The Effect of Fiscal Policy Uncertainty on the Probability of Future Recession in the U.S. and Canada

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Abstract

This paper studies the effect of fiscal policy uncertainty on the probability of future recession using the U.S. and Canadian data. The study uses the economic policy uncertainty index developed by Baker, Bloom, and Davis (2011) as a proxy for fiscal policy uncertainty and the recession indices constructed by the Organization for Economic Co-operation and Development (OECD). The analysis starts with computing the dynamic correlations between the uncertainty index and the recession index for each country and for each of the four quarters ahead. Then a probit regression model is employed to examine the predictive power of the uncertainty index for the probability future recession. The results show that the overall effect of fiscal policy uncertainty on the probability of future recession is ambiguous in both the U.S. and Canada. However, after controlling for the interest rate, the effect of policy uncertainty is amplified, suggesting that the monetary policy may play an important role in smoothing the business cycle. Lastly, the additional effect of policy uncertainty is diminished and become insignificant when all potential leading indicators are included in the probit regression model.

Contents

1. Introduction

While the fiscal policy is being an essential tool for governments of the U.S. and Eurozone countries to improve the economic situation, there have been a lot of debates over which direction the fiscal policy should point to (expansionary or austere?).[1] According to the policy survey conducted by the National Association for Business Economics in 2012, around 45% of the surveyed economists preferred expansionary fiscal policy in 2013, while around 33% of them called for more restrictive policy in 2013. In addition to the disagreement on the future path of fiscal policy, the U.S. and European countries are now facing dilemma when employing fiscal instruments. On the one hand, the gloomy economy requires the governments to expand their budgets.[2] However, this will worsen the sovereign debt circumstance in both economies.[3] On the other hand, if the fiscal policy becomes more restrictive to solve the debt problems, the economies will be further damaged and severe social unrest may happen, as was the case in Greece in 2011 (see Ponticelli and Voth (2011)). Therefore, the anticipation for future fiscal policy, related to government spending, tax rates, and the growth of sovereign debt, has become very uncertain.

1 The monetary policy has been constrained by the zero lower bound problem. In response to the Global financial crisis and the Eurozone sovereign debt crisis, the Federal Reserve has reduced its federal funds rate to zero since 2008 and the European Central Bank also lowered its main interest rates in 2013 to the historical low levels (The deposit facility rate was reduced to zero, and the fixed rate on main refinancing operation and the interest rate of marginal lending facility decreased to 0.25 and 0.75 respectively) in order to provide more liquidity to the financial markets. (see Swanson (2013)).

2 According to the statistics for the third quarter of 2013 from European Commission and Federal Reserve Bank of St. Louis, the real annual GDP growth rate for the Eurozone is -0.4% and the unemployment rate stands at 12.2%; the real GDP growth for the US is around 2.8% annually and the unemployment rate remains above 7%.

3 In the first quarter of 2013, the sovereign debt ratio in the euro area reached 92.2%, 1.6% higher than that in the fourth quarter of 2012. For the European Union, the ratio also increased to 85.9% from 85.2% in the first quarter of 2012. The debt ratios in Greece, Italy, Portugal, and Ireland are more than 100%. For the U.S., the total public debt to GDP ratio has been higher than 100% since the second quarter of 2013. (see Eurostat (2013) and Federal Reserve Bank of St. Louis (2013)).

Unlike the U.S. and the Eurozone, Canada has a relatively sustainable sovereign debt situation. According to the Annual Financial Report of the Government of Canada Fiscal Year 2012-2013 published by the Department of Finance Canada, the federal debt-to-GDP ratio of Canada reduced to 33.1 per cent in 2013 from 33.2 per cent in 2012. This is the lowest among the G7 countries.[4] However, the fiscal policy uncertainty in Canada is also very high currently (see Bloom (2013)). Bloom (2013) states that the current high fiscal policy uncertainty in Canada does not result from Canada's public debt problems, but from the increasing fiscal uncertainty in the U.S.. This is because of the close connection between this two countries in terms of economy and policy (see Bloom (2013), p. 2).

But how does such an increase in fiscal policy uncertainty affect the economic business cycle? To be more specific, will an increase in fiscal policy uncertainty raise or reduce the possibility of recession in the future? In the post global economic crisis period, uncertainty of fiscal policy situation has been widely considered as one of the main challenges for global economic recovery (e.g. Bloom, Kose, and Terrones (2013), Lane (2012), and National Association for Business Economics).[5] Motivated by this issue, this paper intends to answer these two questions.

The current study here mainly focuses on the U.S. data and Canadian data. This is because, with lower government debt ratio compared with the U.S., the Canadian government faces less constraint on making the best decision for the society even when the outlook for future policy making is unclear. As a result, the level of the response of

[4] The G7 countries are the U.S., U.K., France, Germany, Italy, Canada, and Japan.
[5] Baker and Bloom (2011) found that during 2006 and 2011, the increase in fiscal policy uncertainty reduced the maximum of 2.2% of real GDP, along with a 13% decline in private investment and a 2.5 million slip in total employment in the U.S..

economic sectors to the increasing fiscal uncertainty in the U.S. and Canada may be different. Such difference may help us better understand why fiscal uncertainty matters in terms of economic development.

To study the effect of fiscal policy uncertainty on the probability of future recession, we need to understand what the potential channels are. One of the channels may be related to firms' investment decisions. Higher volatility of expectation for future corporation tax rates and government spending may cause unexpected change in the cost of financing.[6] Faced with such higher uncertainty, firms will tend to be more cautious and postpone the decisions on investment projects until they have enough information to revaluate the risk and returns of them. Because once they invest in these projects, it is expensive to withdraw the capital input, such as plants and machines, and financial capitals (see Graham A (1994) and Bloom, Bond, and Reenen (2007)). Similarly, consumption decisions of consumers can also be affected by unexpected changes in fiscal policy environment. For example, consumers tend to purchase less durable goods when the volatility of tax rates on them is high and wait until the outlook for the policy becomes clearer. (see Bloom, Kose, and Terrones (2013)).

Another important channel for uncertain fiscal policy affecting the business cycle is through the financial market. Rapid changes in the fiscal policy (for instance, changes in spending and the way governments finance) can result in larger volatility of sovereign risk spreads, raising the volatility of country risk premiums required by lenders, and thus,

6 This is related to the concept of "crowding-out" effect. That is, an increase in government spending induces an increase in the real interest rates, which reduces the investment (see e.g. Furceri and Sousa (2009)).

the volatility of stock markets.[7] Except for this, a higher haircut will be imposed on the collateral, because the ability of assessing the value of collateral will be limited due to higher uncertainty (see OECD (2012)). Thus, higher interest rates for financing will be charged, discouraging credit-constrained firms to invest more, and curtailing the economic growth (see Bloom, Kose, and Terrones (2013)).

Although the exploration of the channels mentioned above is not the main part of this paper, it does provide an idea that uncertainty of fiscal policy may be used as a leading indicator to predict the probability of future recession. It is because all channels are related to the leading economic indicators (investment, consumption, and interest rate). To examine such predictive power of fiscal policy uncertainty, I apply a methodology of Taylor and Mcnabb (2007). Taylor and Mcnabb (2007) analyze the impacts of the consumer confidence and the business confidence on business cycles. In contrast to their work, the interest of the current paper is on the impacts of fiscal policy uncertainty on business cycles.

Following Taylor and Mcnabb's methodology, the study here starts with testing the dynamic correlations between the growth rate of policy uncertainty index and the recession index for the U.S. and Canada for several forecasting horizons. Then this paper continues to investigate how the fiscal uncertainty affects the probability of future recession in the U.S. and Canada by using a probit regression model.

7 The country risk premium (CRP) is an additional term for calculating the total risk premium for equity markets. The formula of CRP is:

, where the sovereign risk premium is the gap between the yields of sovereign bonds dominated in US dollar and the US treasury bonds of a similar maturities.

Three specifications of this probit model are used for the analysis. The first specification only includes the policy uncertainty index as an independent variable to examine the overall marginal probability effect of policy uncertainty on future recession. The second specification introduces the short term interest rate as a control variable to see if the effect of higher fiscal volatility will be greater in the absence of monetary policy, as suggested by Born and Pfeifer (2011). The third specification controls all potential leading indicators to investigate the additional impact of fiscal uncertainty on recession for the next four forecast horizons.[8]

From this empirical analysis, I find that the dynamic correlations between the fiscal policy uncertainty index and the recession index are insignificant for Canada for the forecasting horizons from one to four quarters ahead. The correlations between the two indices are significant for the U.S. data, but the magnitude of these correlations is very small. The coefficients estimated in the bivariate probit model are mostly insignificant. Furthermore, the signs for the estimators are various, implying that the overall marginal probability effect of fiscal uncertainty is ambiguous. However, when the interest rate is introduced, the marginal probability effect of fiscal volatility becomes significant and much larger in most cases. This result is consistent with the findings by Johannsen (2013), and Born and Pfeifer (2011). At the end, I also discover that the inclusion of all other leading indicators vanishes the predictive power of the policy uncertainty.

In the next section, this paper summarizes the current literature. In section 3, this paper describes the data used, tests the stationarity of the policy uncertainty index, and estimates the correlations between its growth rates and future recession. The construction

8 The potential leading indicators are similar to those used by Taylor and Mcnabb (2007).

of the probit model and the three specifications, as well as the results of analysis are given in Section 4. Lastly, the conclusion is provided in section V.

2. Review of literature

The empirical analysis of the effects of fiscal uncertainty on probability of future recession is the main focus in this paper. However, five questions should be concerned before the analysis: Why is the study of uncertainty shocks other than the level shocks important? How to measure the fiscal policy uncertainty? What are the economic effects of fiscal uncertainty shocks from the theoretical points of view? What are the findings from related empirical analysis on the effects of fiscal uncertainty shocks? This section provides a summary of the previous literature related to these five questions. It also discuss the potential contributions of the current work to the existing literature.

2.1. The importance of the study of uncertainty shocks

One of the most important articles that emphasizes the importance of studying uncertainty shocks other than level shocks is the work of Bloom (2009). Bloom (2009) establishes that, the economic uncertainty has a sizable impact on the economy. However, compared with the study of the level shocks, the study in uncertainty shocks is unclear. To highlight the important roles of uncertainty shocks, the author uses the volatility of stock markets index (VIX) as a proxy for economic uncertainty, and employs the VAR model and the partial equilibrium model to analyze the effects of uncertainty shocks at the firm level. He finds that an increase in economic uncertainty causes the firms to

postpone their investment and hiring, generating a sharp economic downturn in the short run and recovery in the medium term. Therefore, like the level shocks, the uncertainty shocks can also intensify the business cycle. In addition, the author states that the importance of uncertainty shocks also suggests that different types of uncertainty, including the fiscal policy uncertainty, may have a great impact on the economy. As a result, research on the uncertainty shocks other than level shocks is necessary. Since his work, the large literature are emerging to study various aspects of uncertainty (e.g. Baker and Bloom (2013), Fernandez-Villaverde, Guerron-Quintana, Kuester, and Rubio-Ramirez (2011), Beetsma and Giuliodori (2012), and Knotek II and Khan (2011))

2.2. The measure of fiscal policy uncertainty

One of the challenges for analyzing the impact of fiscal policy uncertainty on business cycle quantitatively is to measure the level of fiscal policy uncertainty. There are not many proxies for fiscal policy uncertainty available currently. However, Baker, Bloom, and Davis (2011) developed an economic policy uncertainty index to represent the level of volatility of future fiscal policy for several countries.

According to the authors, the index contains three main components: the information of policy economic uncertainty found on newspapers, the amount of federal tax code provisions that will end in the next years, and the disagreement on the forecasts of future economic activities. In constructing the first part of the index, the authors searched Google News on articles related to uncertainty, economy, and policy on monthly basics

from 1985 to 2011.[9] This part of index was calculated as the ratio of the number of news related to policy uncertainty to the smoothed total number of series in that period. The authors computed the second part of the index as a weighted sum of the amount of federal temporary tax code provisions that would expire in the next few years.[10] The last part of this index was constructed from a quarterly survey of forecasts for a wide range of macroeconomic variables. The dispersion of forecasts, given by the selected forecasters, was taken as the value of this part of index. The overall uncertainty index is the weighted average of these components normalized by their own standard deviations.[11] The authors found that, the policy uncertainty index was largely consistent with some specific historical events such as the 9/11 attack, the Eurozone crisis, and the U.S. debt-ceiling dispute. Also, the authors provided the separated indices for the U.S. and Canada on the Economic Policy Uncertainty website. Therefore, this index is used as a proxy for fiscal policy uncertainty in this paper.

2.3. The theoretical research on the economic effects of fiscal policy uncertainty

There is a wide range of articles trying to estimate the effect of fiscal policy uncertainty on economic activities. Such theoretical research helps us better understand the channels through which through which the fiscal policy volatility affects the economy.

[9] According to the authors, the sources of news are mainly from the US newspapers.

[10] The weights the authors applied are ___, while T is the number of months from the day of research to the day of expiration.

[11] The weights the authors employed are −, −, and − for the three parts respectively, according to their scope of coverage.

Fernandez-Villaverde, Guerron-Quintana, Kuester, and Rubio-Ramirez (2011) analyze the effects of fiscal volatility from both empirical and theoretical points of view. The authors start with an empirical model, including the lagged detrended output and lagged deviation of sovereign debt ratio, to bridge the non-linear relationship between the deviations of four fiscal policy tools and the corresponding time-varying volatilities. The authors model the impact of fiscal volatility on those four fiscal tools by multiplying their innovations by an exponential function of standard deviation of each fiscal tool. Then the authors assume that those standard deviations follow AR (1) process with the controls of the persistence of volatility shocks. The aim of doing this is to build the mechanism of transmission from fiscal volatility to deviations of these fiscal rules. To construct the transmission mechanism from these deviations to economic activities, the authors establish a standard New Keynesian model and derived the endogenous variables as functions of the deviations of fiscal rules. Then they calibrate the structure parameters and simulate the impact of the fiscal volatility shocks. They find that the increase in fiscal volatility significantly dampen output, consumption, investment, employment and real wages rate, and raise inflation. Among the economic variables, the response of investment to the shocks is the strongest. In the contrast, the consumption only go down a little due to the effect of "consumption smoothing".

Instead of constructing a two-stage mechanism of transmission from the fiscal volatility shocks to economic activities, Born and Pfeifer (2011) analyze the importance of policy risks that include the uncertainty of labour tax rates, capital tax rates, government spending and monetary policy. These authors use the framework of dynamic stochastic general equilibrium model (DSGE-model). In the analysis, the authors also

incorporate time-varying volatilities of relative prices of investments to consumption, and total factor productivity. They also model the stochastic process of standard deviations of volatilities of policy variables as AR (1) similar to Fernandez-Villaverde, Guerron-Quintana, Kuester, and Rubio-Ramirez (2011) However, they assume the evolution of fiscal policy instruments followed AR (2) process instead of AR (1). The simulations results show that the effects of fiscal volatility shocks are moderate. For example, the labour tax uncertainty lead to the strongest output decline of only 0.02%. Even a two-standard deviation increase in the volatilities of all policy variables at the same time only reduce output by 0.025%. Born and Pfeifer (2011) point out, the main reason for the small response of economic activity to the uncertainty shocks is the equilibrium effects. Economic sectors in the model would adjust their decisions to adapt to exogenous shocks, and such adjustments tend to have counter effects on business cycle. To verify this the authors conduct a counterfactual experiment by shutting off some mechanisms for the adjustments. The resulting impacts of the shocks are much larger, especially when the nominal interest rate was kept unchanged. Born and Pfeifer propose a possible explanation that monetary policy makers always react quickly to smooth the business cycle by adjusting interest rates. Thus, fluctuations of economic variables are smaller than it would be when there is no monetary policy response. My results from the empirical analysis in this paper also support this fact.

There are some other theoretical articles modelling the implications of uncertainty shocks on welfare. Cho and Cooley (2003) employ a real business cycle model incorporating the variance of total factor productivity. The authors measure welfare as expected indirect utility, which depends on all structure parameters. Lester, Pries, and

Sims (2013) adopt an alternative approach of modelling welfare as the consumption compensation for consumers facing high volatility to obtain the same level of utility as that when uncertainty is low. Positive compensation implies consumers will prefer low risk over high risk, and vice versa. Both papers show that welfare gain or loss from the uncertainty shocks depends on the Frisch labour supply elasticity and the degree of risk aversion. Specifically, when the labour supply elasticity is high and risk aversion is low, consumers prefer higher volatility since they can utilize the "good time" and protect themselves against the "hard time" by adjusting the labour supply. Lester, Pries, and Sims (2013) also find that when capital is introduced the model, the positive effects of volatility can be magnified. The amplification of these positive effects occur because firms are able to choose more aggressive investment projects when the economic environment was more preferable, and be more conservative the economy is gloomy.

The above cited theoretical studies reveal several channels through which the fiscal policy uncertainty can affect the economy. They also provide insights on the factors that determine the size of the effects volatility. The results of these studies help understand the empirical findings in the current paper.

2.4. The empirical analysis on the economic effects of fiscal policy uncertainty

Most of the empirical analysis on the effects of fiscal policy uncertainty is based on the Vector Autoregression (VAR) models. For example, Baker and Bloom (2011) employ different VAR specifications to examine the effects of fiscal policy uncertainty. First, the authors use a bivariate VAR model including the policy uncertainty and industrial

production (or employment), and control for the overall economic uncertainty by adding the VIX index. They find that 124 points increase in the policy uncertainty leads to a 4% decrease in the real industrial output in sixteen months, and a 2.5 million decline in total employment twenty four months after. Second, they include real GDP and investment and find that, the same policy uncertainty shock is followed by a 2.2% fall in GDP of four quarters ahead and a 13% decrease in private investment after three quarters. Lastly, the authors add the consumer confidence index to the previous two specifications to see if the policy uncertainty contains some information about the consumer confidence. They find that the effect of policy uncertainty becomes smaller, implying that the policy uncertainty, to some extent, reflects the consumer confidence.

Johannsen (2013) also employ the VAR model to investigate the impact of fiscal policy uncertainty. Most of the variables included in the model are similar to that of Baker and Bloom (2011). However, instead of controlling for the overall economic uncertainty and consumer confidence, the author control for the federal fund rate and the consumption price index as the factors that determine the evolution of other three time series variables. He finds that the policy uncertainty shocks leads to an economic recession. Furthermore, the negative impact from the higher uncertainty is larger during 2008 and 2012.

The empirical analysis mentioned above suggests that higher fiscal policy uncertainty can have a large negative impact on the economy and can lead to a future recession.

2.5. The contributions of the empirical study in this paper to the literature

Although many papers study the effects of fiscal policy uncertainty on the economy, there are at least two gaps in the previous literature. First, empirical understanding of fiscal policy uncertainty effects on the probability of future recession is limited. Even though Baker and Bloom (2011) and Johannsen (2013) both suggest that an increase in fiscal policy uncertainty may cause a future recession, they do not provide the quantitative evidence on whether this uncertainty affects the likelihood of future recessions. Second, most of the theoretical and empirical analysis focuses on the U.S. data, but very few of the studies concern about the effect of fiscal policy uncertainty in Canada. As mentioned in Section 1, the impact of fiscal policy uncertainty may also be interesting given the different situations between the U.S. and Canada.

The present paper addresses the two gaps in the literature. First, this paper applies the probit regression model to analyze the marginal effects of fiscal policy uncertainty on the likelihood of future recessions. Second, the study uses both the U.S. and Canadian data. The results from different economies can help us better understand the effects of fiscal uncertainty in different fiscal regimes.

3. Data

3.1. Description of Data

The analysis in this paper focuses on the U.S. and Canada using quarterly data from the first quarter of 1990 to the second quarter of 2013. The two main variables of the paper are the index of fiscal policy uncertainty and a recession index. The uncertainty

index was conducted by Baker, Bloom, and Davis (2011). The indices for both the U.S. and Canada are available on the website of Economic Policy Uncertainty (http://www.policyuncertainty.com/). The data for recession indices, explained in detail in the next paragraph, were collected from Federal Bank of St. Louis. Lastly, the study uses a number of leading indicators in multi-variate regression. The leading indicators include the real wage rate, gross domestic product, unemployment rate, narrow monetary aggregation M1, broad monetary aggregation M3, government expenditure, private consumption expenditure, gross fixed investment expenditure, and the short term interest rate. All these series were drawn from the Organization for Economic Co-operation and Development (OECD). The Appendix 1 provides detailed information.

One of the novel characteristics of the presented analysis is the index measuring recession. According to the OECD, the recession index was generated from a list of months in which turning points occurred.[12] The recession period in this measuring method is regarded as the time from the month of peak through the month of trough for monthly and quarterly data, including the months when the peak and trough happened. The index only takes two values. The value is 1 when the period is deemed to be in recession, and is 0 when it is an expansionary period.

Figure 1A and Figure 1B in Appendix 2 present the recession indexes for the U.S. and Canada from the first quarter of 1990 to the second quarter of 2013.

12 It was pointed out that the OECD identified those months of turning points but did not specify the date that turning points occurred. However, since this paper only uses quarterly data, for analysis, this should not cause serious problems.

The graphs show that both the U.S. and Canada went through three main recessions between the early 1990s and the early 2000s. These periods witnessed three international economic crisis swiping the global economy: the Black Monday caused by stock market crash from 1987 to early 1990s, the saving and loan crisis arisen from the pervasive failure among financial institutions in the U.S., and the dot-com bubble bursting in early 2000s. Furthermore, the recession in the U.S. and Canada shown in the graph during 2008 to early 2009 is also consistent with the global financial crisis from 2008 to 2009. As presented in the graph, the U.S. was affected for longer than Canada during the global financial crisis.

The method for measuring fiscal policy uncertainty developed by Baker, Bloom, and Davis (2011) has already been presented in section II. The uncertainty index represents the news on policy uncertainty, the future changes in taxes, and the disagreement on the outlook of future policy. The quarterly data used here are the aggregation of monthly data, using the average over the months within a quarter.

Figure 2A and Figure 2B shows the levels of fiscal uncertainty in the U.S. and Canada from the first quarter of 1990 to the second quarter of 2013.

The graphs show that both countries experienced relatively high fiscal volatility during the early 1990s, around 1995, the early 2000s, and after 2008. All three episodes correspond to the periods of recessions, as described above. Although the time series graphs do not give us a quantitative conclusion for the relationship between fiscal policy uncertainty and recession, they do provide some graphical presentation of how fiscal volatility and the recession index commove with each other. Namely, recessions tend to come with high level of fiscal policy uncertainty.

In addition to the index of fiscal policy uncertainty and the recession index, the probit model in this paper also include several leading indicators.[13] The seasonal adjusted time series data of gross domestic product and its components, private consumption expenditure, government expenditure, and gross fixed investment, are based on chained volume estimation taking 2010 as the reference year. Moreover, the measure for real wage rate selected here is the hourly earning index, with 2010 as the reference year. It only reflects the manufacturing industry because only this measure is obtainable for both countries. The type of unemployment rate chosen for the study is the harmonised unemployment rate. It is measured as the share of unemployed individuals in the total labour force, which is defined as the sum of the number of employed, self-employed, unpaid family workers, and unemployed persons. Moreover, for the measure of monetary aggregates, this paper uses M1 and M3 as proxies for the narrow and the broad monetary aggregates. Lastly, the annualized overnight interbank rate is chosen to represent the monetary policy instrument.

3.2. Tests for stationarity

Before moving on to estimate the correlation between the recession index and the fiscal policy uncertainty index, a test for the stationarity of the time series is necessary. In this section, I applied Kwiatkowski–Phillips–Schmidt–Shin test (KPSS test) proposed by Denis Kwiatkowski, Peter C. B. Phillips, Peter Schmidt, and Yongcheol Shin in 1992. The authors express the time series as the sum of the deterministic trend component, the

13 For detailed information regarding the indicators, please visit the website of the Organization for Economic Co-operation and Development.

random walk component, and the stationary error. Then they use Lagrangian Multiplier test to test the null hypothesis that the random walk has a zero variance. Under the null hypothesis, the time series is trend stationary. Therefore, the KPSS test can be used to test the trend stationarity of a time series.

Table 1A and Table 1B present the results for the U.S. and Canada for the KPSS test. The maximum lag for this test is given as well as the test statistics for each lag order and the critical values for four significance levels: 1%, 2.5%, 5%, and 10%. For both countries, the t-statistics for all the lags chosen are greater than the critical values at 5% level of significance.[14] It means that the null hypothesis that the time series is trend stationary should be rejected, i.e. the uncertainty indexes for both countries are non-stationary. As the time series are not stationary, the correlation between these two time series without modification is misleading. That is because if the time series grow over time, there will be large negative deviations at the beginning and large positive deviations at the end, which can generate a very high correlation coefficient between the time series. To solve this problem, I transformed the time series of uncertainty indexes into the growth rates. The results for KPSS test for the growth rates of the time series are provided in Table 2A and Table 2B. The table shows that the null hypothesis cannot be rejected since the t-statistics for both countries are less than the critical values at 5% level of significance. Hence, the time series for the growth rates of the uncertainty indexes are stationary.

Another popular approach of making the series stationary is to use the Hodrick-Prescott filter to detrend the time series. For example, this approach is adopted by Taylor

14 The maximum number of lags s given by Schwert criterion (see Schwert (1987)).

and Mcnabb (2007). Using the HP filter may be problematic since this method may change the cyclical components of the time series and may generate the spurious correlation between the two series (see also Canova (1998), and Harvey and Jaeger (1993)). Given this situation, this paper only modifies the series of uncertainty indexes by transforming them into growth rates.

The time series data for the growth rates of uncertainty indexes for both countries are plotted in Figure 3A and Figure 3B. The figures show that the growth rates of uncertainty indexes tend to be higher during the crisis time than any other periods.

3.3. The dynamic correlations between the recession index and the uncertainty index

A common approach of measuring comovement between the two economic variables is to compute the dynamic correlations between them. In this subsection, the dynamic correlations between the recession index of four quarters ahead and the growth rate of the uncertainty index are examined for both countries. The confidence intervals for the correlations are computed using Fisher's z transformation (see Fisher R.A. (1915) and Fisher R.A. (1921)).

Table 3 presents the estimated correlations as well as the corresponding confidence intervals for the U.S. and Canadian data. Figure 4A and Figure 4B illustrate the dynamic coefficients, and the upper bands and the lower bands for confidence intervals at 90% level. The horizontal axis shows the four forecasting horizons and the vertical axis represents the degree of the correlations. The green dash line and the red dash line are the upper band and the lower band for the confidence interval at 90% level. The solid line

between the upper band and the lower band represents the dynamic correlations between the uncertainty index and the recession index for four forecasting horizons.

The results show that for the U.S., the correlations between the recession index and the growth rate of the uncertainty index are significantly positive at 10% level for the second and third forecast horizons but insignificant for the others. However, the values for the significant correlations are very small (only 0.215 and 0.204 respectively). In contrast, the correlations are all insignificant for Canada. The result implies that even if the fiscal policy uncertainty is procyclical leading indicator for the U.S. recession index, this co-movement still appears to be small. Also, such co-movement does not even exist for Canada.

This finding of low degree of comovement between the recession index and fiscal policy uncertainty measure may not be so surprising, given the results from the theoretical papers. Those paper argue that the effect of fiscal policy uncertainty on economic activities depends on many factors, including the interactions between fiscal and monetary policies. For example, Johannsen (2013) finds that fiscal policy uncertainty has a large detrimental impact on the economic activities when the zero lower bound problem arises to limit the power of monetary policy. Besides, the effect of fiscal policy uncertainty may also depend on the rigidity of prices, capital adjustment costs, elasticity of labour supply, and so on (see Born and Pfeifer (2011)). Therefore, the simple dynamic correlations established in this section may not well reflect the true effect of fiscal policy uncertainty. In the next section, this paper continues to analyze the effect of fiscal policy uncertainty from another prospective, using a probit regression model. The model allows

me to investigate whether such policy uncertainty has predictive power for forecasting future recessions.

4. Analysis based on a probit regression model

In the previous section, the correlations between the policy uncertainty and the recession index for up to four horizons ahead were found to be small and, in most of cases, insignificant. However, such findings may not be sufficient to conclude that the policy uncertainty does not influence the future economy. To explore this issue further, this section turn the attention to the predictive power of the fiscal policy uncertainty for the probability of recession in the future, using the probit regression model.

The analysis in this section is based on three specifications of the model. The first specification of the probit model only includes the recession index and the uncertainty index. Such construction is used to test the overall effect of fiscal uncertainty on the probability of future recession. The second specification controls for the interest rate to examine the effect of fiscal uncertainty without being disturbed by the monetary policy. As highlighted by Johannsen (2013) and Born and Pfeifer (2011), the reaction of the monetary policy (represented by the change in short term nominal interest rates) can be a critical factor that limits the response of the economic activities to higher fiscal volatility. Born and Pfeifer (2011) also discover that impact of fiscal uncertainty can be three times larger when the reaction of monetary policy is muted. For the last specification, all potential leading indicators will be included in the model to examine whether fiscal

uncertainty has predictive power on the likelihood of future recession beyond the information contained in the other leading indicators.

4.1. The probit regression model

The basic framework of the probit model is set up as following:

,

where is the unobservable variable that determines whether or not the economy is under recession. The time t represents the quarter in which the economic variables are evaluated and k is the number of quarters ahead (k=1, 2, 3, 4 in this paper). The matrix of independent variables represents may include the uncertainty index and other leading indicators mentioned in section 3. In this study, the uncertainty index is included in in all specifications. The second specification adds the interest rate to . The last specification of the model contains all leading indicators in . a vector of coefficients determines the marginal effect of independent variables on the unobservable dependent variable. The error term is assumed to be standard normally distributed. The observable dummy variable, , represents the periods of recession (in this study, is the recession index). Then the relationship between and is the following:

The probability for the economy in the k-th quarter ahead to be recessionary, conditional on the observed vector is given by:

Prob( ) = Prob( )

= Prob( )

= Prob( )

= Prob( )

= ( )

Here (*) is the cumulative standard normal distribution function of . The probit model is estimated by the maximum likelihood. The marginal effect of the independent variables on the probability of future recession is determined by

which is dependent on the value that is imposed on . In the study here, I examine the marginal probability effect of the uncertainty index evaluated at the sample mean. In addition, I report the p-value for the estimators, as well as the pseudo-R^2 used to estimate the explanatory power of probit model (see Estrella et al. (1998)). Lastly, all time series independent variables are transformed into the logarithm, growth rates, and HP-filtered time series for estimation following Taylor and Mcnabb (2007).

4.2. Results of analysis

4.1.1 Specification 1: only includes the policy uncertainty index

Table 4 presents the estimated marginal probability effect of the "log levels", "growth rates", and "HP-filter" of the policy uncertainty index in this specification for the U.S.

and Canada. The table also shows the p-value and the pseudo R^2 for the corresponding estimations.

Results for the U.S. economy

For the U.S. data, most of the estimated coefficients for both the logarithm transformation and the HP-filter transformation are insignificant. These results mean that, in general, the change in the level or the deviation from the trend for the fiscal uncertainty does not have predictive power on the future recession. For the case of the logarithm transformation, the coefficient for the fourth forecast horizon is negative and significant. The coefficient for the HP-filter transformation for the same horizon is also significantly negative, implying that higher deviation of fiscal uncertainty from its trend reduces the chance of recession for the fourth upcoming quarter. In contrast, the growth rate of fiscal uncertainty does help predict the likelihood of recession for the second and third quarters ahead since the coefficients for these two periods are significant. The estimated values for these two coefficients are 0.59% and 0.56% respectively, meaning that a 1% increase in the growth rate of fiscal volatility raises the probability of recession by 0.59% for the second forecast horizon, and 0.56% for the third forecast horizon.

Results for Canada economy

For the Canadian data, the coefficients for both the logarithm and growth rate transformations are all insignificant. Although we can observe the coefficient for the first forecast horizon for the HP-filter transformation is significant, the value is only 0.0047. It means that a 1% increase in the standard deviation only raises the probability of recession for the next quarter by 0.0047%, which is very small.

Such results may not be surprising given that the specification here mainly focuses on the overall effect of fiscal uncertainty. Like other types of uncertainty, the impact of fiscal policy uncertainty on the economy depends on the interactions of economic agents in the society. The economic agents are intent on smoothing business cycles by adjusting their behaviour in response to the uncertainty shocks (see e.g. Born and Pfeifer (2011), and Cho and Cooley (2011)). Therefore, the overall effect of fiscal uncertainty is small.

4.1.2. Specification 2: includes the policy uncertainty index and the interest rate

Table 5 shows the estimated marginal probability effect of the policy uncertainty in terms of three transformations for the U.S. and Canadian data. Also, p-value and pseudo R^2 for the estimations are provided.

Results for the U.S. economy

For the U.S. data, the results show that the inclusion of the interest rate produces more significant results and the estimated coefficients are much larger than those in the first specification. For instance, the logarithm transformed fiscal uncertainty index has relatively stronger predictive power for the recession for the next three horizons. To be more specific, a 1% increase in the level of fiscal policy uncertainty results in higher likelihood for the future recession by 1.1% for the next quarter, 0.9% for the second next quarter, and 0.54% for the third next quarter. On the other hand, the coefficients for HP-filtered policy uncertainty index are also significant for the first two forecast horizons even though the values are still small (less than 0.01). Nevertheless, the effect of the growth rate of fiscal uncertainty index is similar to that in the first specification.

Results for Canada economy

For Canada, the estimated coefficient for the logarithmically transformed uncertainty index is significant for the first horizon. It shows that a 1% higher in the level of policy uncertainty implies a 0.35% larger probability for the recession for the upcoming quarter. The reported coefficients for the HP-filtered series become significant for the first two horizons, but, again, the values are small (less than 0.007). At last, all estimators for the "growth rate" of the uncertainty index remain insignificant.

Such results are largely in line with the findings by Johannsen (2013) and Born and Pfeifer (2011). It implies that, the monetary policy plays an important role in smoothing the economic fluctuations. In addition, the monetary policy makers always appear to act quickly to counteract the business cycle before the fiscal policy uncertainty can affect the economic activities. Without the monetary policy, the negative impact of fiscal policy uncertainty on the future recession becomes much larger.

Furthermore, we can see that the U.S. is more affected by the increase in the level of fiscal policy uncertainty than Canada. One of the possible potent reasons is that, the economic agents believe that the economic environment in Canada is better in the future. This is because the debt-to-GDP ratio of Canada is relatively small, the Canadian government faces less financial constrain on bolstering the economic development.

4.1.3. Specification 3: includes the policy uncertainty index and all potential leading indicators

Table 6 gives the results for the estimated marginal effects of fiscal policy uncertainty for the U.S. and Canada in the specification that controls for the leading indicators. The p-value and pseudo R^2 are also shown in the table.[15]

Resuls for the U.S. economy

In the case of the U.S., the estimated coefficient for the third forecasting horizon in the case of the logarithm transformation is significant. The value suggests that a 1% increase in the level of fiscal uncertainty leads to a 0.7% increase in the probability of recession after three quarters. However, all other estimates are insignificant. Therefore, there is no evidence on the existence of extra roles for fiscal volatility to affect the future recession when all potential leading indicators are included.

Results for Canada economy

For the Canadian data, all estimated coefficients are insignificant. This means, after considering the impact of all leading indicators, the fiscal policy uncertainty is not important in Canada.

There at least three potential reasons for observing such outcome. First, the change in the private investment and private consumption decisions may be proxies for the fiscal uncertainty. As a result, the investment and consumption included in the regression already reflect the effect of fiscal uncertainty. Second, the policy uncertainty index may

15 For some reasons, the statistics software used for this study could not complete the probit regression estimations for the case of HP-filter transformation for the US data. The coefficient for the fourth forecast horizon is missing.

reflect some information other than fiscal policy uncertainty. For example, the construction of the first part of the index is based on the information collected from the US newspapers. So the information presented may be biased and in the interest of the editors. Therefore, the estimated marginal effects may not reflect the true impact of fiscal policy uncertainty on the likelihood of future recession. Third, the inclusion of leading indicators reduces the degrees of freedom, which may make the estimates less precise.

5. Conclusion

5.1. Review of the analysis in the paper

This paper examined the effect of fiscal policy uncertainty on the probability of future recession in the U.S. and Canada. The analysis began with estimating the correlations between the growth rate of policy uncertainty index and the recession index for up to the next four forecast horizons. The correlations were found to be significant for the second and third forecast horizons for the US data. However, the values of the estimates were very small. On the other hand, all estimated correlations were insignificant for the Canadian data.

In the following sections, this paper employed the probit regression model to see whether the policy index had predictive power for the future recessions in the U.S. and Canada. The analysis was based on three model specifications. The first specification was used to estimate the overall margin probability effect of fiscal uncertainty. So only the recession index and the uncertainty index were included in the model. I found that the effects of the fiscal policy uncertainty index in the probit models were mostly

insignificant, and the values for the significant estimators were very small. This result may be due to the tendency for the economic agents to interact to smooth the business cycle. The second specification of the model controlled for the interest rate to insulate the marginal probability effect of fiscal policy uncertainty from the effect the monetary policy. Much more significant and larger estimated coefficients were observed in this specification, which, to some extent, supported the findings from previous research (see e.g. Johannsen (2013), and Born and Pfeifer (2011)). In the last specification, all potential leading indicators were incorporated into the model. But I found that, almost all estimators were insignificant for both countries.

The findings that there is no additional effects of fiscal policy uncertainty may result from two reasons. First, the change private investment and private consumption already reflects the change in fiscal policy. So the inclusion of these two variables can eliminate the effect of fiscal policy uncertainty. Second, the policy uncertainty index may biasedly represent the true level of fiscal uncertainty. This is due to the fact that the source of information for generating the index may be in the interest of some individuals.

5.2. A recommendation for fiscal policy makers

I have shown that the negative effects of fiscal policy uncertainty on future recessions can be magnified in the absence of monetary policy. As a result, the fiscal policy makers for the U.S. and Canada should be more cautious in communicating with the public currently, because the monetary policy makers have been largely constrained by the zero lower bound problems and the consequences of generating uncertainty can be very

damaging. Furthermore, it may be better for the fiscal policy makers to act decisively to reduce policy uncertainty than to spend too much time on discussing the fiscal policy.

5.3. Possible shortcomings for the analysis in this paper

Although the results of the analysis revealed that, in general, the fiscal policy uncertainty had negative impacts on future recessions, there are at least two possible drawbacks of the analysis for limiting the precision of the results. First, the estimated marginal effects of the fiscal policy uncertainty in the analysis were evaluated at the sample mean, so they only represented the marginal effects of fiscal policy uncertainty at the average level. However, during the post crisis periods, the fiscal policy uncertainty is relatively high, so its marginal effects can be larger than what the paper found in this paper. However, there is no criterion for which level of fiscal policy uncertainty should be chosen to reflect the current situation, the further analysis of the impacts of fiscal policy uncertainty in the paper is limited.

Second, Table 4 to Table 6 show that the pseudo R^2s are small even when the model includes several leading indicators (around 0.5 for the U.S. data and around 0.4 for the Canadian data). It means that there may be some other information missing in the model. Therefore, the results for the analysis may not be precise.

5.4. The implications for future research

The study in the paper raises at least two questions for future research. First, what are the potential factors that reduce the magnitude of the effects of fiscal policy uncertainty in Canada compared with the U.S.? In the comparison between the results for the U.S. data and Canadian data, I found that the effects of fiscal policy uncertainty were smaller in Canada in the three specifications of the model. Understanding those factors can provide a guideline for fiscal policy makers to control the negative impacts of policy-induced uncertainty.

Second, what are the effects of fiscal policy uncertainty on the probability of the change in future output, consumption, investment, and employment? This paper does not specify how the fiscal policy uncertainty affects the probability of the change in some key economic variables. By analyzing the likelihood of the response of the key economic variables to the fiscal policy uncertainty, the policy makers can identify which economic variables are most likely to be affected by the increase in fiscal policy uncertainty. Therefore, they can specify the policies to diminish the effects of fiscal policy uncertainty on these economic factors.

Appendix 1: List of data

1. The U.S. and Canadian data for the recession index from the Federal Reserve Bank of St. Louis Economic Research website:
http://research.stlouisfed.org/fred2/search?st=OECD+based+Recession+Indicators

The recession index for the U.S.	OECD based Recession Indicators for the United States from the Peak through the Trough, Monthly, Not Seasonally Adjusted.
The recession index for Canada	OECD based Recession Indicators for Canada from the Peak through the Trough, Monthly, Not Seasonally Adjusted.

2. The U.S. and Canadian data for the economic policy uncertainty index from the Economic Policy Uncertainty website: http://www.policyuncertainty.com/index.html

The policy uncertainty index for the U.S.	Monthly US Economic Policy Uncertainty Index
The policy uncertainty index for Canada	Monthly Canadian Economic Policy Uncertainty Index

3. The U.S. and Canadian data for the leading indicators from the Organization for Economic Co-operation and Development StatExtracts website: http://stats.oecd.org/

The real wage rate for the U.S. and Canada	Hourly Earnings, Manufacturing, index 2010 = 100, Quarterly, Seasonal Adjusted
The GDP for the U.S. and Canada	Gross Domestic Product – Expenditure Approach, Millions of US Dollars, Volume Estimates, Fixed PPPs, OECD Reference Year, Annual Levels, Quarterly, Seasonal Adjusted
The unemployment rate for the U.S. and Canada	Harmonized Unemployment, Total, All Persons, Rate Series, Quarterly, Seasonal Adjusted

The M1 for the U.S. and Canada	Monetary Aggregates – Narrow Money, Index 2010 = 100, Quarterly, Seasonal Adjusted
The M3 for the U.S. and Canada	Monetary Aggregates – Broad Money, Index 2010 = 100, Quarterly, Seasonal Adjusted
The government expenditure for the U.S. and Canada	General Government Final Consumption Expenditure, Millions of National Currency, Chained Volume Estimates, National Reference Year, Quarterly Levels, Seasonal Adjusted
The private consumption for the U.S. and Canada	Private Final Consumption Expenditure, Millions of National Currency, Chained Volume Estimates, National Reference Year, Quarterly Levels, Seasonal Adjusted
The investment for the U.S. and Canada	Gross Fixed Capital Formation, Millions of National Currency, Chained Volume Estimates, National Reference Year, Quarterly Levels, Seasonal Adjusted
The interest rate for the U.S. and Canada	Immediate Interest Rates, Call Money, Interbank Rate, Per cent per annum, Quarterly

Appendix 2: List of figures

Figure 1A: The recession index for the U.S. from the first quarter of 1990 to the second quarter of 2013.

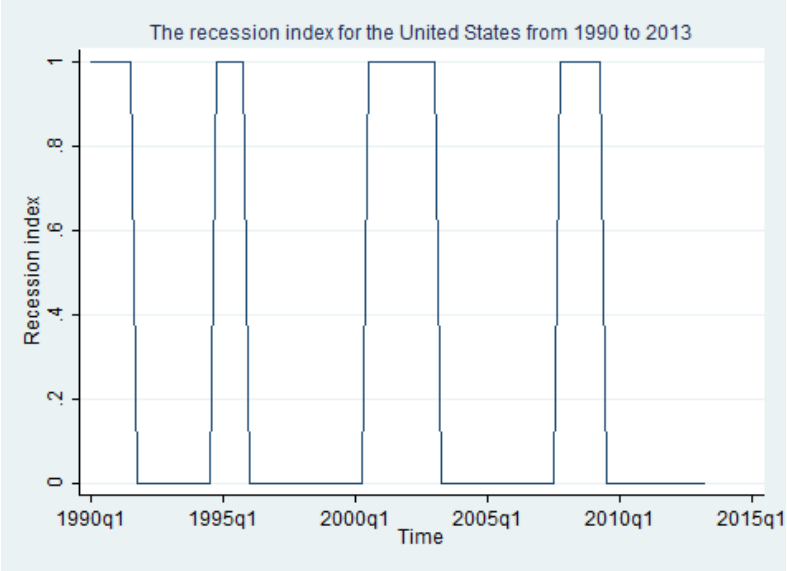

Figure 1B: The recession index for Canada from the first quarter of 1990 to the second quarter of 2013.

Figure 1A and Figure 1B plot the recession indexes for the U.S. and Canada from the first quarter of 1990 to the second quarter of 2013. The index only takes the value of one and zero. If the value is one, the corresponding period is recessionary; otherwise, it is expansionary.

Figure 2A: The economic policy uncertainty index for the U.S. from the first quarter of 1990 to the second quarter of 2013.

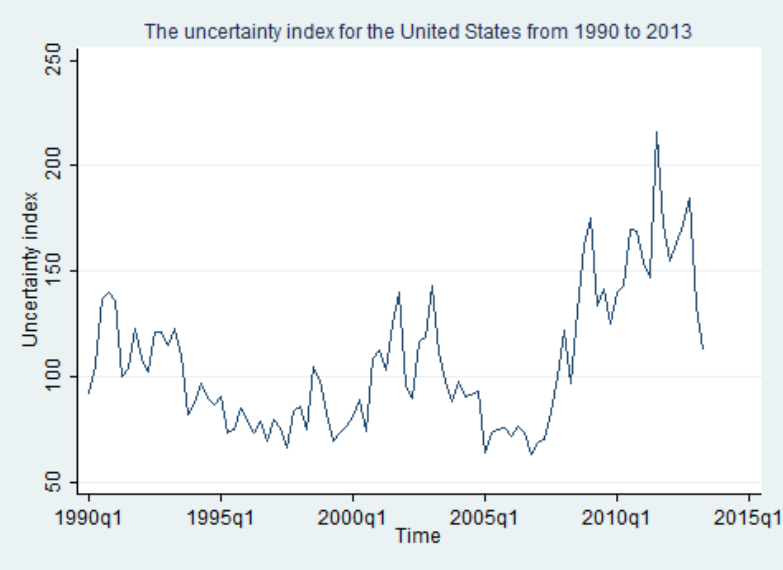

Figure 2B: The economic policy uncertainty index for Canada from the first quarter of 1990 to the second quarter of 2013.

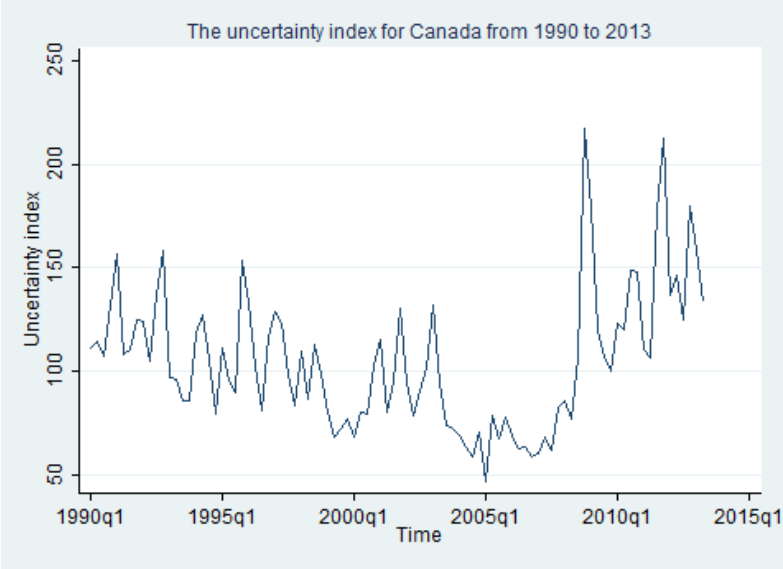

Figure 1A and Figure 2B illustrate the policy uncertainty index for the U.S. and Canada from the first quarter of 1990 to the second quarter of 2013.

Figure 3A: The growth rate of the economic policy uncertainty index for the U.S. from the first quarter of 1990 to the second quarter of 2013.

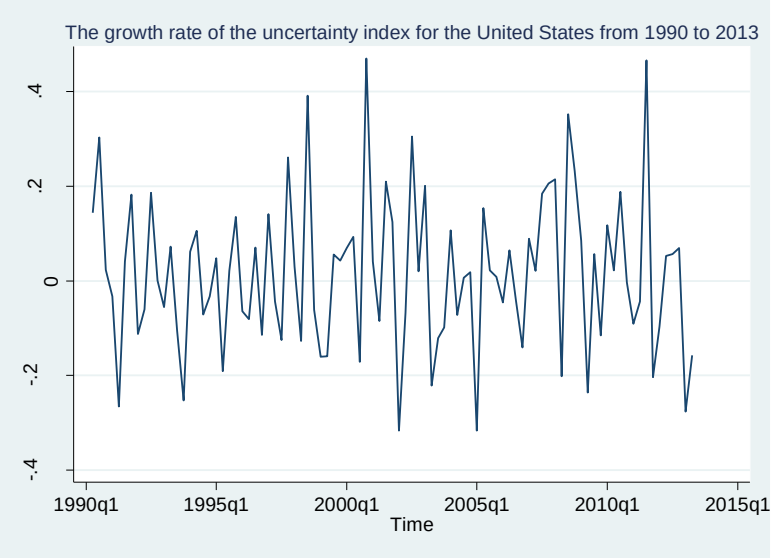

Figure 3B: The growth rate of the economic policy uncertainty index for Canada from the first quarter of 1990 to the second quarter of 2013.

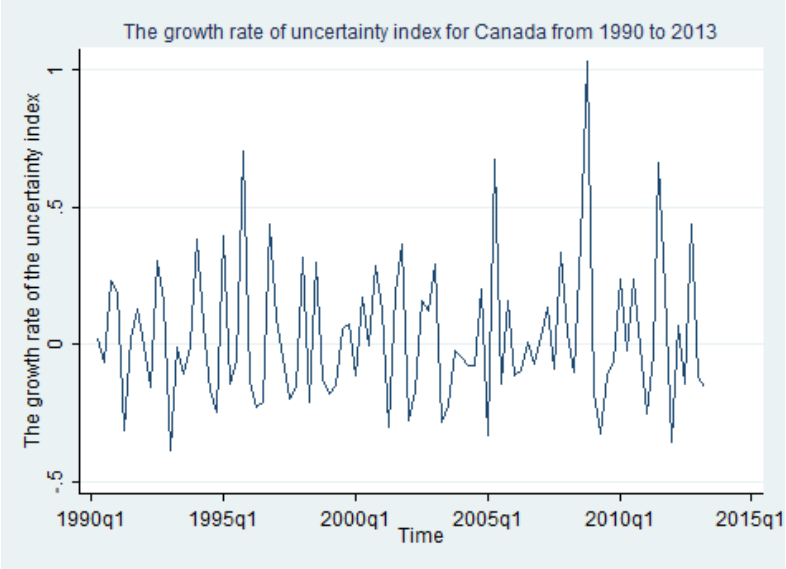

Figure 3A and Figure 3B plot the growth rate of the policy uncertainty index for the U.S. and Canada for the first quarter of 1990 to the second quarter of 2013.

Figure 4A: The dynamic correlations between the policy uncertainty index and the recession index for four quarters ahead: US data.

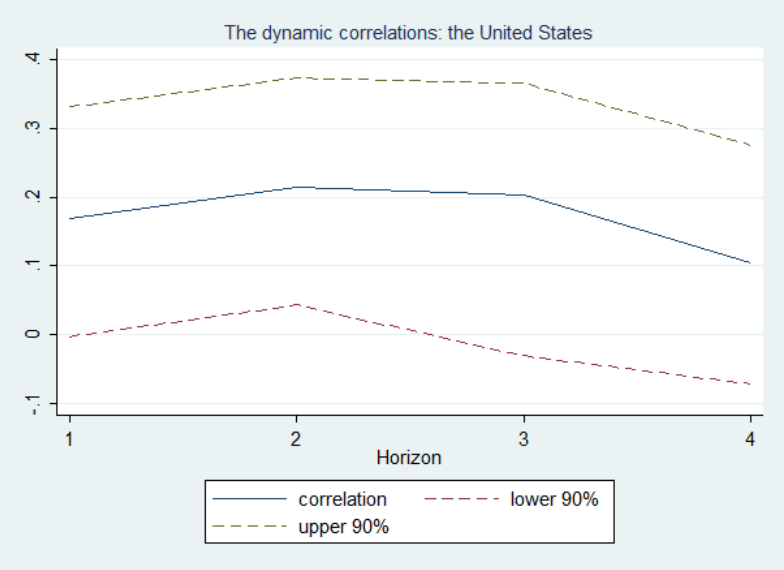

Figure 4B: The dynamic correlations between the policy uncertainty index and the recession index for four quarters ahead: Canadian data.

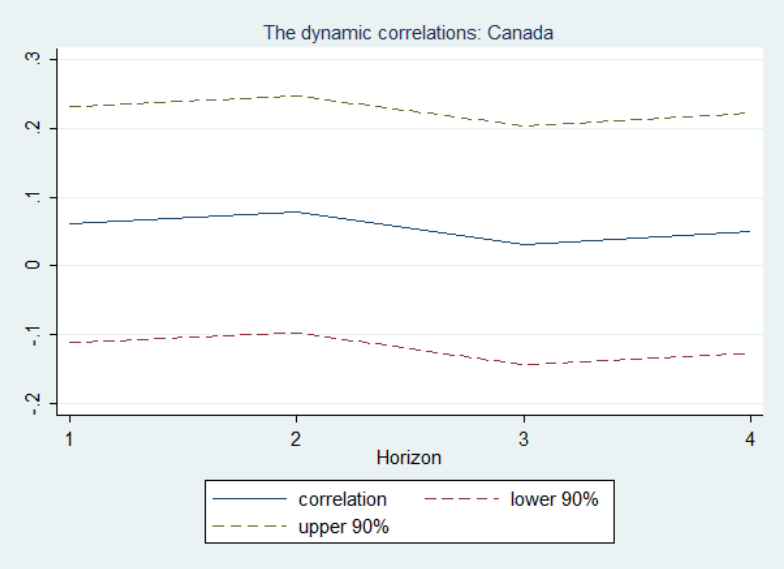

Figure 4A and Figure 4B show the correlations between the policy uncertainty index and the recession index for a forecast horizon of four quarters ahead for both the U.S. and Canada. "lower 90%" represents the lower band of the confidence interval at 90% level, and "upper 90%" represents the upper band of the confidence interval at 90% level.

Appendix 3: List of tables

Table 1A: KPSS test for stationarity of the uncertainty indexes the U.S.

Maxlag = 3 chosen by Schwert criterion
Autocovariances weighted by Bartlett kernel
Critical values for H0: the uncertainty index is trend stationary
10%: 0.119 5% : 0.146 2.5%: 0.176 1% : 0.216

Lag order	Test statistic
0	1.04
1	.577
2	.415
3	.329

Table 1B: KPSS test for stationarity of the uncertainty indexes Canada.

Maxlag = 3 chosen by Schwert criterion
Autocovariances weighted by Bartlett kernel
Critical values for H0: the uncertainty index is trend stationary
10%: 0.119 5% : 0.146 2.5%: 0.176 1% : 0.216

Lag order	Test statistic
0	.941
1	.57
2	.443
3	.37

Table 1A and Table 1B present the results of KPSS test for the uncertainty indexes for the U.S. and Canada. The maximum lag for this test is given as well as the test statistics for each lag order and the critical values for four significance levels: 1%, 2.5%, 5%, and 10%.

Table 2A: KPSS test for stationarity of the growth rate of the uncertainty indexes for the U.S.

Maxlag = 3 chosen by Schwert criterion
Autocovariances weighted by Bartlett kernel
Critical values for H0: guncerin is trend stationary
10%: 0.119 5% : 0.146 2.5%: 0.176 1% : 0.216

Lag order	Test statistic
0	.0336
1	.0388
2	.0495
3	.0542

Table 2B: KPSS test for stationarity of the growth rate of the uncertainty indexes for Canada.

Maxlag = 3 chosen by Schwert criterion
Autocovariances weighted by Bartlett kernel
Critical values for H0: guncerin is trend stationary
10%: 0.119 5% : 0.146 2.5%: 0.176 1% : 0.216

Lag order	Test statistic
0	.0165
1	.0193
2	.027
3	.0365

Table 2A and Table 2B present the results of KPSS test for the growth rate of the uncertainty indexes for the U.S. and Canada. The maximum lag for this test is given as well as the test statistics for each lag order and the critical values for four significance levels: 1%, 2.5%, 5%, and 10%.

Table 3: The dynamic correlations between the growth rate of the uncertainty index and the recession index of four quarters ahead for the U.S. and Canada.

			The growth rate of uncertainty index	
	Countries	Future horizons	Correlation	Confidence interval at 10% level
The recession index	The U.S.	t+1	0.169	(-0.003, 0.332)
		t+2	0.215*	(0.043, 0.374)
		t+3	0.204*	(0.031, 0.366)
		t+4	0.105	(-0.072, 0.276)
	Canada	t+1	0.061	(-0.112, 0.232)
		t+2	0.078	(-0.097, 0.248)
		t+3	0.031	(-0.144, 0.204)
		t+4	0.050	(-0.127, 0.223)

Note: "" represents the correlation is significant at 10% level.*

*Table 4 presents the marginal effects of the policy uncertainty on the recession for four forecast horizons. Three types of transformations of the policy uncertainty index are presented in the table: logarithm levels, growth rates, and HP-filter. Note: M.E. stands for the marginal effect which is evaluated at the sample mean. "**" means that the estimated coefficient is significant at 5% level, and "*" means that the estimated coefficient is significant at 10% level.*

The U.S.	Foreca horizoı
Uncertainty index	t+1
	t+2
	t+3
	t+4
Canada	
Uncertainty index	t+1
	t+2
	t+3
	t+4

Table 4: Results for probit regression estimation: only includes the policy uncertainty index.

*Table 5 presents the marginal effects of the policy uncertainty on the recession for four forecast horizons. Three types of transformations of the policy uncertainty index are presented in the table: logarithm levels, growth rates, and HP-filter. Note: M.E. stands for the marginal effect which is evaluated at the sample mean. "**" means that the estimated coefficient is significant at 5% level, and "*" means that the estimated coefficient is significant at 10% level.*

The U.S.	Foreca horizoı
Uncertainty index	t+1
	t+2
	t+3
	t+4
Canada	
Uncertainty index	t+1
	t+2
	t+3
	t+4

Table 5: Results for probit regression estimation: includes the policy uncertainty index and the interest rate.

*Table 6 presents the marginal effects of the policy uncertainty on the recession for four forecast horizons. Three types of transformations of the policy uncertainty index are presented in the table: logarithm levels, growth rates, and HP-filter. Note: M.E. stands for the marginal effect which is evaluated at the sample mean. "**" means that the estimated coefficient is significant at 5% level, and "*" means that the estimated coefficient is significant at 10% level.*

The U.S.	Forecas horizon
Uncertainty index	t+1
	t+2
	t+3
	t+4
Canada	
Uncertainty index	t+1
	t+2
	t+3
	t+4

ation: includes the policy uncertainty index and all potential leading indicators.

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