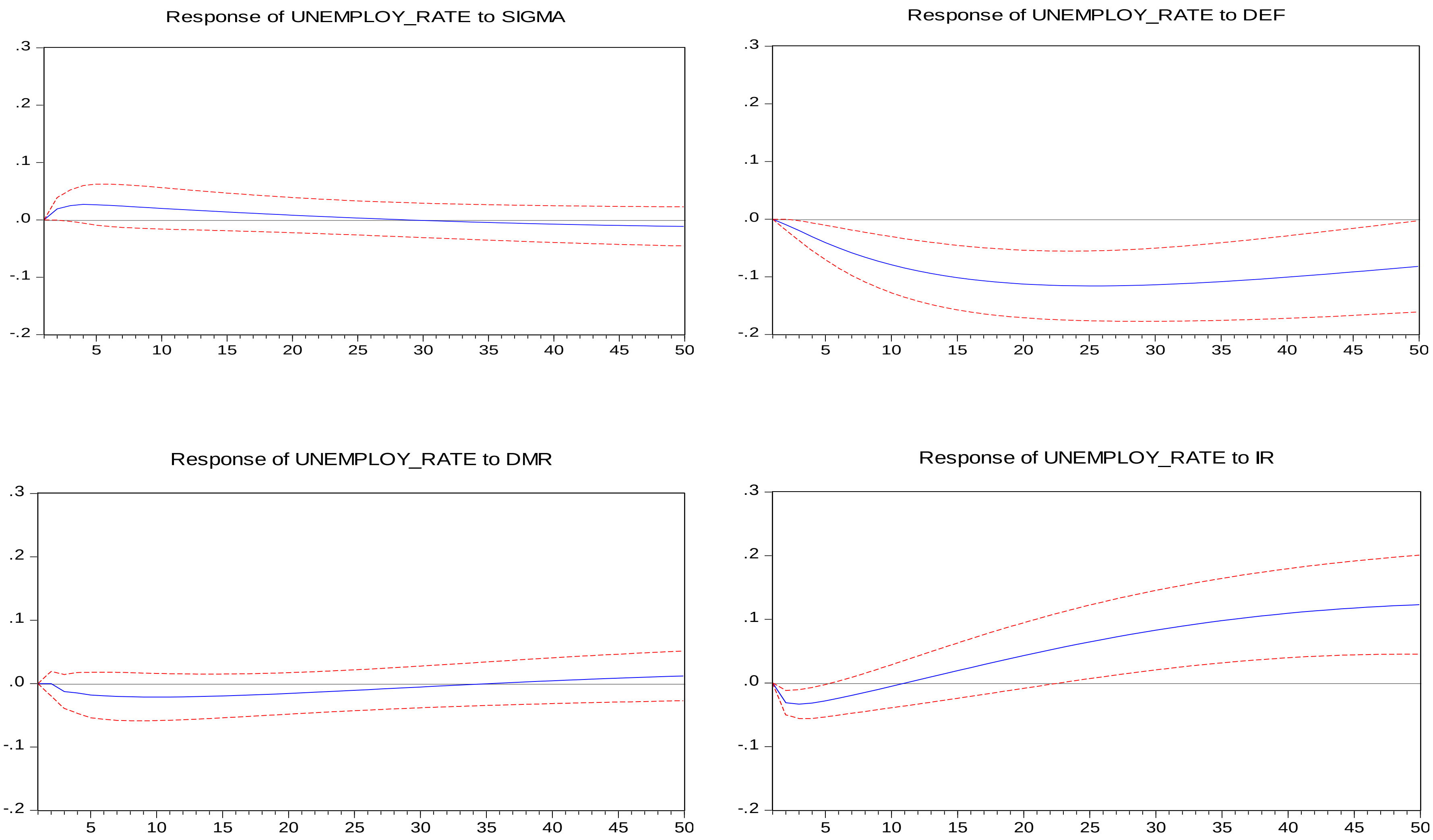


Table 8 : Panel estimations

	Fixed effects model			**Fixed effects model (with lagged Unemployment)**			**Random effects model**			**Random effects model (with lagged Unemployment)**		
Variable	*Coefficient*	*t-stat.*	*Prob.*	*Coefficient*	*t-stat.*	*Prob.*	*Coefficient*	*t-stat.*	*Prob.*	*Coefficient*	*t-stat.*	*Prob.*
c	1.7043*	7.9309	0.0000	0.1122	1.3362	0.1815	1.7035**	2.2082	0.0273	-0.0332	-0.4132	0.6795
Dispersion	-614.6861*	-2.9488	0.0032	-16.3696	-0.2021	0.8398	-598.6515*	-2.8727	0.0041	237.2329*	3.3755	0.0007
Deficit/GDP	-0.4342*	-56.767	0.0000	-0.0424*	-10.904	0.0000	-0.4343*	-56.7748	0.0000	-0.0132*	-4.1261	0.0000
DMR	-646536*	-14.834	0.0000	-4.1628*	-2.3987	0.0165	-64.6979	-14.8446	0.0000	-0.0191	-0.0112	0.991
Energy Index	0.6193	0.7218	0.4704	0.2985	0.8967	0.3699	0.6194	0.7222	0.4703	0.2715	0.8157	0.4147
Interest Rate	-0.0128**	-1.7747	0.0760	0.0033	1.2020	0.2294	-0.0128	-1.7861	0.0741	0.0040	1.4686	0.1420
Exchange Rate	5.6819*	37.904	0.0000	0.4607*	6.8611	0.0000	5.6832*	37.9133	0.0000	0.0805	1.3272	0.1845
Immigration	2.62E-08*	-3.9632	0.0001	2.20E-06	0.8545	0.3929	-2.67E-05*	-4.0436	0.0001	-4.38E-08	-0.0402	0.9679
Unemployment(-1)	-	-	-	0.9124*	155.614	0.0000	-	-	-	0.9821*	375.859	0.0000
							Haussman test Cross-section random Chi sq. statistic 0.0000 Prob. 1.0000			Haussman test Cross-section random Chi sq. statistic 0.0000 Prob. 1.0000		

* indicates significance at 0.01 or 1% level

** indicates significance at 0.05 or 5% level.

Haussman statistic, random effects models ‘pass’ the test implying that this type of panel data estimation explains in a better way the effects that variables may have on unemployment.

7. Conclusion

The present paper examines the validity of the sectoral shifts hypothesis for Canada and its regions during the period 1976-2011. Employing linear approximations (OLS), GARCH models and VAR estimates for Canada and a panel data analysis for regions, many remarkable results emerge. Dispersion index, as measured following Lilien methodology, as long as past values of unemployment rate, when included in the basic unemployment equation, play a dominant role in determining the movements of (current) unemployment rate. This fact reveals that there exists a positive relationship between this dispersion measure variable and unemployment rate volatility. Moreover, Impulse Response Functions, as represented through VAR structures, empowers previous results since unemployment rate is positively affected by the changes of dispersion. The same conclusion is provided when we deal with panel data. Both fixed and random-effects models highlight the significance of the dispersion index, only with the exception of the fixed effects model which includes lagged values of unemployment. In general, our findings for the period and geographical area studied, keep up with the existing literature that supports the perspective of sectoral shifts hypothesis.

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APPENDIX

TABLE A (Unit root tests)

		Variable: ***Unemployment rate***			
		Augmented Dickey-Fuller test		Phillips-Perron test	
		t-statistic	*Probability*	*t-statistic*	*Probability*
CANADA	level	-2.191	0.209	-2.135	0.231
	1rst differ.	-8.485	0.000	-19.751	0.000
ALBERTA	level	-1.599	0.482	-1.861	0.351
	1rst differ.	-23.217	0.000	-23.322	0.000
BR. COLUMBIA	level	-1.336	0.613	-1.741	0.410
	1rst differ.	-24.849	0.000	-24.462	0.000
MANITOBA	level	-2.096	0.246	-2.136	0.231
	1rst differ.	-15.703	0.000	-27.233	0.000
NEW BRUNSWICK	level	-1.745	0.407	-2.103	0.244
	1rst differ.	-18.999	0.000	-29.318	0.000
NEW FOUNDLAND	level	-2.734	0.069	-2.985	0.037
	1rst differ.	-15.549	0.000	-27.067	0.000
NOVA SCOTIA	level	-2.113	0.239	-2.145	0.227
	1rst differ.	-18.382	0.000	-27.501	0.000
ONTARIO	level	-3.085	0.028	-2.568	0.101
	1rst differ.	-9.594	0.000	-22.152	0.000
PRINCE EDWARD	level	-2.719	0.071	-3.359	0.013
	1rst differ.	-20.524	0.000	-39.170	0.000
SASKATCHEWAN	level	-2.026	0.275	-2.323	0.165
	1rst differ.	-18.839	0.000	-29.289	0.000
QUEBEC	level	-1.644	0.459	-1.974	0.299
	1rst differ.	-24.756	0.000	-24.533	0.000

TABLE A (cont'd) (Unit root tests)

		Variable: ***Dispersion index (σ_t)***			
		Augmented Dickey-Fuller test		Phillips-Perron test	
		t-statistic	*Probability*	*t-statistic*	*Probability*
CANADA	level	-9.379	0.000	-15.936	0.000
ALBERTA	level	-4.629	0.001	-14.029	0.000
BR.COLUMBIA	level	-4.309	0.000	-16.814	0.000
MANITOBA	level	-8.830	0.000	-16.608	0.000
NEW BRUNSWICK	level	-13.272	0.000	-13.308	0.000
NEW FOUNDLAND	level	-15.935	0.000	-17.480	0.000
NOVA SCOTIA	level	-13.194	0.000	-14.498	0.000
ONTARIO	level	-3.763	0.000	-15.649	0.000
PRINCE EDWARD	level	-15.882	0.000	-16.235	0.000
SASKATCHEWAN	level	-6.070	0.000	-18.963	0.000
QUEBEC	level	-12.190	0.000	-13.274	0.000
		Variable: ***Deficit to GDP***			
CANADA	level	-2.166	0.219	-1.409	0.578
	1rst differ.	-3.982	0.001	-4.003	0.001
		Variable: ***Money supply M2(gross)***			
CANADA	level	3.726	1.000	5.499	1.000
	1rst differ.	-4.572	0.000	-11.503	0.000
		Variable: ***Energy price index***			
CANADA	level	-1.307	0.627	-1.296	0.633
	1rst differ.	-10.501	0.000	-14.853	0.000
		Variable: ***Interest rate (1-3 year government bond)***			
CANADA	level	-1.211	0.670	-1.054	0.735
	1rst differ.	-18.263	0.000	-18.122	0.000
		Variable: ***Exchange rates***			
CANADA	level	-1.649	0.456	-1.591	0.486
	1rst differ.	-16.043	0.000	-16.179	0.000
		Variable: ***Immigration rates***			
CANADA	level	1.500	0.533	-3.421	0.010
	1rst differ.	-5.955	0.000	-20.691	0.000

TABLE B (VAR estimation)

	Unemployment rate	*Dispersion*	*Deficit to GDP*	*Monetary policy*	*Interest rates*
Unemployment rate(-1)	1.032240	-4.03E-07	-0.008044	-0.001251	-0.416909
	(0.04828)	(1.4E-06)	(0.01217)	(0.00100)	(0.12149)
	[21.3789]	[-0.28750]	[-0.66075]	[-1.25407]	[-3.43156]
Unemployment rate(-2)	-0.059416	-4.16E-07	0.017526	-4.65E-05	0.387903
	(0.04853)	(1.4E-06)	(0.01224)	(0.00100)	(0.12212)
	[-1.22424]	[-0.29508]	[1.43228]	[-0.04635]	[3.17639]
Dispersion(-1)	3019.636	0.219666	550.7005	49.65129	-3694.232
	(1690.95)	(0.04906)	(426.334)	(34.9489)	(4254.87)
	[1.78576]	[4.47705]	[1.29171]	[1.42068]	[-0.86824]
Dispersion(-2)	-41.55530	0.117630	-243.3839	60.85566	2575.495
	(1686.91)	(0.04895)	(425.315)	(34.8654)	(4244.70)
	[-0.02463]	[2.40319]	[-0.57224]	[1.74545]	[0.60676]
Deficit to GDP(-1)	-0.208557	-4.58E-06	1.886150	0.002380	0.028056
	(0.08685)	(2.5E-06)	(0.02190)	(0.00180)	(0.21854)
	[-2.40127]	[-1.81564]	[86.1335]	[1.32610]	[0.12838]
Deficit to GDP(-2)	0.196846	4.26E-06	-0.885652	-0.002774	-0.037257
	(0.08837)	(2.6E-06)	(0.02228)	(0.00183)	(0.22237)
	[2.22742]	[1.66091]	[-39.7484]	[-1.51855]	[-0.16755]
Monetary policy(-1)	1.212494	1.85E-05	0.845455	0.168204	-3.625129
	(2.34563)	(6.8E-05)	(0.59140)	(0.04848)	(5.90221)
	[0.51692]	[0.27164]	[1.42959]	[3.46955]	[-0.61420]
Monetary policy(-2)	-3.263654	8.52E-05	0.262772	0.213197	5.121941
	(2.31910)	(6.7E-05)	(0.58471)	(0.04793)	(5.83546)
	[-1.40729]	[1.26637]	[0.44941]	[4.44793]	[0.87773]
Interest rates(-1)	-0.062819	-9.96E-07	0.003209	0.000664	1.102827
	(0.01934)	(5.6E-07)	(0.00488)	(0.00040)	(0.04866)
	[-3.24825]	[-1.77419]	[0.65810]	[1.66214]	[22.6625]
Interest rates(-2)	0.069695	6.50E-07	-0.005407	-0.000376	-0.110292
	(0.01945)	(5.6E-07)	(0.00490)	(0.00040)	(0.04894)
	[3.58356]	[1.15121]	[-1.10267]	[-0.93481]	[-2.25373]
C	0.122970	1.44E-05	-0.073105	0.010373	0.244288
	(0.10355)	(3.0E-06)	(0.02611)	(0.00214)	(0.26055)
	[1.18757]	[4.80570]	[-2.80019]	[4.84670]	[0.93758]
Energy index	0.042471	4.20E-06	-0.104561	-0.001199	2.105060
	(0.40515)	(1.2E-05)	(0.10215)	(0.00837)	(1.01946)
	[0.10483]	[0.35758]	[-1.02361]	[-0.14317]	[2.06488]

** t-statistic is indicated in brackets [ ]