2-2017

# Three Essays on Fiscal Policy

Sinem Buber Singh
*The Graduate Center, City University of New York*

# Three Essays on Fiscal Policy

by

Sinem Buber Singh

A dissertation submitted to the Graduate Faculty in Business in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2017

This manuscript has been read and accepted by the Graduate Faculty in Business in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

**Professor Merih Uctum**

Date

Chair of Examining Committee

**Professor Wim Vijverberg**

Date

Executive Officer

**Professor Merih Uctum**

**Professor Christos Giannikos**

**Professor Chun Wang**

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

Abstract

THREE ESSAYS ON FISCAL POLICY

by

SINEM BUBER SINGH

Adviser: Professor Merih Uctum

This dissertation examines the domestic and international effects of fiscal policy shocks on country risk, stock markets returns and trading partners. There are three essays in this study.

First essay examines the relative impacts of macroeconomic, financial and political variables on country risk for five advanced economies; the US, the UK, Canada and Singapore for 1984:M1-2014:M12 and Germany for 1990:M9-2014:M12 time periods. To do so, I follow a two stage estimation procedure. In the first stage, a CAPM is used to estimate time-variant country betas which are used as a proxy for country risk by using a DCC-GARCH model. Then, at the second stage, time variant country betas are regressed on a set of macroeconomic, financial and political variables to distinguish the relative effects of each variable on country risk. Finally, a Kalman Filter approach is used to re-estimate time-variant country betas as a robustness check. The empirical findings of this study show that even though the significance and the direction of the impacts of risk factors differ from one country to another, among macroeconomic variables, budget surplus and current account surplus have significant effects on most country betas, whereas, generally, political risk does not have a significant effect on country risk in advanced economies.

In the second essay, I characterize the effects of fiscal policy shocks on aggregate and sectoral stock market returns in the US for 1975-2013 period with a Structural Vector AutoRegressive (SVAR) Model. The results of this study show that in case of an expansionary (tight) fiscal policy, aggregate stock market returns decrease (increase). Unexpectedly, neither sectoral stock returns respond to policy shocks in the same direction, nor is there an observed co-movement between the

reactions of stock returns of different sectors. As energy and utility sector returns move in the same direction with aggregate returns, financial sector returns move in the opposite direction. Moreover, both positive government spending and positive government revenue shocks decrease industrial sector returns whereas increase healthcare sector returns.

Finally, the third essay characterizes the results of US government spending shocks on domestic and foreign economies. To do so, I analyze the dynamic effects of a positive US government spending shock on real output and real household consumption of Canada and the US, as well as, the real exchange rate from 1957 to 2013 by employing a SVAR model. The findings of the study state empirical evidence in favor of a positive international transmission of domestic fiscal expansion. A positive US government spending shock increases not only US output and consumption but also Canadian output, as the real exchange rate appreciates.

# Acknowledgments

Firstly, I would like to thank my advisor Prof. Uctum for her continuous support of my Ph.D. study. Not only did she provide the dataset, insights and valuable feedback for my research, but also her guidance that led me to explore my limits at every challenge and opportunity presented throughout this journey. This dissertation would not be possible without her invaluable support and inputs.

Besides my advisor, I would like to thank the rest of my dissertation committee: Prof. Wang, and Prof. Giannikos, for their insightful comments and encouragement, but also for hard questions which incented me to widen my perspective.

I would like to thank Prof. Vijverberg for his feedback and time on my first research paper which I wrote as a part of the research and writing course thought by him.

I thank to my friends for walking this path with me; especially to Sibel Korkmaz for being a great teacher, Osman Dogan for helping me to construct my first research idea, and Ilhami Gunduz for listening to my complaints all the time. Also, I would like to thank Ahu Yildirmaz for pushing me to the finish line.

I would like to thank my family: my mother for everything she has sacrificed to raise me the person I am today and to my brother and sisters for believing in me even when I did not believe in myself.

Last but not least, I would like to thank my husband for his immense support every single day since I met him. I would not be writing these sentences without him. He drove me to the library every day so that I can study for my examinations; he kept me motivated and did not let me get discouraged even in the worst days of my study. I cannot thank him enough for believing in me and for everything he has done for me.

*To Ali Ilkan*

*Aarav Kerem*

*and Eylul Bilge*

# Contents

# List of Tables

# List of Figures

# Chapter 1

# Relative Effects of Macroeconomic Variables to Country Risk

## 1.1 Introduction

The business world is reshaping as a response to erratic dynamics of an increasingly interconnected world. Many lessons are learned by both business world and public authorities from the recent global imbalances such as the 2008 Great Recession, the Arab Spring, political instability in Ukraine, and Greek debt crisis at the heart of the Eurozone crisis. These global waves reminded the business world that counterparty risk is not the only peril when it comes to minimize the risk exposure, in deed, the country risk which is all systematic risks but the counterparty risk, plays an as important role in a possible default. As we define the country risk as an aggregation of financial, political, and economic risks at both local and global levels, the recent global dynamics underline the importance for the integral structure of it, since not only the Great Recession and Eurozone emphasized the crucial roles of financial, economic and sovereign risk, but also the Arab Spring and Ukraine crisis give a non-negligible weight to political stability.

In existence of inter-correlated global uncertainties, quantifying the country risk is not only a challenge that is increasingly critical to those who are a part of the global business world, but also gaining gradual attention from researchers in the science of economics. Existing methods to measure the country risk include, but not limited to, structured qualitative methods such as country investment ratings assigned by rating agencies, country risk reports published by independent investment consulting firms and quantitative methods based on various statistical models.

As widely used country risk measurements in the business world, the country risk reports and ratings have limitations of being opaque, subjective and unreliable. This critique is supported by the empirical findings of Oetzel et al. (2001). They examine eleven most commonly used country risk measures including those published by Euromoney Magazine, Institutional Investor Magazine and Political Risk Services, across seventeen countries for nineteen years by using a logistic model. They use currency fluctuations to test for the reliability and predictive power of those risk measures and find that commercial risk measures perform poorly at predicting actual risk realizations.

Although the model has the limitation of using only currency fluctuations; not a comprehensive enough proxy for country risk, the study empirically confirms the overall reaction of the investors in global financial markets towards the accuracy of rating agencies given that they granted the mortgage-backed securities with high investment grades during 2008 crisis.

Among quantitative models, limited dependent variable models are commonly used by country risk researchers (Oetzel et al. (2001), Cooper (1999), Lanoie and Lemarbre (1996) and, Muwando and Gumbo (2013)). Apart from the traditional econometric models, artificial and hybrid neural network models as well as discriminant analysis found place in the empirical literature to measure the country risk. Yim and Mitchell (2005) state that among neural network, logit models, cluster techniques and discriminant analysis, hybrid neural network models outperform all and may be a useful tool for markets as well as researchers who are interested in early warning systems.

In this paper, I use a Capital Asset Pricing Model (CAPM) to estimate country betas as a measure of country risk for five advanced economies; the US, the UK, Canada, Germany and Singapore. Since stock market returns are responsive to both global and local dynamics, this approach has the advantage of being able to capture the effects of all risk components that one cannot fully incorporate in a model. Moreover, a Capital Asset Pricing Model is intuitive, transparent and relatively new to country risk applications although it has unrealistic assumptions such as market efficiency. After estimating country betas, this study dives deeper into the country risk analysis and tries to distinguish the relative effects of macroeconomic, financial and political risk variables on country beta for the US, the UK, Canada and Singapore for 1984-2014, and Germany for 1990-2014 time periods.

Although there are a fair number of empirical studies employing country beta approach to quantify the country risk, they have a common limitation of comparing country betas for countries of different financial integration level. Comparison of country betas among countries with varying financial integration levels might be quite misleading since $Q_t$ , an indicator of financial integration, is pretty low for developing countries although those countries have more volatile financial markets than the rest of the world. Therefore, despite the fact that$\sqrt{h_{it}} > \sqrt{h_{wt}}$, country beta, an indicator of country risk level, can be pretty small due to a low $Q_t$ since$\beta_t = Q_t\sqrt{h_{it}}/\sqrt{h_{wt}}$ . This is a common limitation of some studies in the country beta literature since they pool a set of countries with various levels of financial integration (Arfaoui and Abaoub (2010)). The countries in this study are chosen of similar financial integration levels to address this limitation.

In addition, the second stage; examining the relative impacts of economic and financial indicators while controlling for political risk, is quite important and timely since the stress testing and capital planning regulations that the Federal Reserve started to impose on financial institutions after the Great Recession, once again, underline the role of macroeconomic balances in systematic risk composition.

The empirical findings of the study show that, even though the significance and the direction of the impacts of risk factors differ from one country to another, among macroeconomic variables, budget surplus and current account surplus have significant effects on most country betas whereas, generally, political risk does not have a significant effect on country risk in advanced economies.

This paper has six sections. Section 2 summarizes the selected empirical literature, section 3 describes the data, section 4 states the empirical findings of the study, section 5 checks for the robustness and section 6 concludes.

## 1.2 Selected Literature Review

As the components of country risk; political and economic risk attracted more interest in theoretical studies of punctuated equilibrium theory and entrepreneurship theory (Di Gregorio(2005)) in strategic management literature than the field of economics, economics literature gives gradually increasing attention to empirical studies. One of the rare theoretical papers on country risk; Eaton et al. (1986), create a two-period theoretical model in which they distinguish the international lending markets from domestic credit markets due to enforcement problems and the absence of collateral. The model focuses on the potential inefficiencies in international lending such as the magnitude of outstanding lending which increases the likelihood of a default and informational externalities which may contribute to the occurrence of runs leading to a lending crisis. They suggest that the former can be solved by banking regulations that are imposed not only on the ratio of loans to a single borrower but all loans to a single country, and the latter can be solved by a lender-initiated moratorium. They add that another regulation that policy makers should adopt is on the full disclosure requirements of loans made to individual countries.

Another theoretical study on country risk, Damodaran (2003), questions if the country risk can be diversified and finds that given the increasing correlation across equity markets in many countries, country risk cannot be diversified away. Moreover, he tries to calculate a country risk premium by taking into account the default spread on a government bond issued by a particular country and the relative volatility of the country's equity markets to the US equity market. Then, he argues that a company-specific country risk premium should be incorporated in the cost valuations of multinational companies depending on the risk exposure.

Despite the limited scope of theoretical models on country risk, the empirical literature on the topic is quite rich in terms of the variety of approaches adopted to quantify country risk as well as its relationship with various macroeconomic variables. Erb et al. (1996a) is one of the first and leading papers in empirical literature utilizing Sharpe's CAPM in country risk calculation. They use Institutional Investor's country credit ratings and develop measures of payback and calculate the recovery time of an investment by combining the expected hurdle rate with the expected volatility. They criticize the existing International CAPM application of country risk measurement since they argue that one cannot measure the idiosyncratic systematic risk the same way for both developed and emerging markets. They use country beta approach only for developed economies, and volatility of national stock markets, which explain the cross-sectional variations in expected returns better, for emerging markets.

The empirical studies examining the relationship between macroeconomic dynamics and the risk of a country by using a country beta approach follow two different estimation procedures. The early papers on the topic follow a one-step estimation procedure in which the macroeconomic variables are substituted into CAPM framework to replace country beta, instead of estimating country beta singularly and then regressing on macroeconomic variables. Gangemi et al. (2000) is one of the papers which follow a one-step estimation procedure to understand the macroeconomic triggers of Australian country beta over the period 1974 to 1994. Their results show that Australia's exchange rate is the only macroeconomic factor that significantly affects Australian country risk.

Andrade and Teles (2004), another paper that follows a one-step estimation procedure find that monetary policy and international reserves have a significant influence on Brazilian country beta whereas Verma and Soydemir (2006) find that global factors such as real interest and inflation rates of G7 countries have stronger influence on country risk level of Latin American countries including Brazil, than local factors such as monetary policy. The importance of global factors are also mentioned in Glova and Pastor (2013) that use a least square approach to explain the interaction of economic variables and country risk for Visegrad countries; Czech Republic, Romania, Poland and

Hungary, for 2006-2013 time period and state that global factors have greater influence on their betas.

Although a one-step estimation technique, which estimates CAPM parameters after substituting country beta with all macroeconomic variables, models a dynamic country risk, it does not estimate the coefficients of macroeconomic variables singularly to better capture the magnitude of their impact on country risk, but rather estimates the coefficients of the interaction terms between country beta and macroeconomic variables.

A common limitation of the studies that examine the interaction of macroeconomic variables with country risk is to control for political risk factors. Given that country risk is affected from not only financial and economic structure of a country but also its political stability, omission of political risk factors might lead to biased estimates of the relative effects of economic variables. Therefore, in this study I control for political and financial risk factors while focusing on the influence of macroeconomic variables.

Among the papers that follow a two-step estimation procedure and calculate country beta explicitly, Basu et al. (2011) state that Indian country risk is highly correlated with FDI flows, interest rates, exchange rates and unemployment rate. Arfaqui and Abaoub (2010) use a GARCH model to estimate country betas and then employ a panel model to explain the impacts of macroeconomic and financial variables on country betas for 15 countries. They underline the increasing importance of global risk factors and the interferences between idiosyncratic and common factors. The drawback of their study is to put together 15 international stock markets of both developed and emerging markets which are of different global financial integration levels that directly affect the magnitude of country betas used to quantify country risk.

Although there is no agreement in the empirical literature on the optimal methodology to quantify country risk, there is a consensus on the dynamic structure of it. There are various estimation techniques employed to capture the dynamic structure of country betas. Employing a GARCH model is quite common since GARCH family models are to estimate time-variant volatility of both global and national stock market returns, not all dynamic models are able to capture time-variant structure of correlation coefficients which measure the level of global financial integration of a country, yet it is a crucial attribute of a dynamic country beta.

Among GARCH family models, I employ a Dynamic Conditional Correlation Generalized AutoRegressive Conditional Heteroscedasticity (DCC-GARCH) model since not only the volatility of a country's stock market has a time dependent order but also does its financial integration level. Yang et al. (2012) estimate country betas for BRICS from 1995 to 2010 by using a DCC-GARCH model and their results show that the dynamic correlation coefficient of BRICS with global stock returns have an increasing trend, especially after 2008 crisis, implying a higher level of financial integration of BRICS. Marshall et al. (2009) compare DCC-GARCH, Kalman filter, Schwert Seguin and GARCH (1, 1) models in country beta estimation of emerging markets from 1995 to 2008 and conclude that, according to Diebold-Mariano test statistics, Kalman filter approach outperforms the rest. Therefore, I employ a Kalman filter approach to test the robustness of the results of this study.

I believe this paper contributes to the existing empirical literature on country beta approach to examine the effects of macroeconomic variables on country risk by employing a DCC-GARCH model to better capture the dynamics of global financial markets, using a comprehensive dataset on country risk components and, controlling for political and financial risk.

## 1.3 Data

To measure the effects of macroeconomic variables on country risk for five developed economies; the US, Canada, the UK, Germany and Singapore, I follow a two stage estimation procedure. First, I use Capital Asset Pricing Model (CAPM) to estimate country betas which are used as a proxy for country risk and then the estimated country betas are regressed on a set of political, financial and economic variables to distinguish the relative effects of each risk component on country risk overall.

At the first stage, estimated country betas measure the sensitivity of a country's asset market index compared to overall global asset market index. I used national as well as global monthly stock market indices from 1984:M1 to 2014:M12 aggregated by Morgan Stanley Capital International (MSCI) database. The MSCI world index is an aggregated index of 23 developed markets which include: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the UK and the US[1].

At the second stage of the estimation, I regress country betas on a set of economic, financial and political risk components. At this stage, I use monthly ICRG country risk data[2] from 1984:M1 to 2014:M12. ICRG country risk data is based on a statistical model created in 1980 to forecast financial, economic, and political risk for all countries by the editors of International Reports, a widely respected weekly newsletter on international finance and economics. The ICRG country risk data details a comprehensive system that enables various types of risk to be measured and compared between countries. The advantages of this data are that, unlike most of macroeconomic series, ICRG country risk data is monthly and has detailed risk components to measure political risk which are not captured by macroeconomic indicators and can create an omitted variable bias in a model in which political risk components are not distinguished. Table 1.1 shows a detailed description of each component and its point scale for corresponding risk levels. Depending on the riskiness of the component, a point is assigned in a scale of zero to 5, 6, 10, 12 or 15, given the weight of a component in overall composite risk index, in which a low point represents a high risk and a high point represents a low risk level.

This dataset is also used by Erb et al. (1996b). They question the economic content of five

[1]More information about MSCI indices and their methodology can be found at $https://www.msci.com/resources/factsheets/index\_fact\_sheet/msci-world-index.pdf$

[2]More details about ICRG methodology can be found at $https://www.prsgroup.com/wp-content/uploads/2014/08/icrgmethodology.pdf$

different country risk measures; ICRG's political, financial, economic and composite risk indices along with Institutional Investor's country risk ratings if any contain information about future expected stock returns and the results show that they are correlated with future equity returns and highly correlated with equity valuation measures. Together with the availability and monthly frequency of the data, its correlation with equity returns is the reason ICRG data is used in this study.

There are also limitations of ICRG data, since it is a discrete data. It quantifies the risk for a given range therefore, a minimal change in a variable does not affect the point assigned for the risk level. For example; Table 1.6 shows the point system for budget balance as a percentage of GDP. 9 points are given to a country if budget surplus is between 2% and 2.9% of GDP and 9.5 points are assigned if budget surplus is between 3% and 3.9% of GDP. Therefore the effect of a minimal change in budget balance/GDP, say from 2% to 2.1%, is not reflected in the risk level unless the ratio shifts from 2% to 3%. Along with the limitation of the data stated, since the risk components have various weights, in this study, only the significance and direction of coefficients are interpreted rather than the magnitudes.

For all subcategories of risk components, a lower score represents a higher level of risk and a higher score represents a lower level of risk. Although political risk components are criticized of being subjective, economic and financial risk components are far from this criticism. For all subcategories of both economic and financial risk components, the point assignment depends on the magnitude of that particular variable. For example; current account/GDP point has a scale of zero to fifteen for a range of -40% or below to 10% or more scale for current account/GDP ratio. The higher the current account/GDP ratio is, the higher the points assigned for the component are, which means that the lower the risk level is. To detail more, if a country's current account surplus is between 6% and 7.9% of her GDP, 14 points are given to the risk score for current account/GDP component, and if a country's current account deficit is between 35% and 39.9% of her GDP, then the country gets only 0.5 point. The same logic and pre-determined bin limits are applied to all subcategories of economic and financial risk components.

In this study, I include the subcategories of economic risk and the composite indices for financial and political risk categories in the model since this paper focuses on the relative effects of macroeconomic variables on country risk while controlling for financial and political risks.

## 1.4 Model and Methodology

As explained in the data section, the estimation is done in two stages. At the first stage, a CAPM is utilized to estimate country betas which are used as a proxy for country risk and at the second stage, country betas are regressed on economic, financial and political variables to distinguish the relative effects on country risk.

In the following subsections, I detail the estimation procedure along with the results.

### 1.4.1 Estimation of Country Betas

Capital Asset Pricing Model (CAPM) was developed by Sharpe in 1964 and is commonly used in finance literature to quantify the relationship between the two distinct features of a stock; its risk and return. A CAPM beta is to quantify the "systematic risk" of a particular stock in relation with the overall portfolio.

Here, I adopt the same approach to measure the systematic risk of a particular country in comparison to the world. An international CAPM is defined as;

$$R_t = \alpha + \beta_t R_{wt} + \epsilon_t \tag{1.1}$$

$$\epsilon_t \sim N(0, \sigma^2) \tag{1.2}$$

where $R_t$ is the national stock market return of a country, $\beta_t$ is the systematic risk measure for that country, $R_{wt}$ is the world stock market return and $\epsilon_t$ is i.i.d. residual term.

Figure 1.1 shows national stock market returns for Germany from 1990:M9 and from 1984:M1 for the US, Canada, the UK, Singapore and global stock returns. Stock returns for all countries are stationary and have time-varying variances. For all countries, the stock returns are more volatile after 2008 crisis and during 1987 crash. Therefore I employ a multivariate GARCH model to calculate time variant country betas which measure the sensitivity of stock returns of each country with respect to the global returns.

Among multivariate GARCH models, A Dynamic Conditional Correlation Generalized Auto Regressive Conditional Heteroscedasticity (DCC-GARCH) model is used to estimate an improved time variant country beta in existence of a dynamic correlation between the country's stock return and the world stock return since all countries in the study; the US, Canada, the UK, Germany and Singapore, are included in the aggregated world stock market return. DCC-GARCH Model is one of the latest members of GARCH family introduced by Engle (2002)[3] and estimates the time variant correlation coefficient between a country's stock return and world stock return along with time-variant variances of both. This property makes DCC-GARCH model a better fit to estimate country betas since the correlation coefficient between the world and a country quantifies the integration of a country's financial markets with the rest of the world and given that the time period for the study is long enough to assume that the financial integration of each country varies throughout the sample due to changes in both local and global dynamics.

Moreover, the countries in the study are selected according to their integration level with global markets. All countries have a mean correlation coefficient of a range of 0.87 to 0.91; therefore I can assume that all countries have similar financial integration levels. This assumption is particularly important when it comes to ranking the countries in risk levels according to the magnitude of country betas.

By using a DCC GARCH (1, 1) model, time-variant country betas are estimated from 1984:M1 to 2014:M12 for the US, Canada, the UK and Singapore and from 1990:M9 to 2014:M12 for Germany. Table 1.3 shows the descriptive statistics of and Figure 1.2 plots country betas for all

[3] Appendix A summarizes Engle (2002)'s DCC GARCH framework

countries. As clearly seen in Figure 1.2, country betas reach at high levels during the 2008 financial crisis. This result is consistent with Glova and Pastor (2013) and Yang et al. (2012). Glova and Pastor (2013) state that country betas for Visegrad countries, including Czech Republic, Romania, Hungary and Poland, reach the highest levels during 2008 whereas their volatility increases and Yang et al. (2012) find the same results for BRICS.

Among the countries in the sample, Singapore shows the highest peaks and the volatility. Singaporean country beta reaches the highest level at 1987 stock market crash and stays higher than the rest of the countries during 1998 Asian crisis. The fact that Singapore is more sensitive to global crises than the rest of the countries is attributed to her economy's high dependency on international trade. Furthermore, Germany has the highest country beta levels starting from 2008 since Germany is affected more from Eurozone debt crisis which followed 2008 global financial crisis.

The means for country betas range between 0.87 (the US) and 1.23 (Germany). A higher beta refers to a higher return therefore a higher level of country risk. According to the comparison of the means of time-variant country betas, country risk level is the lowest for the US, followed by Canada, the UK and highest for Singapore for period of 1984-2014. Also Germany has a high mean beta of 1.23 for time period of 1990-2014. Moreover, Singapore has the highest volatility in country risk level with a standard deviation of 0.47 whereas Canada has the least volatile country risk level with a standard deviation of 0.17. Other than the US, none of the time-variant country betas are normally distributed.

The next subsection details the second stage of the estimation in which the relative effects of each economic variable along with the composite financial and political variables on country risk level are estimated.

### 1.4.2 Effects of Macroeconomic Variables on Country Risk

At the second stage of the estimation, time-variant country betas are regressed on the growth rates of a set of macroeconomic variables; budget balance as a percentage of GDP ($BB$), current account as a percentage of GDP ($CA$), GDP per capita ($GDP$)[4] , inflation rate ($\pi$), along with the composite financial risk ($FR$) and political risk ($PR$) variables.

Although stock markets are financial institutions and should react to financial risk, since expectations play an important role, it reacts not only to financial risk but also economic and political risk as well. This is evident by real time stock market movements to announcements of economic policy changes and/or political news, like election results or civil wars. Besides, Blanchard (1981) creates a theoretical model connecting economic policy shocks and stock market returns and explains that not only the economic policy implementations, but also the anticipation of the policy changes affect the stock returns through aggregate demand and interest rate channels. Furthermore, Arfaqui and Abaoub (2010), Basu et al. (2011), Yang et al. (2012), Andrade and Teles (2004), Verma and Soydemir (2006), Glova and Pastor (2013) are among the empirical studies that explain the movements in country betas by economic and financial indicators.

DCC-GARCH time variant country betas are used as a proxy for country risk level for each country and an Autoregressive Distributed Lags (ARDL) Model is used to estimate the relative effects of variables on country risk. An ARDL model is used since the second step regression for each country combines a mix of I(0) and I(1)series. An ARDL model enables us to use both I(1) and I(0) series together and estimate the long-run forms in case of a cointegration. Before running an ARDL model, I check if country beta series are stationary. Table 1.4 shows three different unit root test results for each country beta series. UK and US betas have unit roots according to a set of unit root tests; Augmented Dickey-Fuller (ADF), Philips-Perron (PP) and Dickey-Fuller Generalized Least Squares (DF-GLS). UK and US betas are included in ARDL models as I(1) and since there are a combination of I(0) and I(1) series, Bounds test is performed for all five ARDL models for cointegration.[5]. According to Bounds Test results, Canada and Germany models have

[4]Real GDP growth is excluded from the model due to multicollinearity problem.

[5]ARDL Models are estimated for US and UK betas by using both at levels and first differences. Since the signs and significance of the right hand side variables coefficients are same for both versions, here I report the results for the models with I(1) dependent variables to keep the dependent variables comparable across countries.

cointegration and therefore long-run forms are estimated for those two countries[6]. The following subsection reports the results in details.

A general form of ARDL (p,q) model is represented as:

$$\beta_t = \alpha_0 + \sum_{i=1}^{p} \gamma_i L^i \beta_t + \sum_{j=0}^{q} {}_j L^j X_t + \epsilon_t \tag{1.3}$$

$$X_t = [BB_t, CA_t, GDP_t, \pi_t, FR_t, PR_t] \tag{1.4}$$

where $\beta_t$ is country beta for country i, $BB$ is growth rate of budget balance as a percentage of GDP, $CA$ is growth rate of current account as a percentage of GDP, $GDP$ is growth rate of GDP per capita, $\pi$ is percentage change in inflation rate, $FR$ is growth rate of financial risk composite index and $PR$ is growth rate of political risk composite risk index. Akaike Information Criterion (AIC) is used in model selection and Table 1.5 shows the model specifications for all five countries. Additionally, Table 1.6 summarizes the residuals, stability and model specification tests results for all models.

#### 1.4.2.1 Variable Selection

The variables in the ARDL model are chosen to include the main macroeconomic indicators for a country with respect to capture fiscal and monetary policy, overall living standards, liquidity position as well as the financial and economic structures.

$BB$: Growth rate of budget balance as a percentage of GDP is used as an indicator for fiscal performance of an economy. This fiscal indicator represents debt repayment ability of the Federal Government given a country's national income level. As shown in Table 1.6, risk points are assigned to certain levels of budget balance/GDP ratios and the higher the budget surplus is the higher the points are and vice versa. Since a large budget deficit gives the Federal government more difficulty to honor the debt service and therefore increases the probability of default, one

[6] Table 1.6 summarizes the residuals, stability and model specification tests results.

would expect to see a negative correlation between BB and country beta. Since a higher budget surplus leads to a lower risk for an economy, which leads to a lower country beta, the coefficient of $BB$ is expected to be negative.

$CA$: Growth rate of current account as a percentage of GDP is used as an economic indicator representing liquidity position of a country. Current account balance; one of the two components of balance of payments, consists of trade balance, net factor income and net transfers. Just like budget balance/GDP, the risk points are assigned to certain levels of current account/GDP. The higher current account surplus/GDP ratio is the higher the points are. Since a higher current account surplus indicates a better liquidity position for an economy, one would expect to see a negative correlation between $CA$ and country beta.

$GDP$: Growth rate of GDP per capita is included in the model as an economic measure for the overall standards of living in a country. A higher GDP/capita leads to higher point for this risk category and since countries with better living standards are considered less risky, one would expect a negative correlation between $GDP$ and country beta.

$\pi$: Inflation is included in the model as both an overall economic indicator measuring the uncertainty in an economy and representing the stance of a country's monetary policy. In ICRG data, a lower inflation level gets higher points for this risk category and vice versa, a higher inflation gets lower points. Since high-inflation countries are often pronounced with higher uncertainty levels in investment episodes, therefore higher country risk levels, it is expected to see a negative correlation between $\pi$ and country beta.

$FR$: Growth rate of financial risk composite index is included in the model to measure the overall health of financial risk in an economy. Although financial risk category is composed of various financial indicators from exchange rate stability to net international liquidity, only the composite index is included in the model without further details of each subcategory, since the focus of this study is on the relative effects of macroeconomic variables. Additionally, just like the other risk components, a higher financial risk level is assigned lower points and higher points are given to countries with lower financial risk.

$PR$: Growth rate of political risk composite index is included in the model to control for all non-financial and non-economic variables in a country. ICRG data has an immensely detailed political risk index which accounts for any political issues from corruption to religious tensions. Moreover, according to ICRG risk points system, the higher the political risk in a country is the lower the points assigned to this index are. Therefore one would expect to see a negative correlation between country beta and political risk variable.

### 1.4.3 Estimation Results

In this subsection, I report the estimation results. Table 1.7 shows the estimation results for all five countries. Prior to the results, I would like to explain the independent variables used in the model in order to understand the results better:

#### 1.4.3.1 The US

Model specification of the selected ARDL Model is ARDL (1, 2, 2, 1, 1, 0, 1) which means the model includes the first lag of the dependent variable country beta; $\beta_{t-1}$, the first two lags of $BB$ and $CA$, first lag of $GDP$, inflation and $PR$, and the contemporaneous value of all independent variables.

According to residuals, stability and model specification tests results summarized in Table 1.6, there is no serial correlation or heteroscedasticity problems, however the residuals do not follow a normal distribution. Moreover, the coefficients are stable over time and there is no model misspecification issue. Additionally; Bounds test indicates no cointegration and therefore the long run form of the model is not estimated.

Table 1.7 shows the estimation output for all countries and according to US output, budget balance/GDP, current account/GDP, GDP per capita and inflation have significant effects on country beta; therefore country risk level of the US.

Budget balance/GDP and inflation have expected effects on the country risk level. According to the estimation output, the first two lags of $BB$ have negative effects on county beta which means a higher budget deficit at time t-1 and t-2 decrease US beta, therefore country risk level. This finding underlines the importance of fiscal policy in the US, especially after 2008 crisis when fiscal policy is effectively used to stabilize the economy. Moreover a lower level of inflation, decreases the risk level of the US.

The effect of a higher GDP/capita on the country risk is ambiguous for the US since $GDP$ has a positive coefficient concurrently but a negative coefficient at time t-1. Since both coefficients are significant,according to the estimation output, the model is inconclusive about the effect of living standards in the US on country risk level.

The impact of $CA$; current account/GDP is quite unexpected. According to the estimation results, $CA$ has a positive significant coefficient both at time t-1 and t-2. In other words, a higher current account deficit or a lower current account surplus decreases US country beta; therefore US country risk. Given that a country faces a current account deficit when imports are higher than exports (IM>EX), when US economy buys more goods and services from the rest of the world than it sells, her country risk is perceived low by investors. According to the wald test results, the coefficients of lagged values of $CA$ are jointly significant.

Both financial and political risk do not have significant effects on US county risk despite the fact that the lagged values of political risk have expectantly negative coefficients.

The coefficient of $\beta_{t-1}$is 0.962 and significant at 1% which is the reason of a high adjusted $R^2$. Since a high adjusted $R^2$might be a sign of multicollinearity problem, I check both Variance Inflation Factors (VIF) and correlation coefficient matrix for explanatory variables. Both do not show a sign of multicollinearity problem[7].

[7]In the first form of the models, GDP growth rate variable is included in the model along with GDP/capita and after test result indicated multicollinearity between the two variables, GDP growth rate is excluded from all models.

#### 1.4.3.2 Canada

Canadian country risk model is estimated for 1984:M1-2014:M12 period and Akaike Information Criterion (AIC) is used for model selection. According to AIC, as shown in Table 1.5, an ARDL (2, 4, 3, 1, 1, 2, 2) model is selected which means that the right hand side variables include 2 lags of country beta, 4 lags of $BB$, 3 lags of $CA$, 1 lag of $GDP$ and inflation, and 2 lags of $FR$ and $PR$ as well as contemporaneous values of all independent variables.

According to the estimation output of Canada, in the short-run, $BB$, $CA$, $GDP$ ,inflation and financial risk have significant effects on country risk of Canada but unfortunately only the effects of $GDP$ and inflation are conclusive and expected.

The reason behind the significant effects of GDP per capita growth and inflation on Canadian country risk might be due to the inflation targeting regime in Canada since 1991. Inflation targeting has been the major economic policy in Canada to stabilize the economy after 1987 crash; "Black Monday". Bank of Canada has been applying inflation targeting policy quite successfully since 1991 and in 2011, Bank of Canada in collaboration with the government decided to extend the regime to the end of 2016. Therefore, in Canada, inflation rate is one of the major economic indicators in terms of measuring the credibility of monetary authority as well as the health of overall economy.

According to the results in Table 1.7, a higher GDP per capita growth rate and a lower inflation rate decrease the Canadian country risk with a one month delay. By comparing the magnitudes of the coefficients of these two factors, a deviation from the monetary policy target has a bigger impact on the country risk than a change in the standards of living in Canada.

Although the coefficients of $BB$, $CA$ and $FR$ are significant for many lags, the signs of the coefficients change from lag to lag therefore it is difficult to conclude the direction of the impacts of these variables.

Since in all models, a mix of I(1) and I(0) variables are employed together, despite the fact that in Canadian model all series are stationary, Bounds test is performed to check for the cointegration relationships for all countries. According to the Bounds test result for Canada stated in Table 1.6, the variables are cointegrated.

Therefore I estimate the long-run model to see the interaction between macroeconomic variables with country risk of Canada in the long-run. Table 1.8 shows the log-run form of the model. According to the results, any change in economic variables has a significant impact on country risk of Canada only in the short-run; however, in the long run Canadian country risk is not affected. Newey-West residuals are used in the model therefore, as seen in Table 1.6, there is no homoscedasticity issue. I also checked the correlogram up to 36 lags to better see if the residuals are autocorrelated. According the correlogram, Durbin Watson test statistics and Breusch-Godfrey LM test results, the residuals are not autocorrelated. VIF shows no sign of multicollinearity between the explanatory variables. Additionally CUSUM test results show that the parameters are stable for the given time period. However the residuals are not normally distributed.

#### 1.4.3.3 The UK

UK country beta model is estimated for 1984:M1-2014:M12 period and AIC is used for model selection. According to AIC, an ARDL (1, 0, 0, 1, 0, 2, 0) is selected to estimate the effects of economic, financial and political risk on country beta of the UK. Given the vector of explanatory variables $X_t = [BB_t, CA_t, GDP_t, \pi_t, PR_t]$, the model includes the first lag of the dependent variable; UK country beta itself as well as contemporaneous values of $BB$, $CA$, inflation and political risk variables, current value and first lag of $GDP$, and current value and the first two lags of financial risk variables.

According the model results stated in Table 1.7, among the risk components included in the model, $BB$, $GDP$ and $FR$ have significant effects on UK country risk. I believe the economic stabilization steps that British government has taken since 1992 recession in the UK explains the significant impacts of these variables on country risk in the UK for the estimation period.

After 1992 recession, British government took serious policy steps by keeping taxes relatively low and loosening the labor market regulations in order to increase the economic growth rates in the UK. British government successfully increased and kept GDP per capita growth rates higher than the other G-6 countries for 1997-2007 period. Following this economic prosperity decade, British economy was affected from 2008 global crisis severely and had to partly nationalize a group of financial institutions. Since 2010, British government pursued an austerity program to cut the budget deficit which decreased from 11% to 5% for the last 5 years. To go back to the results, a higher Budget Surplus/GDP, a higher GDP/capita growth rate and lower financial risk decrease UK country risk significantly. All of the significant coefficients for the risk components have expected signs. The comparison of the magnitudes of the coefficients tells us that financial risk and growth rate of GDP/capita have bigger impacts on UK country risk than budget balance/GDP.

Since the first lag of country beta has a significant coefficient of 0.958, the adjusted $R^2$ is 0.924. A high adjusted $R^2$might be a sign of multicollinearity problem, therefore I check both Variance Inflation Factors (VIF) and correlation coefficient matrix for explanatory variables. Both do not show a sign of multicollinearity problem.

Apart from the multicollinearity, I check the DW test statistics, correlogram and Breusch-Godfrey LM test results for autocorrelation and none of the statistics shows evidence in favor of serial correlation problem. Table 1.6 shows the residuals, stability and model specification tests results. Briefly, according to the tests results, the parameters are stable and the model has no misspecification.

#### 1.4.3.4 Germany

German country risk model is estimated for 1990:M9-2014:M12 period and AIC is used for model selection. The specification of the selected model is ARDL (1, 1, 2, 0, 5, 0, 1). According to the model results, German country beta is explained by the first lag of itself, the first lags of $BB$ and $PR$, the first two lags of $CA$, the first five lags of $\pi$ as well as the contemporaneous values of all independent variables.

According to the estimation results, the growth rates of budget balance/GDP, current account/GDP, inflation rate and political risk have significant effects on German country risk. Except for the current account/GDP, the directions of the effects of macroeconomic and political variables are as expected.

In details, a higher budget surplus or a lower budget deficit decreases the country risk in Germany. Additionally a lower inflation rate has a negative effect on country beta and thereby lowers country risk with a five month delay.

Also political risk has a negative significant effect on country risk. A lower political risk decreases German country beta thereby lowers country risk level. Furthermore; given the magnitudes of the coefficients, inflation and political risk components have bigger impacts on country risk compared to the growth rates of budget balance/GDP and current account/GDP.

Among the sample of countries in this study, Germany is the only one whose political risk has a significant effect on country risk. Since the sample includes advanced and newly industrialized countries, having political risk no significant effect on country risk is expected due to stable political structures for these countries. However the time period of Germany used in this study explains why political risk has a significant negative effect on country risk. The period of 1990:M9-2014:M12 includes sensitive political events in German political and economic history starting with the reunification of West and East Germany in the second half of 1990.

Unexpectedly, $CA$ has a positive significant effect on German country risk for two consecutive lags. The interpretation of these coefficients is as follows: a higher current account deficit or a lower current account surplus decreases German country beta; namely reduces country risk level in Germany. Therefore; just like in the US and Singapore, that I talk about in the next subsection, when Germany imports more goods and services than it exports, the country risk level decreases.

Furthermore, as seen in Table 1.6, the Bounds test result shows that the variables in German country risk model are cointegrated. Therefore, I estimate the long-run form of the model. According to the long-run coefficients, shown in Table 1.8, the growth rates of budget balance/GDP, current account/GDP and inflation have significant effects on country risk in Germany in the long-run as well; whereas the effect of political risk becomes insignificant. Given the magnitudes of the coefficients, inflation has a bigger impact on country risk than $BB$ and $CA$.

The residual tests results for Germany in Table 1.6 show no sign of multicollinearity, heteroscedasticity and serial correlation issues. Additionally, according to CUSUM test, model parameters are stable and Ramsey RESET test result shows that there is no model misspecification.

The coefficient of $\beta t - 1$ is 0.872 and significant at 1% which leads to a high adjusted $R^2$ of 0.877. Since a high adjusted $R^2$might be a sign of multicollinearity problem, I check both Variance Inflation Factors (VIF) and correlation coefficient matrix for explanatory variables. Both do not show a sign of multicollinearity problem.

#### 1.4.3.5 Singapore

Despite the fact that Singapore has the highest GDP growth rates accompanied by the lowest unemployment rates in our sample of countries, she also has the most volatile country beta implying the highest risk in the sample for 1980-2014 time period. Possible economic reasons behind this controversy are her being the youngest economy among all in our sample with a highly international trade and FDI dependent economic structure. Singapore has the quarterly GDP growth rates as high as 36% and as low as -11% for 2007-2014 time period. Despite the positive outlook that a double digit growth rate creates, high volatility of economic parameters reflects an unstable economic trend for Singapore. This makes Singapore the highest risk country in our sample. Singaporean country risk model is estimated for 1984:M1-2014:M12 period and AIC is used for model selection. According to AIC, and an ARDL (1, 3, 2, 4, 0, 0, 0) is selected to estimate the effects of economic, financial and political risk on Singaporean country beta. Given the vector of explanatory variables $X_t = [BB_t, CA_t, GDP_t, \pi_t, FR_t, PR_t]$, the model includes the contemporaneous values of all explanatory variables as well as the first lag of the dependent variable;

Singaporean country beta itself, three lags of BB, two lags of CA, and four lags of GDP.

According to the model results, BB, CA and GDP have significant effects on country risk in Singapore. The effects of $BB$ and $GDP$ on Singapore country risk are inconclusive due to alternating signs of coefficients of different lags, whereas inflation and political risk components have expected impacts on Singapore country risk even though the coefficients are insignificant.

Moreover, $CA$ has a positive significant effect on Singaporean country beta, namely a higher current account surplus increases Singaporean country risk and, vice versa, a reduction in current account surplus decreases Singaporean country beta, therefore country risk. At first, this result might sound unexpected as one would think of a higher current account surplus as a good economic indicator, but given persistent, and large current account surplus/GDP ratios that Singapore has since 1988, the sign of the coefficient captures the sensitivity of Singaporean economy well. A persistently high current account surplus over years generally indicates an unbalanced economy and, in Singapore, arises as a result of a high export dependent/driven growth model. This export dependent structure of Singaporean economy makes the country highly responsive to global economic imbalances. As seen from Figure 1.2, Singaporean country beta responds to 1987 stock market crash, 1998 Asian crisis, 2008 Great Recession and end of 2009 Eurozone crisis more largely than the rest of the countries in the sample regardless of which country/region the crisis originated from. Additionally, a firmly higher export than import is an indication of an unbalanced economy in which household consumption and/or government spending are low.

According to the model specification and stability tests results, shown in Table 1.6, model parameters are stable, and there is no model misspecification, Furthermore, residual tests, DW test statistics, correlogram and VIF show no sign of multicollinearity, serial correlation and heteroscedasticity problems. Adjusted $R^2$ is high due to a significant coefficient of $\beta_{t-1}$ with a magnitude of 0.915.

## 1.5 Robustness Check

In this section, I check if the results of the study are sensitive to the methodology employed to measure country betas. As an alternative to DCC-GARCH, a Kalman Filter approach is adopted to estimate time-variant country betas in the first stage and then Kalman country betas are regressed on the same set of economic, political and financial variables to see if the direction of the impacts change.

### 1.5.1 An Alternative Estimation Method: Kalman Filter Approach

State space models have been widely used in both finance and economics literature for a various econometric issues including estimation of time-variant parameters. Kalman Filter is a recursive form of state space models in time series, estimating the optimal state vector. The state space representation of CAPM is stated as:
The observation equation;

$$Y_t = Z_t B_t + v_t \qquad v_t \sim N(0, \sigma) \tag{1.5}$$

The state equation;

$$B_t = \Phi B_{t-1} + \varepsilon_t \qquad \varepsilon_t \sim N(0, \Xi) \tag{1.6}$$

where $B_t$ represents the time-variant country betas (to make the comparison, I call time-variant country betas estimated by Kalman filter as Kalman country betas from now on) , and $v_t$ and $\varepsilon_t$ are i.i.d error terms and uncorrelated at all lags.

Figure 1.3 shows the comparison of DCC-GARCH country betas and Kalman country betas for each country separately. As seen from the figures, country betas estimated by two different approaches follow quite similar trends for all countries for the same time periods.

Table 1.9 summarizes the descriptive statistics of Kalman country betas for the same time periods as the original model. Descriptive statistics of Kalman country betas are quite similar to the statistics of DCC-GARCH country betas, stated in Table 3. The US has the lowest average country beta and Singapore has the highest volatility in country risk, same as DCC-GARCH estimation results.

### 1.5.2 Relative Effects of Macroeconomic Variables on Country Risk

Once time-variant country betas are estimated by using Kalman filter, they are regressed on the same set of economic, political and financial variables. An ARDL model is used to estimate the relative effects of each risk component on the country risk for each country.

A general form of ARDL (p,q) model is represented as:

$$\beta_t = \alpha_0 + \sum_{i=1}^{p} \gamma_i L^i \beta_t + \sum_{j=0}^{q} \eta_j L^j X_t + \epsilon_t \tag{1.7}$$

$$X_t = [BB_t, CA_t, GDP_t, \pi_t, FR_t, PR_t] \tag{1.8}$$

Akaike Information Criterion (AIC) is used in model selection and Table 11.10 shows the model specifications for all five countries and Table 1.11 summarizes the residuals, stability and model specification tests results for all models.

### 1.5.3 Estimation Results

In this subsection, I report the estimation results of the alternative model and compare the direction of relative effects of each independent variable on country risk for each country with the original model results.

#### 1.5.3.1 The US

AIC is used to specify the model and an ARDL (1, 2, 2, 2, 2, 2, 2) model is selected. Table 1.12 shows the estimation results of the model. According to the results, $BB$, $CA$, $\pi$ and $FR$ have significant effects on US country risk. The directions of the relative impacts of each risk component on country betas of the US are almost same as the original model. A higher budget surplus decreases US country risk, whereas a higher current account surplus increases. While country risk increases as a result of a higher inflation rate, the impact of $GDP$ on US country risk is inconclusive due to alternating signs of $GDP$ coefficients. Although these results confirm the findings of the original model, unlike the original model, in the alternative model, the impact of financial risk on country beta is significant. The estimation output of the alternative model shows that a higher financial risk has a significant effect on US country beta, therefore increases US country risk.

Table 1.11 summarizes the residual, stability and model specification tests results for all Kalman country beta models. According to the tests results, US Kalman country beta model does not have heteroscedasticity, multicollinearity and serial correlation problems. Furthermore, Ramsey RESET test indicates that there is no model misspecification and Bounds test result shows no evidence in favor of cointegration.

#### 1.5.3.2 Canada

According to AIC, and ARDL (1, 3, 3, 0, 0, 1, 0) model is selected. The results of the alternative model confirm the findings of the original model. $BB$, $CA$, $\pi$ and $FR$ have significant effects on Canadian country beta. Like the original model results, the effects of $BB$ and $CA$ are significant but unfortunately inconclusive due to alternating signs of the coefficients. Additionally, $GDP$ has a negative effect on Canada country beta, implies that a higher GDP/capita growth rate decreases Canadian country beta, therefore, decreases Canadian country risk despite the fact that the coefficient is not significant.

The only dissimilarity between the original and the alternative model is the effect of financial risk component. In the original model, the results were inconclusive about the impact of financial risk on Canadian country beta due to alternating signs of the coefficients for different lags. However, the alternative model concludes that a lower financial risk decreases country beta, thereby country risk of Canada.

According to the residuals, stability and model specification test results stated in Table 1.11, the model does not have heteroscedasticity, serial correlation, multicollinearity and misspecification problems with stable parameters. Moreover, Bounds test result indicates no cointegration.

#### 1.5.3.3 The UK

AIC is used for model specification and an ARDL (1, 0, 2, 0, 0, 1, 0) is selected. The results of the alternative model for the UK country risk are aligned with the findings of the original model except for the effect of $BB$. In the original model a higher budget surplus decreases the UK country risk whereas in the alternative model, it does not a significant impact on UK country beta.

The rest of the findings are quite similar to the original model since a lower financial risk, a higher GDP/capita growth rate and a lower current account deficit/GDP decrease UK country beta, thereby, UK country risk.

According to the residuals, stability and model specification test results stated in Table 1.11, the model does not have heteroscedasticity, serial correlation, multicollinearity, misspecification and cointegration issues and parameters are stable for the estimation period.

#### 1.5.3.4 Germany

According to AIC, an ARDL (1, 0, 2, 0, 0, 0, 0) model is selected. The alternative model results are same as the original model results for Germany for the same time period of 1990:M09-2014:M12. $BB$, $CA$ and $PR$ have significant effects on Germany country risk. In detail, a higher budget surplus, a lower current account surplus and a higher political risk increase German country beta. These findings are aligned with the findings of the original model.

However, unlike the original model, Bounds test result does not indicate a cointegration relationship. The residual, stability and model specification tests results are shown in Table 1.11. According to the tests results, the model does not have heteroscedasticity, serial correlation, multicollinearity, misspecification and cointegration issues and parameters are stable for the estimation period.

#### 1.5.3.5 Singapore

AIC is used for model selection and an ARDL (1, 1, 1, 3, 0, 0, 0) model is selected. The signs of the coefficients of the alternative model are quite similar to those in the original model. According to the estimation output of the alternative model, budget balance/GDP, current account/GDP, GDP/capita and political risk have significant effects , however the results are inconclusive about the direction of the impact of GDP/capita growth rate, alike the original model.

In line with the original model, a higher current account surplus increases Singaporean country risk. A Bounds test is performed for all models in the study and the test result of the alternative model for Singapore indicates cointegration between variables. Table 1.8 summarizes the long-run form of the model. In agreement with the short-run model for Singaporean country risk, in the long run a higher budget surplus/GDP and a lower current account surplus decrease the country risk in Singapore.

Table 1.11 states the residual, stability and model specification tests results which indicate that the model does not have heteroscedasticity, serial correlation, multicollinearity and misspecification problems, and parameters are stable for the estimation period of 1984-2014.

## 1.6 Conclusion

Given the number of multinational companies, increasingly global financial markets and cross border investment opportunities even for small size investors, measuring the country risk becomes a more and more important challenge not only for global investors but also for policy makers and researchers. In this paper, I use country beta approach to quantify the country risk for five advanced economies and question what the relative impacts of economic, financial and political risk components on country risk are.

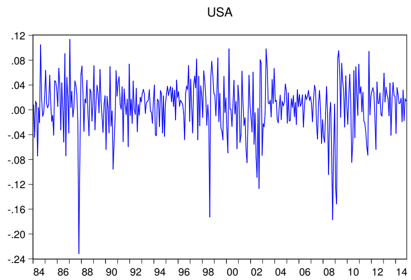
To do so, I use a Capital Asset Pricing Model to estimate the time-variant country betas by employing a DCC-GARCH approach, for the US, the UK, Canada, Germany and Singapore. Compared to static estimates, a time-variant country beta better reflects not only the dynamic structure of country risk but also of global financial integration of each country. These country betas are used to quantify country risk. Then, at the second stage of the estimation, I look deeper into the triggers of a higher country risk. To do so, time-variant country betas are regressed on a set of macroeconomic variables; the growth rates of budget balance/GDP, current account balance/GDP, inflation rate, GDP per capita and inflation, along with the growth rates of composite financial and political risk measures for the US, the UK, Canada and Singapore and Germany.

The empirical findings of the study show that, even though the significance and the direction of the impacts of risk factors differ from one country to another, among macroeconomic variables, budget surplus and current account surplus have significant effects on most country betas whereas, generally, political risk does not have a significant effect on country risk in advanced economies.

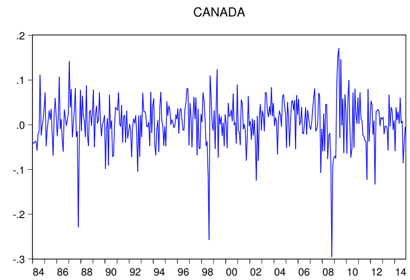
Although there are a fair number of empirical studies employing country beta approach to quantify the country risk, they have a common limitation of comparing country betas for countries of different financial integration level. This study contributes to the existing literature by comparing the countries of similar financial integration levels and examining the relative impacts of economic and financial indicators while controlling for political risk. This is quite important since omitting political risk might create a bias in the results.

Figure 1.1: Stock Market Returns

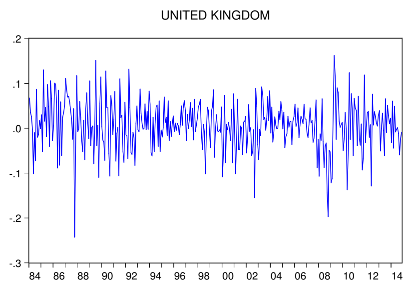
(a) The US



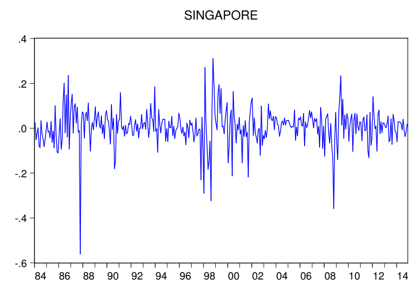

(b) Canada



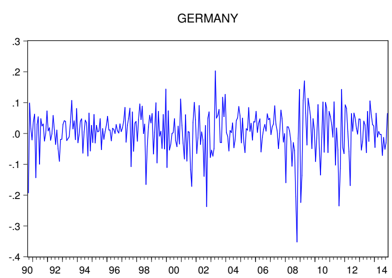

(c) The UK




(d) Singapore




(e) Germany




(f) World-MSCI Global Return

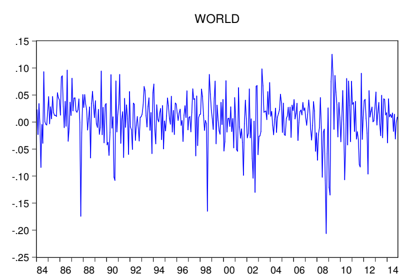


Figure 1.2: Time-Variant Country Betas-DCC GARCH

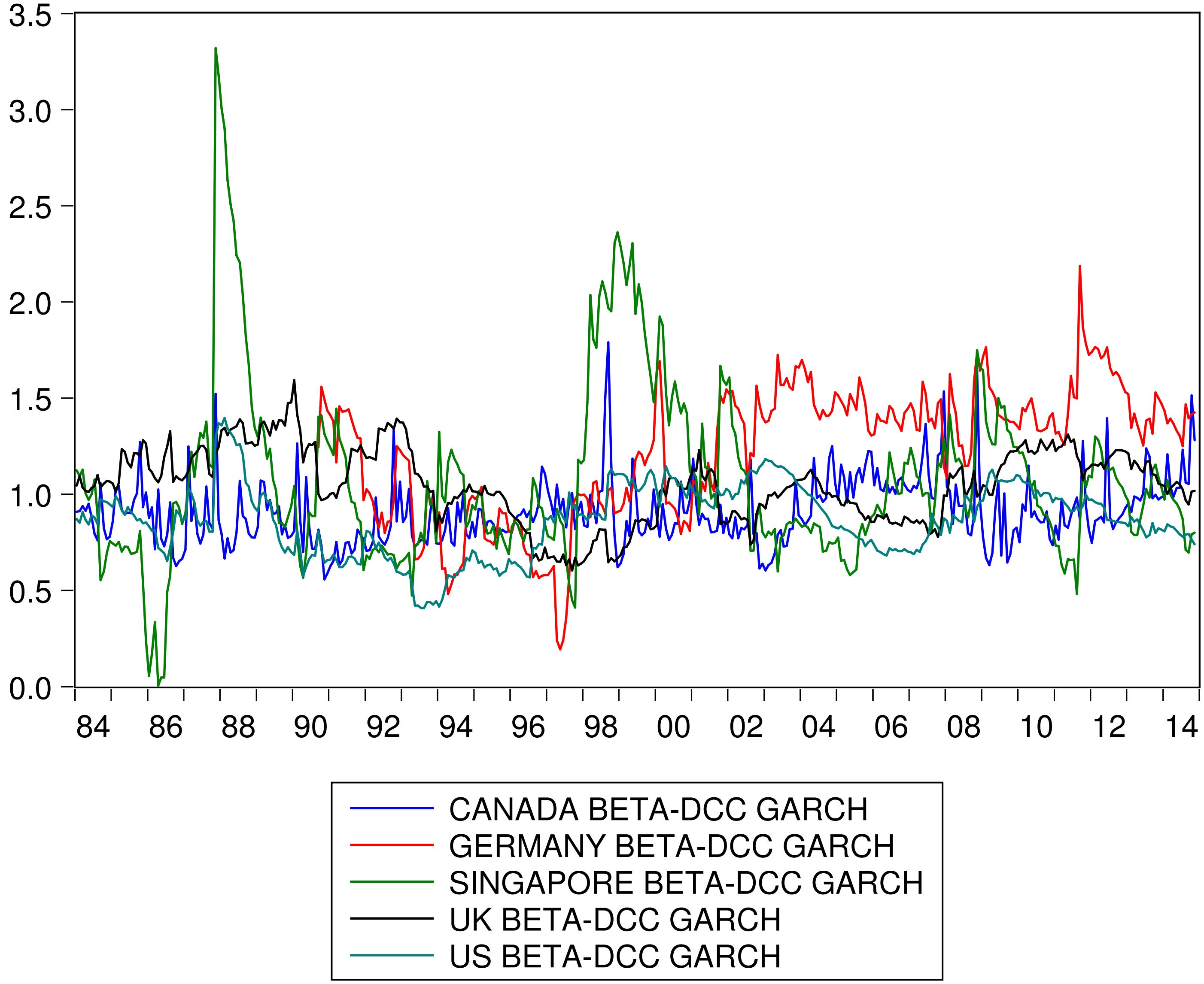
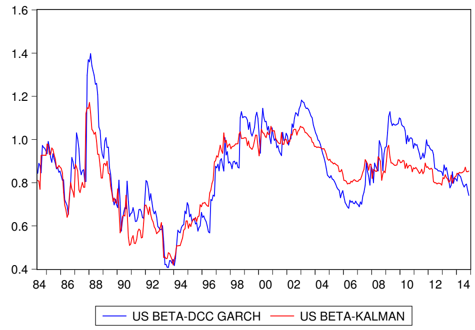
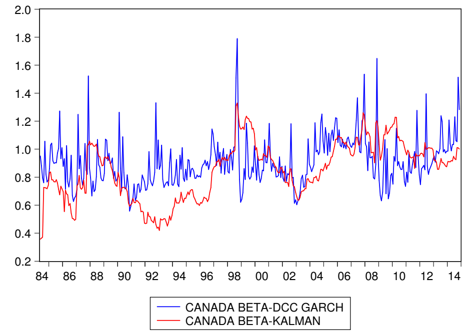


Figure 1.3: Comparison of Time-Variant Country Betas Estimated by DCC-GARCH and Kalman Filter Approaches

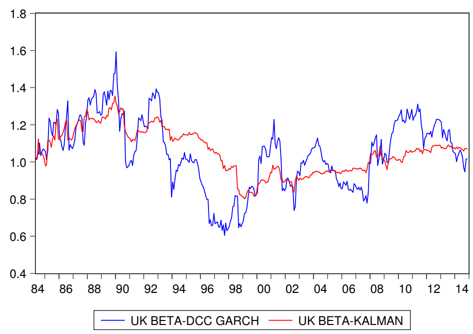
(a) The US



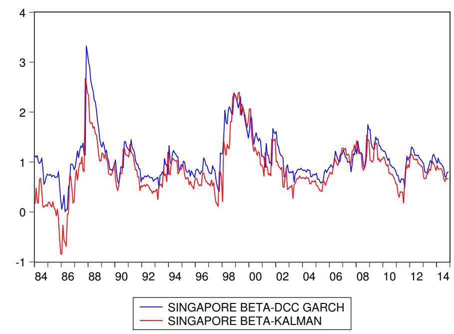

(b) Canada




(c) The UK




(d) Singapore




(e) Germany

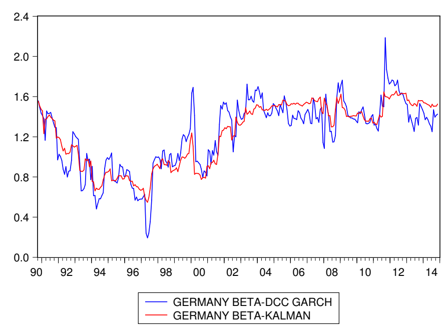


Table 1.1: ICRG Data Description

| ICRG Country Risk Data Description | | High Risk | Low Risk | |
|---|---|---|---|---|
| Political Risk | | Minimum Points | Maximum Points | |
| | Government Stability | 0 | 12 | |
| | Socioeconomic Conditions | 0 | 12 | |
| | Investment Profile | 0 | 12 | |
| | Internal Conflict | 0 | 12 | |
| | External Conflict | 0 | 12 | |
| | Corruption | 0 | 6 | |
| | Military in Politics | 0 | 6 | |
| | Religious Tensions | 0 | 6 | |
| | Law and Order | 0 | 6 | |
| | Ethnic Tensions | 0 | 6 | |
| | Democratic Accountability | 0 | 6 | |
| | Bureaucracy Quality | 0 | 6 | |
| | | | | 100 |
| Economic Risk | | | | |
| | GDP per Head | 0 | 5 | |
| | Real GDP Growth | 0 | 10 | |
| | Annual Inflation Rate | 0 | 10 | |
| | Budget Balance as a Percentage of GDP | 0 | 10 | |
| | Current Account as a Percentage of GDP | 0 | 15 | |
| | | | | 50 |
| Financial Risk | | | | |
| | Foreign Debt as a Percentage of GDP | 0 | 10 | |
| | Foreign Debt Service as a Percentage of Exports of Goods and Services | 0 | 10 | |
| | Current Account as a Percentage of Exports of Goods and Services | 0 | 15 | |
| | Net International Liquidity as Months of Import Cover | 0 | 5 | |
| | Exchange Rate Stability | 0 | 10 | |
| | | | | 50 |
| Composite Risk | | | | 200 |

Table 1.2: Point System for Risk Level of Budget Balance as a Percentage of GDP

| Budget Balance as a Percentage of GDP | Points |
|---|---|
| 4.0 or plus | 10 |
| 3.0 to 3.9 | 9.5 |
| 2.0 to 2.9 | 9 |
| 1.0 to 1.9 | 8.5 |
| 0.0 to 0.9 | 8 |
| -0.1 to -0.9 | 7.5 |
| -1.0 to -1.9 | 7 |
| -2.0 to -2.9 | 6.5 |
| -3.0 to -3.9 | 6 |
| -4.0 to -4.9 | 5.5 |
| -5.0 to -5.9 | 5 |
| -6.0 to -6.9 | 4.5 |
| -7.0 to -7.9 | 4 |
| -8.0 to -8.9 | 3.5 |
| -9.0 to -9.9 | 3 |
| -10.0 to -11.9 | 2.5 |
| -12.0 to -14.9 | 2 |
| -15.0 to -19.9 | 1.5 |
| -20.0 to -24.9 | 1 |
| -25.0 to -29.9 | 0.5 |
| -30.0 below | 0 |

Table 1.3: Descriptive Statistics of DCC GARCH Country Betas

| | $\beta_{CANADA}$ | $\beta_{GERMANY}$ | $\beta_{SINGAPORE}$ | $\beta_{UK}$ | $\beta_{US}$ |
|---|---|---|---|---|---|
| Mean | 0.91 | 1.23 | 1.08 | 1.05 | 0.87 |
| Median | 0.88 | 1.33 | 0.97 | 1.05 | 0.87 |
| Maximum | 1.79 | 2.19 | 3.32 | 1.59 | 1.40 |
| Minimum | 0.56 | 0.19 | 0.01 | 0.60 | 0.41 |
| Std. Dev. | 0.17 | 0.34 | 0.47 | 0.19 | 0.19 |
| Skewness | 1.24 | -0.55 | 1.58 | -0.18 | -0.03 |
| Kurtosis | 6.07 | 2.83 | 6.98 | 2.61 | 2.88 |
| Jarque-Bera | 241.19 | 15.25 | 399.11 | 4.40 | 0.28 |
| Probability | 0.00 | 0.00 | 0.00 | 0.11 | 0.87 |
| Sum | 336.77 | 357.02 | 399.53 | 389.17 | 321.41 |
| Sum Sq. Dev. | 11.18 | 33.37 | 80.29 | 13.37 | 12.71 |
| Observations | 371 | 291 | 371 | 371 | 371 |

Table 1.4: Unit Root Test Results

| | | $\beta_{CANADA}$ | | $\beta_{GERMANY}$ | | $\beta_{SINGAPORE}$ | | $\beta_{UK}$ | | $\beta_{US}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DCC GARCH | KALMAN | DCC GARCH | KALMAN | DCC GARCH | KALMAN | DCC GARCH | KALMAN | DCC GARCH | KALMAN |
| ADF | TEST VALUE | -10.84 | -5.93 | -3.18 | -1.68 | -3.89 | -4.03 | -2.73 | -4.71 | -2.62 | -4.55 |
| | PROB | 0 | 0 | 0.02 | 0.44 | 0 | 0 | 0.07 | 0 | 0.09 | 0 |
| PP | TEST VALUE | -11.19 | -5.93 | -2.85 | -1.67 | -3.85 | -3.86 | -2.66 | -4.72 | -2.65 | -4.64 |
| | PROB | 0 | 0 | 0.05 | 0.44 | 0 | 0 | 0.08 | 0 | 0.08 | 0 |
| DF-GLS (ERS) | TEST VALUE | -10.85 | -0.05 | -3.19 | -0.95 | -3.88 | -2.51 | -2.73 | -1.92 | -2.62 | -0.49 |
| | PROB | 0 | $>0.1$ | $<0.01$ | $>0.1$ | $<0.01$ | $<0.05$ | $<0.01$ | $<0.1$ | $<0.01$ | $>0.1$ |

Table 1.5: Model Selection for DCC GARCH Country Beta Models

| | $\beta$ | BB | CA | GDP | $\pi$ | FR | PR | CONSTANT | TREND |
|---|---|---|---|---|---|---|---|---|---|
| The US | 1 | 2 | 2 | 1 | 1 | 0 | 1 | Y | N |
| The UK | 1 | 0 | 0 | 1 | 0 | 2 | 0 | Y | N |
| Canada | 2 | 4 | 3 | 1 | 1 | 2 | 2 | Y | Y |
| Germany | 1 | 1 | 2 | 0 | 5 | 0 | 1 | Y | Y |
| Singapore | 1 | 3 | 2 | 4 | 0 | 0 | 0 | Y | N |

Table 1.6: Residuals and Stability Test Results

| Residual \Stability Test: | Test | Null Hypothesis | Probability(test statistic) | | | | |
|---|---|---|---|---|---|---|---|
| | | | The US | The UK | CANADA | GERMANY | SINGAPORE |
| Homoscedasticity | Breusch-Pagan-Godfrey | Homoscedastic residuals | 0.93 | 0.64 | 0.15 | 0.92 | 1.00 |
| Serial Correlation | Breusch-Godfrey LM | No serial correlation | 0.58 | 0.72 | 0.93 | 0.37 | 0.79 |
| Multicollinearity | VIF | There might be multicollinearity if VIF>10 | No Multi-collinearity | No Multi-collinearity | No Multi-collinearity | No Multi-collinearity | No Multi-collinearity |
| Normality | Jarque-Bera | Residuals are normally distributed | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Stability Test | CUSUM Test | | Stable parameters | Stable parameters | Stable parameters | Stable parameters | Stable parameters |
| Model Specification | Ramsey RESET | Model is not misspecified | 0.87 | 0.15 | 0.13 | 0.16 | 0.83 |
| Cointegration | Bounds | No long-run relationship exists | No cointegration*** | No cointegration*** | Cointegration exists*** | Cointegration exists*** | No cointegration*** |

Table 1.7: DCC GARCH Beta Models-Estimation Outputs

| | $\beta_{US}$ | $\beta_{UK}$ | $\beta_{CANADA}$ | $\beta_{GERMANY}$ | $\beta_{SINGAPORE}$ |
|---|---|---|---|---|---|
| $\beta_{t-1}$ | 0.962*** | 0.958*** | 0.425*** | 0.872*** | 0.915*** |
| $\beta_{t-2}$ | - | - | 0.121** | - | - |
| $BB_t$ | -0.025 | -0.037* | -0.355 | -0.094 | 0.048 |
| $BB_{t-1}$ | -0.085*** | - | -0.625** | -0.291** | -0.1** |
| $BB_{t-2}$ | -0.076*** | - | 0.855*** | - | -0.18*** |
| $BB_{t-3}$ | - | - | 0.514* | - | 0.129*** |
| $BB_{t-4}$ | - | - | 0.431** | - | - |
| $CA_t$ | -0.121 | -0.054 | 0.125 | 0.282 | 0.143 |
| $CA_{t-1}$ | 0.186*** | - | 0.819** | 0.645*** | 0.353 |
| $CA_{t-2}$ | 0.147* | - | -0.455 | 0.311** | 0.872** |
| $CA_{t-3}$ | - | - | -0.656** | - | - |
| $GDP_t$ | 0.327*** | -0.021 | 0.035 | 0.023 | 0.033 |
| $GDP_{t-1}$ | -0.179*** | -0.128** | -0.304** | - | -0.444* |
| $GDP_{t-2}$ | - | - | - | - | -0.768** |
| $GDP_{t-3}$ | - | - | - | - | 0.161 |
| $GDP_{t-4}$ | - | - | - | - | 0.812** |
| $\pi_t$ | 0.017 | 0.043 | 0.046 | -0.266 | -0.036 |
| $\pi_{t-1}$ | -0.195** | - | -0.813* | -0.633 | - |
| $\pi_{t-2}$ | - | - | - | -0.382 | - |
| $\pi_{t-3}$ | - | - | - | 0.055 | - |
| $\pi_{t-4}$ | - | - | - | -0.600 | - |
| $\pi_{t-5}$ | - | - | - | -1.225** | - |
| $FR_t$ | 0.027 | 0.039 | 1.372** | -0.109 | 1.042 |
| $FR_{t-1}$ | - | 0.190 | -1.171* | - | - |
| $FR_{t-2}$ | - | -0.164** | -1.544** | - | - |
| $PR_t$ | -0.337 | -0.131 | -1.260 | 0.028 | -0.089 |
| $PR_{t-1}$ | -0.424 | - | - | -1.36* | - |
| $PR_{t-2}$ | - | - | - | - | - |
| $C$ | 0.032*** | 0.044*** | 0.372*** | 0.07** | 0.09*** |
| $TREND$ | - | - | 0.0002*** | 0.000377*** | - |
| $PROB(F)$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$ | 0.931 | 0.926 | 0.378 | 0.884 | 0.858 |
| $ADJR^2$ | 0.928 | 0.924 | 0.342 | 0.877 | 0.851 |
| $DW$ | 1.890 | 2.001 | 2.011 | 2.057 | 2.001 |

Variable Definitions: $BB$: Budget Balance as a percentage of GDP, $CA$: Current Account as a percentage of GDP, $GDP$: Growth rate of GDP per capita, $\pi$: Inflation rate, $FR$: Financial Risk, $PR$: Political Risk.

Table 1.8: Long Run Forms

| | $\beta_{DCC-CANADA}$ | $\beta_{DCC-GERMANY}$ | $\beta_{KALMAN-SINGAPORE}$ |
|---|---|---|---|
| $BB_t$ | 1.803 | -3.013** | -5.257*** |
| $CA_t$ | -0.365 | 9.689** | 11.713* |
| $GDP_t$ | -0.593 | 0.182 | 0.316 |
| $\pi_t$ | -1.690 | -23.861* | 1.84 |
| $FR_t$ | -2.953 | -0.852 | 17.505 |
| $PR_t$ | -2.772 | -10.436 | 24.807* |
| $C$ | 0.819*** | 0.549*** | 0.868*** |
| $TREND$ | 0.00049*** | 0.003*** | 0.000 |

Variable Definitions: $BB$: Budget Balance as a percentage of GDP, $CA$: Current Account as a percentage of GDP, $GDP$: Growth rate of GDP per capita, $\pi$: Inflation rate, $FR$: Financial Risk, $PR$: Political Risk.

Table 1.9: Descriptive Statistics of Country Betas-Kalman Filter Estimation

| | $\beta_{CANADA}$ | $\beta_{GERMANY}$ | $\beta_{SINGAPORE}$ | $\beta_{UK}$ | $\beta_{US}$ |
|---|---|---|---|---|---|
| Mean | 0.84 | 1.23 | 0.86 | 1.05 | 0.83 |
| Median | 0.88 | 1.35 | 0.80 | 1.06 | 0.86 |
| Maximum | 1.33 | 1.68 | 2.67 | 1.35 | 1.17 |
| Minimum | -0.50 | 0.55 | -0.84 | 0.42 | 0.16 |
| Std. Dev. | 0.23 | 0.32 | 0.52 | 0.13 | 0.16 |
| Skewness | -1.26 | -0.45 | 0.50 | -0.45 | -0.77 |
| Kurtosis | 7.81 | 1.70 | 4.96 | 4.31 | 3.29 |
| Jarque-Bera | 455.84 | 30.10 | 74.84 | 38.86 | 38.03 |
| Probability | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sum | 310.45 | 358.07 | 318.11 | 390.28 | 309.23 |
| Sum Sq. Dev. | 20.33 | 28.81 | 100.26 | 6.24 | 9.70 |
| Observations | 371 | 291 | 371 | 371 | 371 |

Table 1.10: Model Selection for Kalman Beta Models

| | $\beta$ | BB | CA | GDP | $\pi$ | FR | PR | CONSTANT | TREND |
|---|---|---|---|---|---|---|---|---|---|
| US | 1 | 2 | 2 | 2 | 2 | 2 | 2 | Y | Y |
| UK | 1 | 0 | 2 | 0 | 0 | 1 | 0 | Y | Y |
| Canada | 1 | 3 | 3 | 0 | 0 | 1 | 0 | Y | Y |
| Germany | 1 | 0 | 2 | 0 | 0 | 0 | 0 | Y | Y |
| Singapore | 1 | 1 | 1 | 3 | 0 | 0 | 0 | Y | N |

Table 1.11: Residuals and Stability Test Results-Kalman Beta Models

| Residual \Stability Test: | Test | Null Hypothesis | Probability (test statistic) | | | | |
|---|---|---|---|---|---|---|---|
| | | | The US | The UK | CANADA | GERMANY | SINGAPORE |
| Homoscedasticity | Breusch-Pagan-Godfrey | Homoscedastic residuals | 0.16 | 0.12 | 0.57 | 0.74 | 0.99 |
| Serial Correlation | Breusch-Godfrey LM | No serial correlation | 0.14 | 0.29 | 0.96 | 0.84 | 0.47 |
| Multicollinearity | VIF | There might be multicollinearity if VIF>10 | No Multi-collinearity | No Multi-collinearity | No Multi-collinearity | No Multi-collinearity | No Multi-collinearity |
| Normality | Jarque-Bera | Residuals are normally distributed | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Stability Test | CUSUM Test | | Stable parameters | Stable parameters | Stable parameters | Stable parameters | Stable parameters |
| Model Specification | Ramsey RESET | Model is not misspecified | 0.58 | 0.11 | 0.56 | 0.30 | 0.45 |
| Cointegration | Bounds | No long-run relationship exists | No cointegra-tion*** | No cointegra-tion*** | No cointegara-tion*** | No cointegara-tion*** | Cointegration exists** |

Table 1.12: Results for Kalman Beta Models-Estimation Outputs

| | $\beta_{US}$ | $\beta_{UK}$ | $\beta_{CANADA}$ | $\beta_{GERMANY}$ | $\beta_{SINGAPORE}$ |
|---|---|---|---|---|---|
| $\beta_{t-1}$ | 0.965*** | 0.977*** | 0.954*** | 0.956*** | 0.911*** |
| $BB_t$ | -0.05*** | 0.012 | -0.252*** | -0.108** | -0.185*** |
| $BB_{t-1}$ | -0.067*** | - | 0.064 | - | -0.282*** |
| $BB_{t-2}$ | 0.003 | - | 0.234*** | - | - |
| $BB_{t-3}$ | - | - | 0.2** | - | - |
| $CA_t$ | 0.091*** | -0.015 | 0.262** | 0.331*** | 0.181 |
| $CA_{t-1}$ | 0.094 | 0.014 | 0.049* | 0.188*** | 0.86** |
| $CA_{t-2}$ | -0.004 | -0.06*** | -0.216* | 0.104 | - |
| $CA_{t-3}$ | - | - | -0.247** | - | - |
| $GDP_t$ | -0.060 | -0.039* | -0.059 | -0.040 | -0.273 |
| $GDP_{t-1}$ | 0.011 | - | - | - | -0.430 |
| $GDP_{t-2}$ | 0.062 | - | - | - | -0.146 |
| $GDP_{t-3}$ | - | - | - | - | 0.876** |
| $\pi_t$ | -0.128** | -0.031 | -0.385** | -0.034 | 0.164 |
| $\pi_{t-1}$ | -0.134 | - | - | - | - |
| $\pi_{t-2}$ | -0.021 | - | - | - | - |
| $FR_t$ | 0.003 | 0.070 | -0.131 | -0.012 | 1.556 |
| $FR_{t-1}$ | -0.119** | -0.059** | -0.403* | - | - |
| $FR_{t-2}$ | -0213* | - | - | - | - |
| $PR_t$ | -0.235 | -0.042 | 0.481 | -0.714** | 2.206* |
| $PR_{t-1}$ | -0.071 | - | - | - | - |
| $PR_{t-2}$ | -0.017 | - | - | - | - |
| $C$ | 0.027** | 0.028* | 0.031*** | 0.016 | 0.077*** |
| $TREND$ | 0.000 | 0.000 | 0.00005* | 0.0002*** | - |
| $PROB(F)$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$ | 0.945 | 0.969 | 0.944 | 0.973 | 0.857 |
| $ADJ-R^2$ | 0.942 | 0.097 | 0.941 | 0.972 | 0.852 |
| $DW$ | 1.824 | 1.955 | 1.962 | 2.019 | 2.065 |

Variable Definitions: $BB$: Budget Balance as a percentage of GDP, $CA$: Current Account as a percentage of GDP, $GDP$: Growth rate of GDP per capita, $\pi$: Inflation rate, $FR$: Financial Risk, $PR$: Political Risk.

# APPENDIX: DCC-GARCH FRAMEWORK

This section summarizes Engle (2002)'s DCC-GARCH framework which is used to estimate the time-variant country betas at the first stage of this study. In order to calculate the time-variant betas, the following equations are estimated:

$r_t$ is the return vector of a portfolio of $n$ assets and can be defined as;

$$r_t|\Psi_{t-1} \sim N(0, H_t) \tag{1.9}$$

$$H_t = E(r_t r_t^{'}|\Psi_{t-1}) \tag{1.10}$$

$$r_t = H_t^{1/2} v_t \tag{1.11}$$

where $v_t = [v_{1t}, v_{2t}, v_{3t}, ...., v_{nt}]'$ and $v_t \sim N(0, I_n)$

In DCC-GARCH, $H_t$, the time-variant conditional standard deviations matrix is defined as; $H_t = D_t \rho_t D_t$ where $D_t$ is the diagonal matrix of time-variant conditional standard deviations matrix:

$$D_t = \begin{bmatrix} \sqrt{h_{1t}} & 0 & 0 & \dots & 0 \\ 0 & \sqrt{h_{2t}} & 0 & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \dots & \sqrt{h_{nt}} \end{bmatrix}$$

and $\rho_t$ is conditional correlation matrix of the standardized disturbances; $u_t$

$$\rho_t = \begin{bmatrix} 1 & q_{12,t} & q_{13,t} & \dots & q_{1n,t} \\ q_{21,t} & 1 & q_{23,t} & \dots & q_{2n,t} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ q_{n1,t} & q_{n2,t} & q_{n3,t} & \dots & 1 \end{bmatrix}$$

where $u_t = D_t^{-1} r_t \sim N(0, \rho_t)$, $H_t$ and $\rho_t$ are positive definite and $|q_{ij}| \leq 1$. Then $\rho_t$ is decomposed into:

$$\rho_t = \gamma_t^{-1} Q_t \gamma_t^{-1} \tag{1.12}$$

in which $Q_t$ reflects the structure of the dynamics and $\gamma_t^{-1}$ rescales the elements of $Q_t$ to satisfy $|q_{ij}| \leq 1$ condition.

$$Q_t = (1 - \alpha - \beta)\bar{Q} + \alpha u_{t-1} u_{t-1}^{'} + \beta Q_{t-1} \tag{1.13}$$

where $\bar{Q} = E(u_t u_t^{'})$ and, $\alpha$ and $\beta$ are scalars.

Then DCC ($p$,$q$) can be formulated as;

$$Q_t = \left(1 - \sum_{i=1}^{p} \alpha_i - \sum_{j=1}^{q} \beta_j\right) \bar{Q} + \sum_{i=1}^{p} \alpha_i u_{t-i} u_{t-i}^{'} + \sum_{j=1}^{q} \beta_j Q_{t-j} \tag{1.14}$$

Then the likelihood function $l(\Theta)$ is maximized to estimate the parameters; $\Theta(\Phi, \varphi)$

$$l(\Theta) = -0.5 \sum_{t=1}^{T} \left(n \log(2\pi) + \log(|H_t|) + r_t^{'} H_t^{-1} r_t\right) \tag{1.15}$$

$$= -0.5 \sum_{t=1}^{t} \left(n \log(2\pi) + 2\log(|D_t|) + \log(|\rho_t|) + u_t^{'} \rho_t^{-1} u_t\right) \tag{1.16}$$

Once the parameters are estimated for DCC (1,1) model, time-variant country betas are calculated as:

$$\beta_t = \frac{Q_t \sqrt{h_{it}}}{\sqrt{h_{wt}}} \tag{1.17}$$

# Chapter 2

# The Effects of Fiscal Policy on Stock Market Returns: A Sectoral View

## 2.1 Introduction

The severity of recent global financial crisis which was triggered in US financial markets and spread gradually to the rest of the world required policymakers to employ fiscal policy side by side with monetary policy to stabilize the economy. Particularly during the Eurozone crisis recovery, policymakers vastly employed fiscal stimulus packages in order to stabilize the financial markets at the cost of long term stability of public debt despite the Maastricht Criteria. These implementations of fiscal policy as a cure for financial crises led the researchers to examine the linkage between fiscal policy and financial markets.

What is the correlation between financial markets and fiscal policy? How do fiscal policy shocks affect stock markets returns? In this paper, I try to answer these questions by employing a Structural Vector AutoRegressive Model for 1975:Q1 to 2013:Q2 period in the US. This study analyzes not only the effects of fiscal policy shocks on aggregate stock market returns but also on sectoral returns for energy, financial, utility, industrial and healthcare sectors.

Although there are a sufficient number of studies examining the relationship between monetary policy shocks and stock market returns, relatively few studies define the correlation between fiscal policy shocks and asset markets and there is no consensus on the magnitude and direction of effects of an expansionary fiscal policy shock on stock market returns. This paper aims not only to fill this gap but also to contribute to the existing literature by raising a new question about the impact of a fiscal policy shock. Do all sectoral returns move in the same direction with aggregate stock market return? Is there a co-movement between the reactions of different sector indices as a result of an expansionary fiscal policy shock?

This study shows that aggregate stock market returns decrease as a result of a positive government spending shock and increase as a result of a positive government revenue shock in the US between 1975 and 2013. This paper also shows that sectoral returns do not necessarily move in the same direction along with aggregate stock market returns as a response to a fiscal policy shock. While the stock returns of energy and utility sectors react the same way as aggregate stock market returns, financial sector returns respond in opposite direction.

More interestingly, healthcare and industrial sector returns respond completely different than the rest of the sectoral returns. Both positive government spending and positive government revenue shocks increase healthcare sectoral returns and decrease stock returns of the industrial sector.

This article is organized as follows. Section 1 introduces, section 2 reviews the literature briefly, section 3 describes the data and the model, section 4 presents the results and robustness check, and section 5 concludes.

## 2.2 Selected Literature

Blanchard (1981) develops a model emphasizing the joint response of and the interaction between output, stock market and term structure interest rate to a change or announcement of a change in monetary and fiscal policy. The real value of stock market is defined as the ratio of anticipated profit to discount rate. Since both profit and interest rate are increasing functions of output, and output increases in case of an expansionary fiscal policy, the net effect of a higher output on stock market returns is ambiguous. Stock market returns decrease if the interest rate effect dominates which is called *bad news* case, and increase if the profit effect dominates which is called *good news* case.

Blanchard (1981) underlines that anticipation and rational expectations play an important role in the joint response of output and stock market to a change in policy since not only the implementation of the policy which follows the announcement, but also the announcement itself leads to a change in expected rate of profit and interest rate. The net response of stock market is a matter of whether an increasing profit or an increasing interest rate effect compensates the other one in case of an expansionary fiscal policy.

Shah (1984) is another theoretical paper on the effects of fiscal policy on stock market. The paper tracks the long-term jump between two steady state values of stock market interrelated to a change in investment level as a result of a money-financed fiscal policy change. Shah (1984) underlines the veridicality of comprehending the model with a variable stock of capital instead of Blanchard (1981)'s assumption of a constant capital stock. Nonetheless, the study focuses on long term impact of a change in money-financed fiscal policy, rather than short-term consequences of a debt-/tax-financed policy shock, which is the main question of this paper. Shah (1984) concludes that in the long term a money-financed fiscal expansion does not affect the stock market value which remains unchanged despite a lower level of capital stock. Additionally, in the short term, the response of stock market to a fiscal policy shock varies under different circumstances.

Not only the theoretical, but the empirical studies on the topic are inconclusive about response of stock market returns to a change in fiscal policy. Empirical studies on the topic can be divided into categories with respect to different reasons assigning the direction of the response of stock market returns to fiscal policy shocks.

The first group of the studies states that in order to ascertain the direction of the response of stock market returns to a fiscal policy shock, the interaction between fiscal and monetary policies has to be taken into account and should be studied in one framework. Even so, the empirical studies in which monetary and fiscal policy interaction is modeled, show no consensus on the direction of stock market response.

Darrat (1990), Chatziantoniou et al. (2013) and Jansen et al. (2007) analyze the effects of monetary and fiscal policy jointly and their empirical evidence shows that an expansionary fiscal policy has a negative impact on stock market return. Jansen et al. (2007) utilizes the flexibility of a semi-parametric approach arguing that as fiscal policy acts as a binding constraint on monetary policy, it is insufficient to employ a parametric model whereas Darrat (1990) employs multivariate Granger Causality Approach and Chatziantoniou et al. (2013) use a Structural VAR Model. The empirical findings of this paper also show a negative effect of an expansionary fiscal policy by employing a SVAR Model.

Although Tavares and Valkanov (2003) and Arin et al. (2009) also take the interaction between fiscal and monetary policy into account, they show that the stock market return increases as a result of an expansionary fiscal policy innovation. Arin et al. (2009) employ a VAR model to investigate the relative impacts of various tax policies in the US, Germany and Japan and show that the magnitude of the impact of indirect taxes on stock market return is higher than the magnitude of the impact of labor taxes as the impact of corporate taxes is insignificant due to a firms ability to switch between equity and debt financing.

Akitoby and Stratmann (2008) draw attention to the choice of fiscal policy variable and claim that employing fiscal deficit as one variable instead of distinguishing government revenue and expenditure, can be a misleading indicator. Although it is supportive of Akitoby and Stratmann (2008)‘s argument that the empirical works[1] which include budget deficit as the only fiscal variable and agree on the negative effect of an increasing budget deficit on stock returns, the claim is not sound enough since there is no consensus on the net impact of an expansionary fiscal policy among

[1] Darrat (1990), Jansen et al. (2007) and Agnello and Sousa (2010).

the studies in which fiscal policy variable components are distinguished. In this paper, I investigate the effects of government spending and revenue separately to avoid this limitation.

Finally, Afonso and Sousa (2011) include the feedback from government debt along with the government revenue and government spending and argue that the sign of the stock market return depends if the analysis is controlled by public debt. Their study state empirical evidence in favor of a negative correlation between an expansionary fiscal policy and stock returns. In this paper, I employ SVAR framework which utilizes the identification restrictions of Afonso and Sousa (2011) and control for public debt as well. The direction of the response of stock market return to a change in fiscal policy is consistent with the results of the benchmark model of Afonso and Sousa (2011).

This paper contributes to the existing empirical literature by not only focusing on the response of aggregate stock market returns but also sectoral stock returns for five major sectors; financial, industrial, healthcare, utility and energy. The results show that there is no co-movement between the stock returns of different sectors as a result of a fiscal policy shock.

## 2.3 Data and the Model

### 2.3.1 The Empirical Model and Methodology

I analyze the relationship between fiscal policy shocks and stock market returns by employing the same SVAR Model from Afonso and Sousa(2011). I first replicate their model for aggregate stock returns and then employ the same model to define the reactions of sectoral returns for five super sectors in US economy as a result of a fiscal policy shock.

A SVAR model is employed to analyze the effects of fiscal shocks on stock market returns because of endogeneity problem.

Model is defined as;

$$AX_t = A^*(L)X_{t-1} + B^*Z_t + \epsilon_t \tag{2.1}$$

$$Au_t = \epsilon_t \tag{2.2}$$

$$X_t = [G, T, \pi, i, HR, SR]' \tag{2.3}$$

$$Z_t = [FederalDebt, D1987, D1990, D1997.D2000, D2002, D2008, D2010] \tag{2.4}$$

where $X_t$ is the endogenous variable set and $Z_t$ is the exogenous variable set. D1987 is the time dummy for 1987 Black Monday, D1990 is for early recession, D1997 is for Asian financial crises, D2000 is for Dotcom bubble, D2002 is for stock market downturn, D2008 is for 2008 global economic crises and D2010 is for European sovereign debt crises. $\epsilon_t$ is the vector of structural shocks, $u_t$ is the vector of reduced form residuals, $X_t$ is the vector of endogenous variables, $G$ is government spending, $T$ is government revenue, $\pi$ is inflation rate, $i$ is the interest rate, $HR$ is housing return and $SR$ is stock market return.

The endogenous variable set includes the variables selected by Afonso and Sousa (2011). Government spending and government revenue are proxies for fiscal policy, inflation rate is a proxy for monetary policy, interest rate is the transmission channel to the stock markets as defined in Blanchard (1981). Housing return is included in the model since Afonso and Sousa (2011) specifies that the interaction between the housing market and stock market affects the stock market's reaction to policy shocks.

The identification restriction matrix $A$ is defined following Afonso and Sousa (2011) as:

$$A = \begin{bmatrix} 1 & a_{12} & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & 0 & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix}$$

### 2.3.2 Data Description

I use quarterly data from 1975:Q1 to 2013:Q2 for the US. The variables included in the model are US government spending, US government revenue, inflation rate, housing prices, aggregate stock market return and sectoral returns.

Nominal government spending and investment, and nominal government revenue series from Bureau of Economic Analysis-NIPA Tables are used as proxies for government spending and government revenue. US Treasury constant maturity rate from Federal Reserve of St. Louis is used for interest rate. Housing price index is provided from Office of Federal Housing Enterprise Oversight.

For stock market returns, S&P 500 and S&P Dow Jones sectoral indices are employed to calculate aggregate and sectoral stock returns. Additionally Federal Debt series from the Federal Reserve Bank of St Louis is used to calculate federal debt variable and included as an exogenous variable in the model. All variables are in natural logarithms and deflated by inflation rate.

## 2.4 Results and Robustness Check

### 2.4.1 Results for Aggregate Stock Returns

First, SVAR model is estimated from 1975:Q1 to 2013:Q2 and the impulse response functions of inflation rate, interest rate, housing return[2] and aggregate stock market return to positive government investment and government revenue shocks are calculated. Figure 2.7 and Figure 2.8 show the responses of variables to positive government spending and government revenue shocks for period 1975-2013.

As a result of a positive government investment shock, both inflation rate and housing return decrease and vice versa, as a result of a positive government revenue shock, both inflation rate and housing return increase. These results are consistent with the result of Agnello and Sousa (2007).

Unfortunately due to the unavailability of a shorter frequency data for fiscal policy variables, quarterly data is used in the analysis. Since stock market immediately adjusts to shocks, the effect diminishes within a short period of time after the shock. Therefore, only the direction of the first jump of the return is observed in order to analyze how stock market return responds.

Stock market value is defined as the net present value of expected future profits which is the ratio of aggregated future profits to discount rate. Also, since both profit and interest rate are increasing functions of output, and output increases as result of an expansionary fiscal policy, the sign of the response of stock market returns is assigned by the dominant effect. Stock market returns decrease when interest rate effect dominates the profit effect and increase when the profit effect compensates more than the effect of an increasing interest rate.

As a result of a positive government investment shock, interest rate increases with a quarter delay after the shock while aggregate stock return decreases. As expected, as a result of a positive tax shock, stock market return increases as interest rate decreases. The responses of aggregate

[2]The original model from Afonso and Sousa (2001) emphasize the importance of the interaction between housing and stock markets. To capture this interaction, housing return is included in the model but the study does not focus on the response of housing return. Therefore, the response of housing return is not detailed in the rest of the paper.

stock market return and interest rate are consistent with the results of Afonso and Sousa (2011).

Although the responses of interest rate and aggregate stock market return follow opposite patterns, since there is a time gap between the announcement and the implementation of the policy and stock market responds faster to changing expectations compared to interest rate, which moves as output moves after the actual implementation of the policy, the responses of interest rate and stock market returns are not synchronized.

### 2.4.2 Results for Sectoral Returns

In order to calculate the response of each sectoral return, I re-estimate the SVAR model by alternating the stock market return variable and calculate the impulse response functions of each sectoral return to positive government investment and tax shocks. Since the sectoral indices are available only after 1990:Q1, first, I re-estimate the SVAR Model for aggregate stock market return to check for subsample stability for period 1990:Q1-2013:Q2. The model includes 4 lags and 2008 quarterly dummies and federal debt as exogenous variables.

Figure 2.3 and Figure 2.4 show that, for period 1990-2013, the responses of variables to a fiscal policy shock follow a similar pattern to the period 1975-2013. Stock market return, housing return and inflation rate increase as a result of a positive government investment shock and decrease as a result of a positive government revenue shock.

Once the model is shown to be stable for the subsample of 1990-2013, it is employed to estimate the responses of returns of utility, energy, financial, healthcare and industrial sectors. Figure 2.5 represents the responses of utility and energy sector returns to fiscal shocks.

Energy and utility sectors respond to fiscal policy shocks following a similar pattern to the response of aggregate stock market return. Energy sector return decreases within a quarter after the shock and the effect vanishes away after the first quarter as a result of a positive government investment shock, and increases as a result of a positive government revenue shock. Although utility sector return responds negatively to a positive change in government investment and negatively to a positive change in tax revenue, the response comes with a quarter delay and becomes significant temporarily at the second quarter. The delay in response of utility sector implies that actual implementation of the policy is more effective than the announcement of the policy change.

Figure 2.6 represents the impulse response functions of financial, healthcare and industrial sector returns. As clear from the impulse response functions, there exists no co-movement between the sector returns to a fiscal policy innovation.

Financial sector return response is opposite to aggregate stock returns. Financial sector return increases as government spending goes up and decreases as tax revenue goes up. The expectation of higher future profits dominates the effect of higher interest rate and therefore, financial sector returns move in the same direction with profit.

Unexpectedly, healthcare and industrial sectors do not respond to different shock in opposite directions. Healthcare sector return increase as a result of both positive government investment and tax revenue shocks. An intuitive explanation for an increasing healthcare sector return can be driven from the fact that healthcare sector is a government subsidized sector. For this reason, both a higher government spending and a higher tax revenue indicate a higher subsidy rate; therefore a higher future profit for healthcare sector.

On the other hand, industrial sector return follows a more pessimistic pattern and decreases as a result of both an expansionary and a tight fiscal policy. An intuitive explanation for this response might be the fact that investors are more pessimistic about the future profits of the industrial sector as a result of a fiscal policy change.

### 2.4.3 Robustness Check

There is insufficient number of theoretical frameworks modeling the relationship between fiscal policy and stock market performance, moreover; the empirical literature on the topic is inconclusive about the effects of fiscal policy changes on stock markets returns. According to Afonso and Sousa (2011), the response of stock market return is sensitive to the model specification if the model does not control by public debt. Therefore, I adopt a similar SVAR Approach to Afonso and Sousa (2011) and include the federal debt as an exogenous variable in the model.

In this section, I examine if the responses of variables including both aggregate and sector returns change when the model is estimated without debt feedback. As the next step, I re-estimate both the model for aggregate stock returns for 1975-2013 period and the model for sectoral returns for 1990-2013 period without the debt feedback. Also, given that the model includes both government spending and revenue in the endogenous variable set, not only the effects of existence but also the exogenity pf federal debt variable is questionable, I believe exclusion of federal debt variable can clear up both discussions.

Figure 2.7 and Figure 2.8 represent the impulse response functions of inflation rate, housing return, interest rate and aggregate stock market return for 1975-2013 period when debt variable is excluded from the estimation. All variables follow the same response as the original with debt feedback. Inflation rate, housing return and aggregate stock returns decrease as result of a positive government spending shock, and increase as a result of a positive tax shock.

Figure 2.9 and Figure 2.10 show the impulse response functions for sectoral returns when debt feedback is excluded. Similarly, sector returns give the same responses to fiscal policy shocks when the debt feedback is excluded from the model. Utility and energy sectors follow the same pattern with aggregate stock returns whereas financial sector return responds in opposite direction. Moreover; healthcare sector return increases and industrial sector return decreases as a result of both policy changes. However, the magnitude of the responses of sector returns are stronger when debt feedback is excluded.

## 2.5 Conclusion

In this paper, I investigate the effects of fiscal policy shocks on both aggregate stock market and sectoral returns in the US for period 1975-2013. The empirical findings of the paper show that in case of a positive government investment shock; inflation rate, housing return and aggregate stock market return decrease whereas interest rate increases. As expected, a positive government revenue shock increases both housing return and aggregate stock market returns.

However, neither sectoral stock returns react to policy shocks in the same direction, nor there observed a comovement between the reactions of stock returns of different sectors. Among five sectoral returns employed in the analysis, only energy and utility sector returns move in the same direction with aggregate stock returns. Financial sector return response is quite the opposite of aggregate stock return response. A positive government investment shock increases financial sector return while a positive tax shock decreases.

The behavior of industrial and healthcare sectors is worthwhile since they give the same responses to counter shocks. Both positive government spending and positive government revenue shocks decrease industrial sectoral returns whereas increase healthcare sectoral returns.

These findings state empirical evidence in favor of a negative impact of expansionary fiscal shocks on stock market performance. Additionally, since the particular effect of fiscal shocks on sectoral returns have not been investigated, I believe this study fills the gap in the literature.

# APPENDIX: Global Industry Classification Standard (GICS)[3]

**Energy Sector:** The Energy Sector comprises companies engaged in exploration & production, refining & marketing and storage & transportation of oil & gas and coal & consumable fuels. It also includes companies that offer oil & gas equipment and services.

**Industrial Sector:**The Industrial Sector includes manufacturers and distributors of capital goods such as aerospace & defense, building products, electrical equipment and machinery and companies that offer construction & engineering services. It also includes providers of commercial & professional services including printing, environmental and facilities services, office services & supplies, security alarm services, human resource & employment services, research & consulting services. It also includes companies that provide transportation services.

**Health Care Sector:** The Health Care Sector includes health care providers & services, companies that manufacture and distribute health care equipment & supplies and health care technology companies. It also includes companies involved in the research, development, production and marketing of pharmaceuticals and biotechnology products.

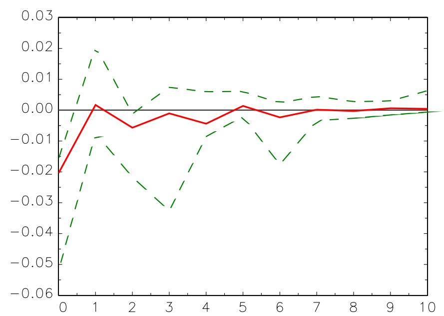
**Financial Sector:** The Financial Sector contains companies involved in banking, thrifts & mortgage finance, specialized finance, consumer finance, asset management and custody banks, investment banking and brokerage and insurance. This Sector also includes real estate companies and REITs.

**Utilities Sector:** The Utilities Sector comprises utility companies such as electric, gas and water utilities. It also includes independent power producers & energy traders and companies that engage in generation and distribution of electricity using renewable sources.

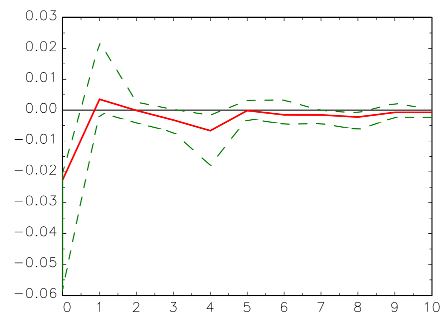
[3]Sector definitions are taken from Morgan Stanley Capital International Resource Center website: https://www.msci.com/resources/pdfs/GICSSectorDefinitions.pdf

Figure 2.1: Impulse Response Functions for 1975-2013 Period

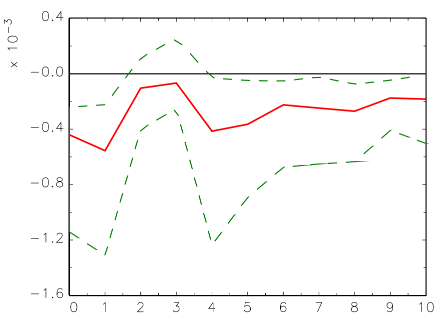
(a) Response of Government Revenue to a Positive Government Spending Shock



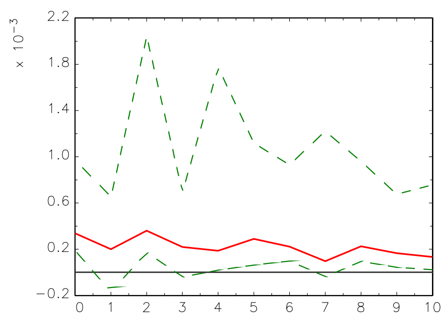

(b) Response of Government Spending to a Positive Government Revenue Shock



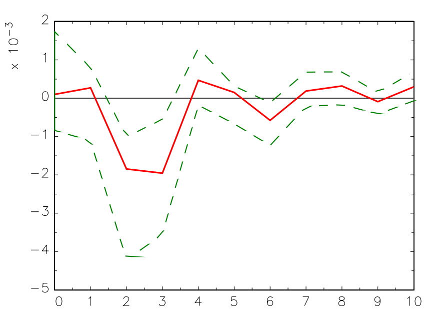

(c) Response of Inflation to a Positive Government Spending Shock




(d) Response of Inflation to a Positive Government Revenue Shock




(e) Response of Housing Return to a Positive Government Spending Shock




(f) Response of Housing Return to a Positive Government Revenue Shock

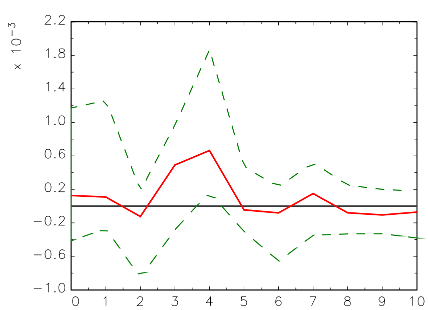
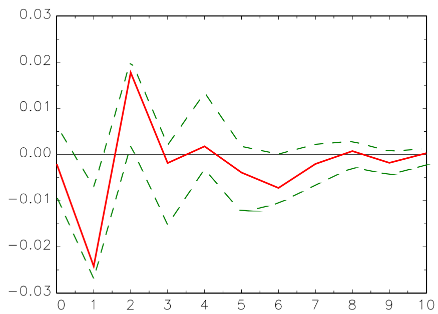
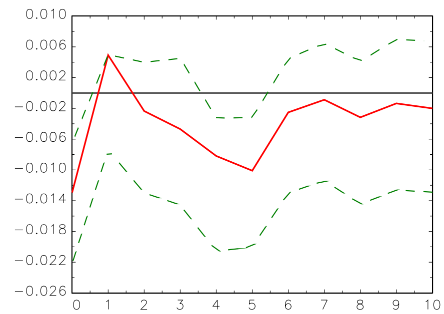


Figure 2.2: Impulse Response Functions for 1975-2013 Period

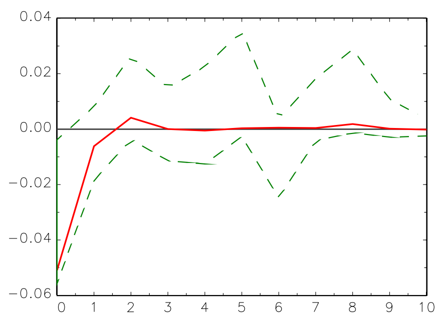
(a) Response of Interest Rate to a Positive Government Spending Shock




(b) Response of Interest Rate to a Positive Government Revenue Shock




(c) Response of Aggregate Stock Market Returns to a Positive Government Spending Shock




(d) Response of Aggregate Stock Market Returns to a Positive Government Revenue Shock

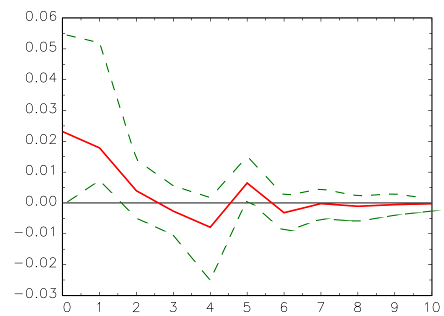
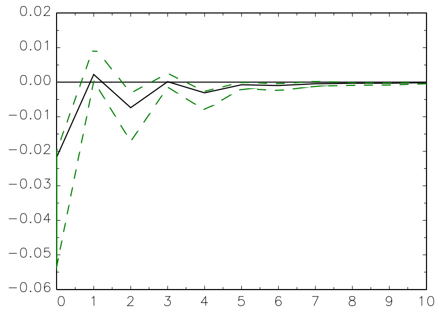
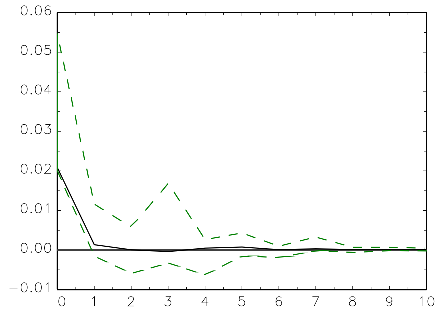


Figure 2.3: Impulse Response Functions for 1990-2013 Period

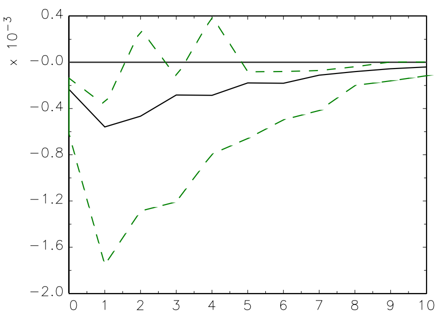
(a) Response of Government Revenue to a Positive Government Spending Shock



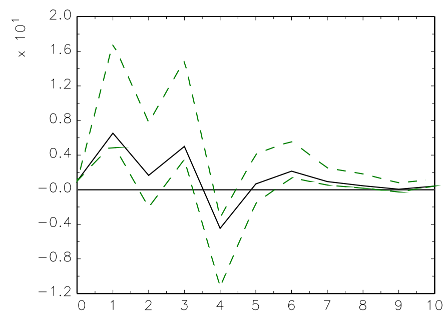

(b) Response of Government Spending to a Positive Government Revenue Shock



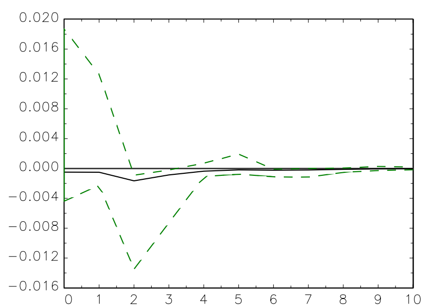

(c) Response of Inflation to a Positive Government Spending Shock




(d) Response of Inflation to a Positive Government Revenue Shock




(e) Response of Housing Return to a Positive Government Spending Shock




(f) Response of Housing Return to a Positive Government Revenue Shock

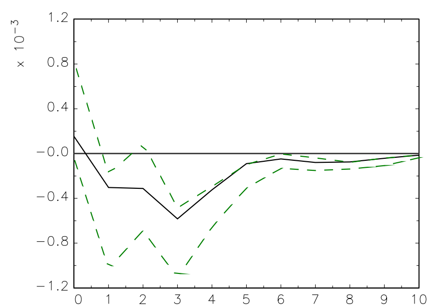
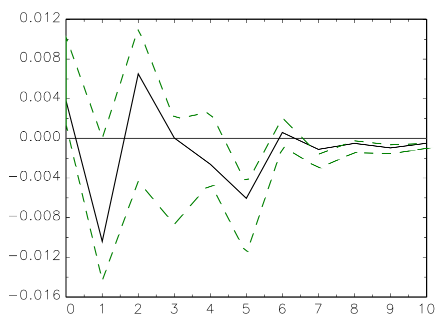
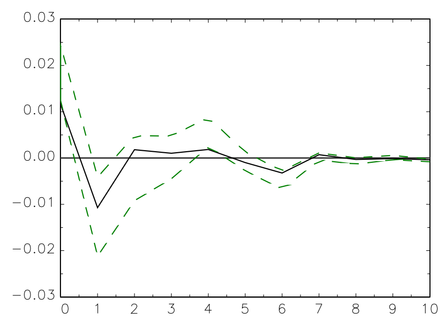


Figure 2.4: Impulse Response Functions for 1990-2013 Period

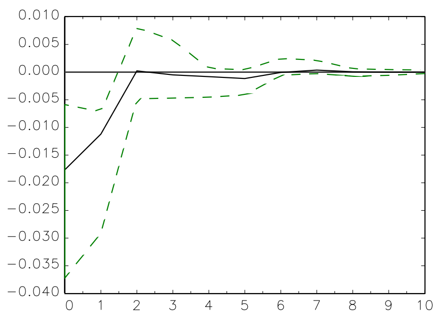
(a) Response of Interest Rate to a Positive Government Spending Shock




(b) Response of Interest Rate to a Positive Government Revenue Shock




(c) Response of Aggregate Stock Market Returns to a Positive Government Spending Shock




(d) Response of Aggregate Stock Market Returns to a Positive Government Revenue Shock

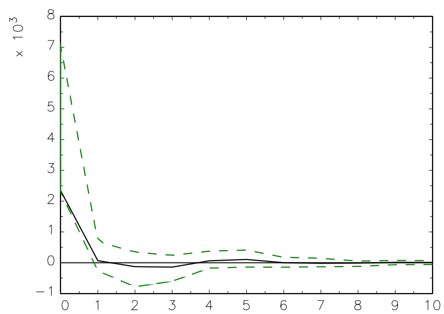
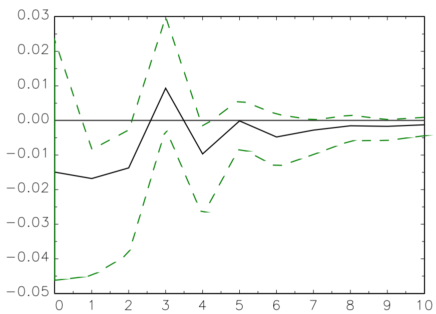
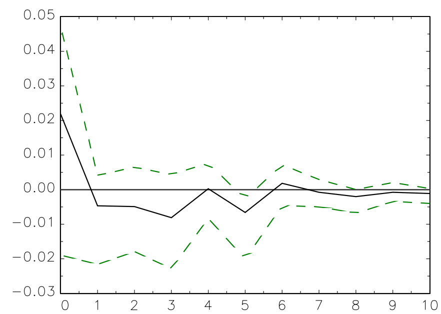


Figure 2.5: Impulse Response Functions for Sectoral Returns without Debt Feedback

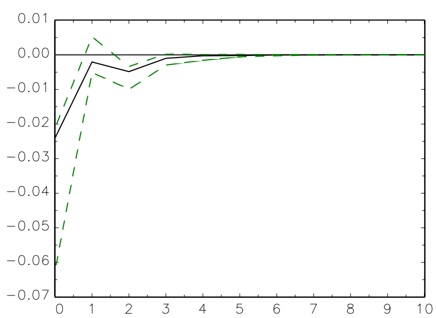
(a) Response of Utility Sector Returns to a Positive Government Spending Shock




(b) Response of Utility Sector Returns to a Positive Government Revenue Shock




(c) Response of Energy Sector Returns to a Positive Government Spending Shock




(d) Response of Energy Sector Returns to a Positive Government Revenue Shock

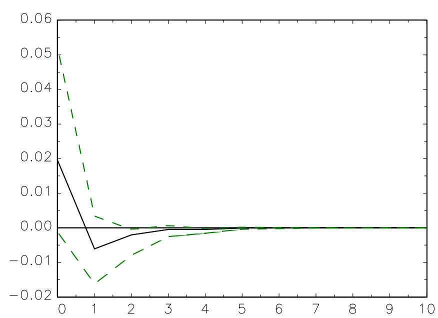
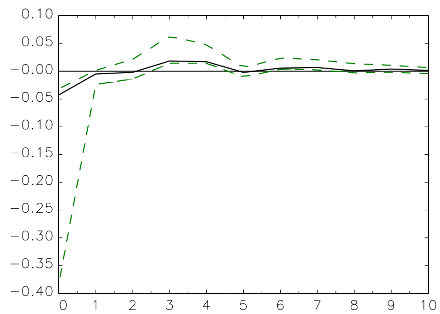
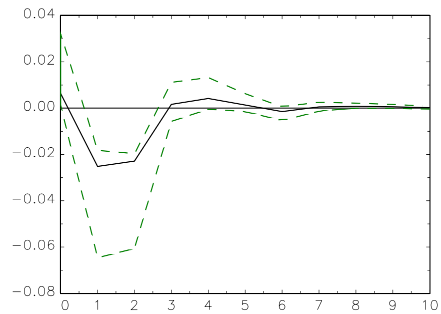


Figure 2.6: Impulse Response Functions for Sectoral Returns

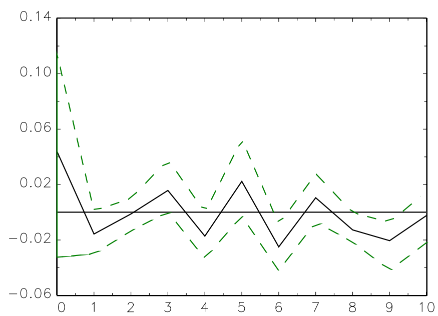
(a) Response of Financial Sector Returns to a Positive Government Spending Shock



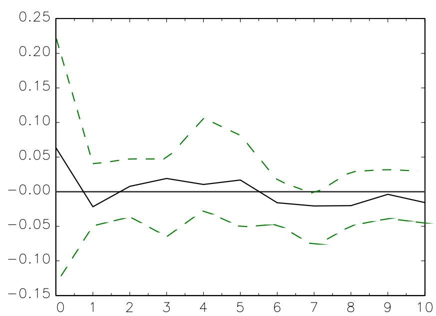

(b) Response of Financial Sector Returns to a Positive Government Revenue Shock



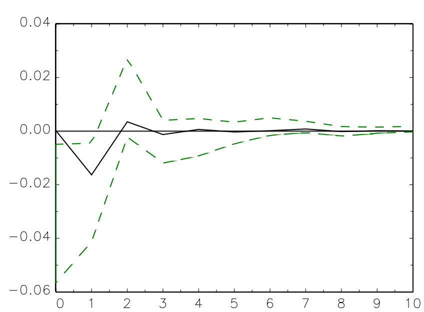

(c) Response of Healthcare Sector Returns to a Positive Government Spending Shock




(d) Response of Healthcare Sector Returns to a Positive Government Revenue Shock




(e) Response of Industrial Sector Returns to a Positive Government Spending Shock




(f) Response of Industrial Sector Returns to a Positive Government Revenue Shock

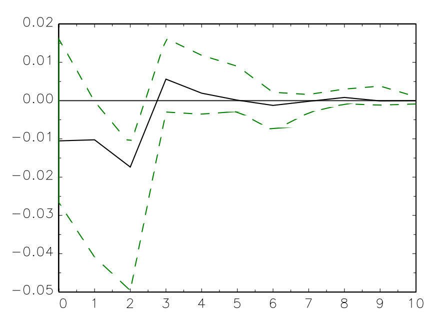
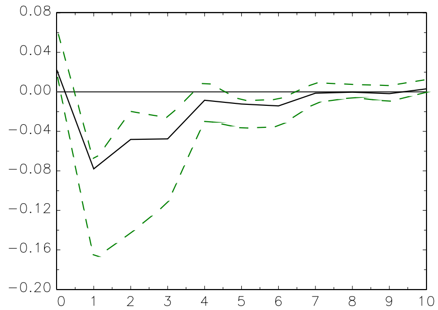
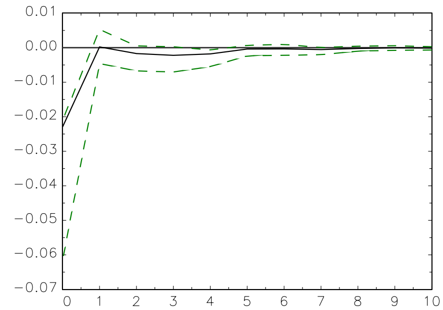


Figure 2.7: Impulse Response Functions for 1975-2013 Period without Debt Feedback

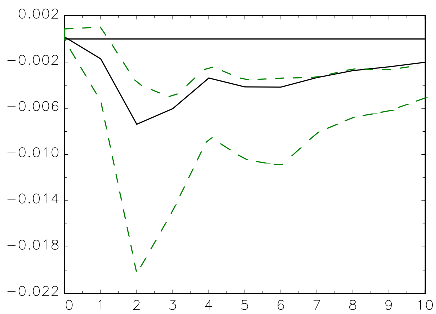
(a) Response of Government Revenue to a Positive Government Spending Shock



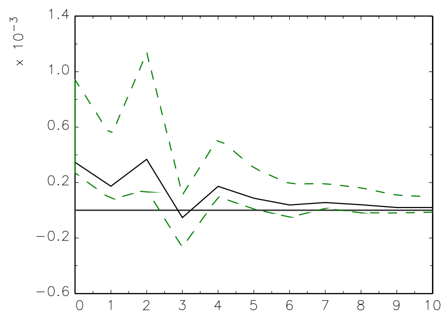

(b) Response of Government Spending to a Positive Government Revenue Shock



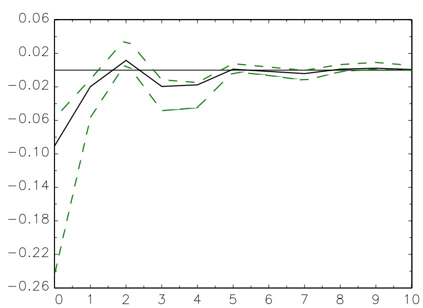

(c) Response of Inflation to a Positive Government Spending Shock




(d) Response of Inflation to a Positive Government Revenue Shock




(e) Response of Housing Return to a Positive Government Spending Shock




(f) Response of Housing Return to a Positive Government Revenue Shock

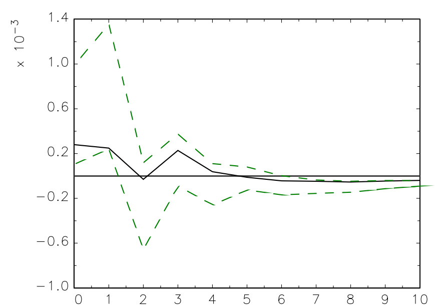
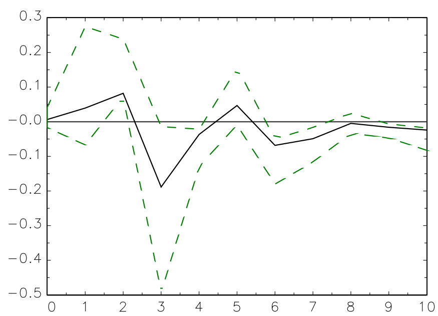
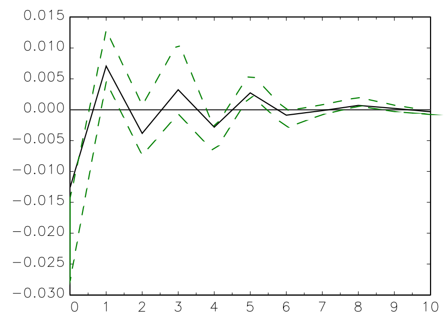


Figure 2.8: Impulse Response Functions for 1975-2013 Period without Debt Feedback

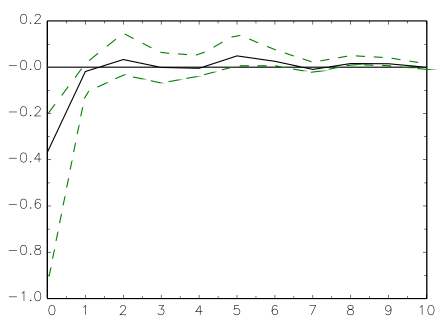
(a) Response of Interest Rate to a Positive Government Spending Shock




(b) Response of Interest Rate to a Positive Government Revenue Shock




(c) Response of Aggregate Stock Market Returns to a Positive Government Spending Shock




(d) Response of Aggregate Stock Market Returns to a Positive Government Revenue Shock

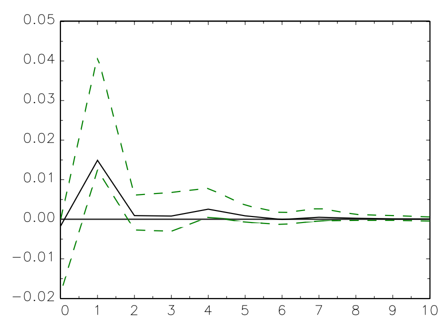
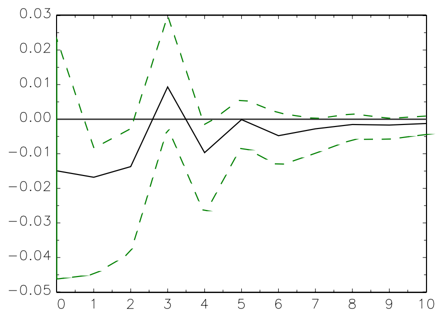
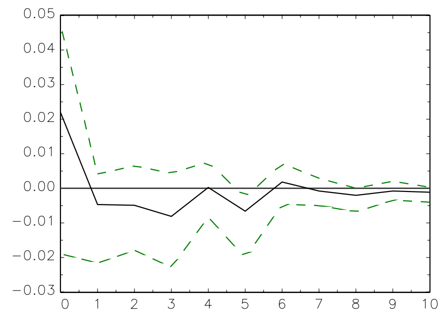


Figure 2.9: Impulse Response Functions for Sectoral Returns without Debt Feedback

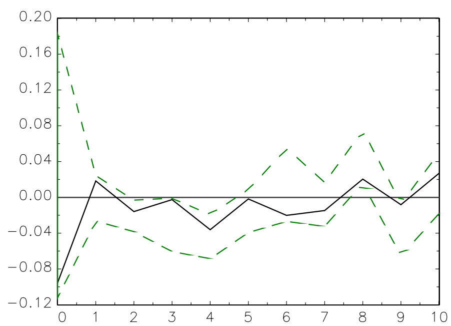
(a) Response of Utility Sector Returns to a Positive Government Spending Shock




(b) Response of Utility Sector Returns to a Positive Government Revenue Shock




(c) Response of Energy Sector Returns to a Positive Government Spending Shock




(d) Response of Energy Sector Returns to a Positive Government Revenue Shock

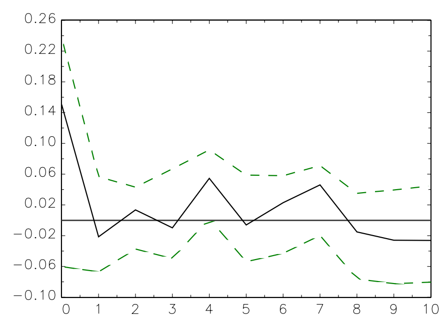
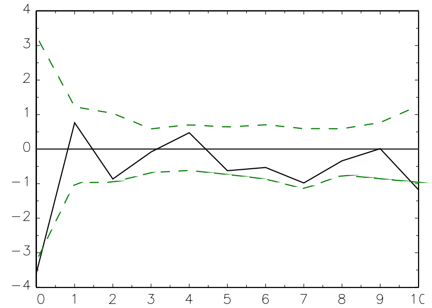
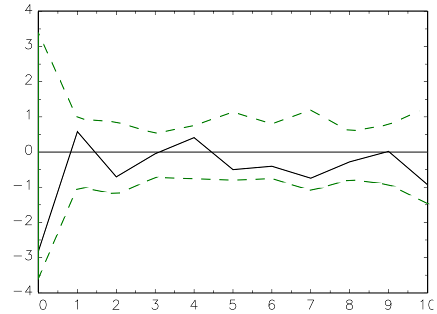


Figure 2.10: Impulse Response Functions for Sectoral Returns without Debt Feedback

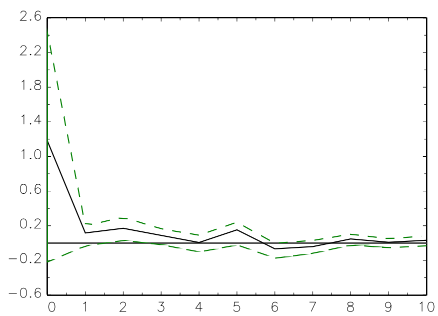
(a) Response of Financial Sector Returns to a Positive Government Spending Shock



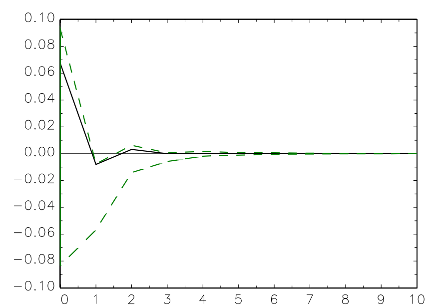

(b) Response of Financial Sector Returns to a Positive Government Revenue Shock



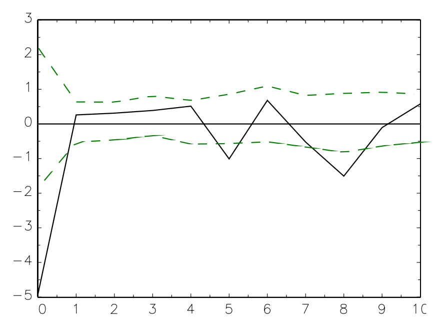

(c) Response of Healthcare Sector Returns to a Positive Government Spending Shock



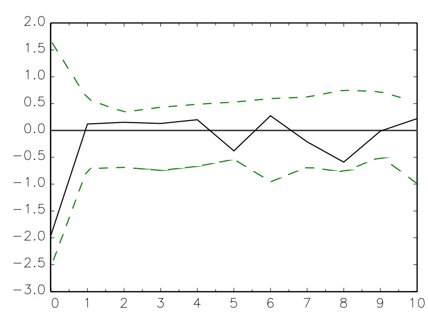

(d) Response of Healthcare Sector Returns to a Positive Government Revenue Shock




(e) Response of Industrial Sector Returns to a Positive Government Spending Shock




(f) Response of Industrial Sector Returns to a Positive Government Revenue Shock



# Chapter 3

# International Effects of US Government Spending Shocks: The Case of Canada

## 3.1 Introduction

One of the lessons of the 2008 crisis has been, once again, to highlight the international interdependence of economies. Not only do international markets have a tremendous impact on domestic markets, but domestic policies are transmitted on a global level. This is even more relevant now when most industrialized economies are poised to or have already embarked on fiscal retrenchment. In an age where monetary policy is less reliable, how is fiscal policy transmitted abroad? What are the effects of US fiscal policy on both domestic and foreign markets? To answer these questions, in this study, I aim to characterize the international effects of US fiscal expansion. More specifically, I examine the effects of US government spending shocks on output and consumption levels in the US, as well as, in Canada from 1957 to 2013. Empirical results of the paper show that during the period of 1957-2013, a positive US government spending shock is positively transmitted to her trading partner. As a result of domestic fiscal expansion, output and consumption levels in both countries increase. There are different theories on the reasons and transmission channels of the positive international transmission of domestic policies.

Most of the theoretical models accept the case that domestic economic policies can be transmitted to other countries both positively and negatively. The main dissimilarity of the theories is the international transmission channel of domestic policies. According to the traditional Mundell-Fleming model, the milestone of the theoretical literature, the direction of the international transmission of a domestic fiscal shock depends on the exchange rate regime the home country is under since the exchange rate is defined as the transmission channel. Briefly, a domestic fiscal expansion is transmitted negatively to trading partners under a flexible exchange rate regime, reflecting a "beggar thy neighbor" effect. Vice-a versa, domestic output, as well as, foreign output increases as a result of a domestic fiscal expansion under a fixed exchange rate regime.[1]

In contrast to the Mundell-Fleming Model, Svensson (1987) claims that given the production capacity of the home country, the spillover effect of domestic fiscal expansion on foreign output depends on whether home and foreign goods are Edgeworth Pareto complements or substitutes, and whether the domestic government finances domestic fiscal expansion by a monetary expansion or tax revenue. If home and foreign goods are Edgeworth Pareto complements, a domestic fiscal expansion is transmitted positively. In other words, both foreign output and consumption levels increase when there is underconsumption of home goods. If there is a liquidity shortage in the domestic market, then a domestic fiscal expansion has no effect on consumption and output levels in either domestic or foreign economies. In the third case, when domestic production is at full capacity, an increase in domestic government spending is transmitted negatively to the foreign country. In this case, both foreign output and consumption levels decrease, but it has no effect on the domestic macroeconomic parameters. It is the opposite when home and foreign goods are Edgeworth substitutes. Svensson (1987) also adds that, unlike the Mundell Fleming Model, neither the exchange rate nor the terms of trade are the international transmission channels of domestic fiscal policies. Instead, the consumption of home and foreign goods is defined as the transmission

[1] See Fleming (1962) and Mundell (1968) for more details.

channel.

Another two-country general equilibrium model shows that the direction and the channel of the international transmission of domestic fiscal shocks depend on the structure of the international assets market (Betts and Devereux (1999)). If the international assets market is complete, then a domestic fiscal expansion is transmitted positively to the foreign economy. As a result both foreign and domestic output levels increase, whereas consumption levels in both countries fall.

Despite the lack of consensus regarding the spillover effects of domestic fiscal policy shocks, it is widely accepted that domestic fiscal expansion does affect trading partners. In the next section, selected empirical literature on the international transmission and the domestic effects of fiscal policy is reviewed. Since the theoretical models are inconclusive and empirical literature on the international transmission of fiscal policy is still in its infancy, I believe that this study helps to fill in this gap, contributing to the empirical literature by examining the domestic and international effects of US government spending shocks. I anticipate that this study will provide motivation for further empirical studies on this topic.

This paper is structured in four sections. Section 2 gives information about the empirical literature on the international and domestic effects of US fiscal policy. Section 3 explains the data, the methodology and the empirical results. Section 4 concludes.

## 3.2 Selected Empirical Literature

There are a remarkable number of empirical studies on the domestic effects of US fiscal shocks. Although in most of the macroeconomic models, it is shown that an expansionary fiscal policy increases domestic output level and therefore appreciates the domestic currency, there is no consensus about the effects of an expansionary fiscal policy on private consumption. According to Blanchard and Perotti (2002), one of the most recent studies on this topic, a positive government spending shock increases both US output and private consumption levels. Gali et al. (2007) also confirm these results and question the infinitely-lived Ricardian household assumption of the Real Business Cycle models which claim that private consumption falls in case of a positive government spending shock. Both papers employ the Structural Vector AutoRegression (SVAR) technique to identify the fiscal shocks.

In contrast, Perotti (2007) argues that Blanchard and Perotti (2002) find a positive response of private consumption to a fiscal expansion because of the methodology used to identify fiscal shocks. Perotti (2007) claims that it is important to insulate the “abnormal” fiscal events, such as war and post-war periods, in order to obtain the “normal” responses of other endogenous variables to a fiscal shock. He employs both dummy variable and SVAR approaches and shows that the dummy variable approach where abnormal fiscal events can be isolated gives results in favor of a negative response of private consumption. However, the SVAR approach with the same variables and for the same data period confirms the earlier findings of Blanchard and Perotti (2002). This robustness check supports his arguments.

Ramey (2011) is another study criticizing the standard VAR identifying restrictions of Blanchard and Perotti (2002) and alternatively adopts Ramey-Shapiro narrative approach to identify the effects of government spending shocks. She argues that in the standard VAR approach employed by many empirical papers on the topic, the shocks are missing the timing of the shocks and likewise Perotti (2007), she adds that anticipated and unanticipated shocks have different effects on domestic consumption. Since an increase in defense spending is anticipated several quarters before it actually occurs and it explains most of the volatility in government spending, she creates a military date variable which is a dummy variable for “war dates” and analyzes the effects of a shock to the military date variable on private consumption and output levels. As a result of a positive shock to defense spending, domestic output goes up whereas private consumption goes down. Although the empirical results of the study are consistent with the argument that anticipated defense spending shocks affect private consumption negatively, the study generalizes the results for non-defense government spending shocks as well and fails to distinguish between the effects of non-defense and defense spending shocks.

Aarle et al. (2003) and Muller (2008) also examine the domestic impacts of US fiscal spending shocks with the Vector AutoRegression (VAR) methodology. Aarle et al. (2003) adopt the identification restriction that there is no accumulated effect of government spending shocks on US output level in the long-run. Therefore, the study does not present any impact of a positive government spending shock on US output. However, Muller (2008) states findings in favor of an increase in output and private consumption levels as a response to a positive US government shock. The study adopts Blanchard and Perotti's (2002) identification restriction, which states that government expenditure does not respond to shocks sourced by other endogenous variables simultaneously. Empirical results of Muller (2008) are also in line with Blanchard and Perotti (2002); a positive US government spending shock increases US output and consumption levels and thereby the US dollar appreciates.

Despite a voluminous literature on domestic effects of fiscal policy, the empirical literature on international fiscal interdependence is still in its infancy with only a handful of studies examining the topic. Canzoneri et al. (2003) modifies Blanchard and Perotti's (2002) VAR model for domestic transmission in order to obtain both domestic and spillover effects of US fiscal shocks while preserving the baseline identification restrictions. They examine the effects on US output and consumption levels as well as the effects on output and the real exchange rate of Italy, France and the UK. They state findings in favor of a positive transmission of US fiscal shocks to the three European economies. As a result of a positive US government spending shock and a negative tax shock, all three European countries face higher output levels accompanied by a depreciation in their currencies. These results are consistent with the results of this study. I also find empirical evidence in favor of a positive transmission of US government spending shocks to Canada as Canadian output rises while the US dollar appreciates.

Corsetti and Muller (2011), one of the most recent studies on the topic, examine the effects of a positive US government spending shock on the Euro Zone and the UK as well as the US economy itself. For domestic transmission of fiscal shocks, they make a comparison of two different identification schemes; the standard VAR approach introduced by Blanchard and Perotti (2002) and the narrative approach by Ramey (2011). They find that the responses of domestic macroeconomic variables are similar although the magnitudes are slightly different. For the international transmission of the fiscal policy shocks, they define the asset markets as the transmission channel, therefore include the real interest rate of the US in the model and examine the effects of US fiscal policy shocks on output levels of the UK and the Euro Zone. As a result, both UK and European output levels go up. Even though, the interest rate is defined as the transmission channel, bilateral exchange rates are included in the estimation and hence the variance decomposition is not specified in the study, it is not clear if US government spending shocks are transmitted through the interest rate or the exchange rate channel. In this study, I define the bilateral exchange rate as the transmission channel.

Another study on the transmission of US fiscal shocks to Canada is Arin and Koray (2009). The results of Arin and Koray (2009) are in favor of a negative transmission, which is called a "beggar thy neighbor" effect. They claim that domestic fiscal policy is transmitted through exchange rate and interest rate channels to Canada. Impulse-response functions of the SVAR model for period 1961:Q1-2004:Q4 show that a positive fiscal shock in the US leads the real exchange rate to appreciate; US output level to increase; but, in contrast, Canadian output to fall. This result is inconsistent with the empirical findings of this study. The limitation of Arin and Koray (2009) is the identification restrictions defining US fiscal shocks since the restrictions do not depend on any theoretical framework or previous empirical studies on both the domestic and spillover effects of US fiscal expansion. In this study, I adopt the baseline identification restrictions of Blanchard and Perotti (2002), which are widely used in empirical research, for domestic transmission, and of Canzoneri et al. (2003) to characterize the international effects.

To the best of my knowledge, Beetsma et al. (2006) is the only study that employs a panel VAR approach to analyze the international spill-overs of fiscal policy shocks. They examine the international effects of a domestic fiscal expansion within European Union countries and find empirical evidence in favor of a positive international transmission of a domestic fiscal expansion. They show that the magnitude of the effect of a domestic fiscal expansion on foreign output depends on the size of the economy from which the shock is originated. Larger economies such as Germany have bigger impacts on relatively smaller economies. Due to the dimensionality problems, the effect is estimated in three steps. First they create a panel model which they refer as “fiscal block” analyzing the effects of a fiscal expansion on domestic output. Second they create an independent panel model called a “trade block” analyzing the relationship between domestic output and foreign exports. Finally they translate the movements in foreign exports into changes in foreign output. Although the study has the advantage of analyzing 14 European countries at a time, since the estimation is not done in one single model, it is not clear that the effect on foreign output is sourced by a domestic fiscal shock or a positive foreign export shock. Another limitation of the study is that they use annual observations and adopt Blanchard and Perotti’s (2002) identification restrictions which are stated to be valid only for quarterly data and not valid for annual data. In this study, a two-country structural VAR is estimated by using quarterly data.

Given the limited number of empirical studies on the international transmission of domestic fiscal policy shocks, I believe that this study helps to fill in this gap, contributing to the empirical literature by examining the domestic and international effects of US government spending shocks on her biggest trading partner, Canada for a long period of time by employing Blanchard and Perotti’s (2002) identification restriction on a quarterly data. I anticipate that this study will provide motivation for further empirical studies on this topic.

## 3.3 Empirical Evidence

### 3.3.1 Data Description

In this section, I estimate a Structural VAR model and compute the associated impulse response functions to understand the effects of a positive US government spending shock on both US and Canadian output and consumption levels. To do so, quarterly data are used from 1957:Q1 to 2013:Q1. Table 3.1 defines the series and variables used in this study. US government consumption expenditure and gross investment data, which aggregates federal, local and state government consumption expenditure, and gross investment, is defined as government spending. To find real GDP and real consumption of the US, nominal GDP and nominal household consumption of the US are deflated by US GDP deflator, respectively and are defined in US dollars (USD). Nominal GDP and nominal household consumption of Canada are deflated by Canadian GDP deflator in order to find real GDP and real consumption levels of Canada, respectively. Canadian variables are defined in Canadian dollars (CAD). All series, except for government consumption and investment expenditure are obtained from the International Monetary Fund-International Financial Statistics (IMF-IFS) online database. US government consumption and investment data are obtained from the Bureau of Economic Analysis/US department of Commerce. Additionally, the real exchange rate is employed in the model and is calculated as the nominal exchange rate multiplied by US Consumer Price Index and divided by Canadian Consumer Price Index.

This study employs the SVAR Model to estimate the effects of US government spending on countries consumption and output levels as well as the real exchange rate since the VAR estimation technique is one of the most common estimation methods in order to investigate the dynamic effects of policy changes on macroeconomic parameters in existence of endogeneity. Most of the empirical studies on international fiscal transmission employ VAR models to estimate the effect of policy shocks.[2]

[2] Arin and Koray (2009) and Ramey (2011) employ unrestricted VAR Models, Canzoneri et al. (2003) employ a

### 3.3.2 The Model and Methodology

The SVAR Model comprises real GDP and real consumption levels for each country, US real government consumption and investment expenditure and the real exchange rate. In addition to these endogenous variables, the model includes exogenous variables such as seasonal dummies. Additionally, dummies for 1990 and 1991 for the recession in Canada, 1988 for the free trade agreement between Canada and the US, and 1994 and 2008 for the global recession years are added to the model.

Before creating the SVAR model, I check if all variables are stationary. Table 3.2 shows the unit root test results for each variable. Both Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit root tests are performed. The unit root test results show that none of the variables are stationary when measured in levels. Therefore, I take the first difference of all variables; both test results show that all differenced variables are stationary at 1%significance level. For this reason, the first differenced variables are placed in the SVAR model.

The model is defined as:

$$AX_t = A^*(L)X_{t-1} + B^*Z_t + \epsilon_t \tag{3.1}$$

$$Au_t = \epsilon_t \tag{3.2}$$

$$Z_t = [seasonaldummies, D1990, D1991, D1988, D1994, D2008] \tag{3.3}$$

where $X_t = [\Delta g, \Delta y, \Delta c, \Delta e, \Delta y^*, \Delta c^*]'$ is the vector of endogenous variables, $L$ is the lag operator, $\epsilon_t$ is the vector of structural shocks and $u_t$ is the vector of reduced form residuals. $Z_t$ is the set of exogenous variables for time dummies; D1990 and D1991 are 1990 and 1991 Recession in Canada, D1998 is for 1998 Free trade agreement between Canada and the US, D1994 and D2008 are for 1994 and 2008 Global economic crises, respectively.

---

Structural VAR Model whereas Beetsma et al. (2006) employ a Panel VAR Model.

The identification restriction matrix $A$ is defined as:

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & a_{34} & 0 & 0 \\ a_{41} & a_{42} & 0 & 1 & a_{45} & 0 \\ 0 & a_{52} & 0 & a_{54} & 1 & 0 \\ 0 & a_{62} & 0 & a_{64} & a_{65} & 1 \end{bmatrix}$$

For identification, I adopt the identification restrictions of Blanchard and Perotti (2002) on the dynamic effects of US government spending shocks on domestic variables. Blanchard and Perotti (2002) use institutional information about the tax and transfer systems, and the timing of tax collections in order to measure the "reaction time" that policymakers need to adjust fiscal policy as a response to a GDP shock. They find that policymakers need more than a quarter to adjust the fiscal policy, if any, to stabilize output fluctuations. It is also stated that this assumption holds for quarterly data, but not necessarily for annual data since fiscal policy can respond to an output shock within a year. Therefore, US government spending is set as the most exogenous variable in the model and not affected by any of the variables contemporaneously. US government spending shocks affect all US variables including the real exchange rate. Since the real exchange rate is a bilateral variable, it is affected by both US and Canadian output shocks.

Moreover, in regards to the transmission of US government spending shock to Canada, I adopt the identification restrictions of Canzoneri et al. (2003). They state that US fiscal policy does not have a direct impact on foreign country's output, but has an indirect impact through the real exchange rate and its direct impact on US GDP. Therefore, Canadian output and consumption levels are affected by US output shocks but not US government spending shocks contemporaneously. Since the US economy is larger than the Canadian economy, the identification restriction that US economic variables are not affected by but affect Canadian economic variables is a reasonable assumption.

Having identified an appropriate structure for the model, I test for the validity of identification restrictions since model is overidentified. According to LR test result, the identification restrictions are valid. Then, I estimate the SVAR Model and compute the impulse response functions to analyze the dynamic effects of US fiscal shocks on the US and Canada. The results are stated in the following subsection.

### 3.3.3 Empirical Results

Impulse response functions of the model are estimated. Figure 3.1 shows the responses of US government spending, US output, US consumption, Canadian output, Canadian consumption and the real exchange rate, to a one unit shock to US government spending, respectively. The horizontal axis denotes time measured in quarters and the vertical axes are stated in US dollars for US variables, in Canadian dollars for Canadian variables and in percentage points for the real exchange rate.

For period 1957:Q1-2013:Q1, as a result of a one unit shock to US government spending, US output increases by USD1.73 in the first quarter. The effect on US output reaches a peak at the second quarter and starts to diminish gradually after that. The increase in US output becomes USD1.43 at the third quarter and dies off at the end of the fifth quarter after the shock. This finding is similar to the result of Canzoneri et al. (2003) who analyze the dynamic effects of US fiscal policy after 1975. They find that US GDP increases by USD0.90 within a quarter and USD1.30 in twelve quarters as a response to a one dollar increase in US government spending. This result is also consistent with Blanchard and Perotti (2002) since they find a USD0.84 increase in US output within a quarter, increasing to a peak of USD1.30 within fifteen quarters as a result of a one dollar increase in US government spending for period 1960- 1997.

In contrast to the Real Business Cycle (RBC) models, US household consumption increases due to a positive government spending shock and follows a similar pattern to the response of US output. As a response to a one dollar government spending shock, US household consumption rises by USD0.37 within a quarter and reaches a peak at the second quarter after the shock. This equals to 25% of the increase in US output. Similarly, Blanchard and Perotti (2002) predict a USD0.50 increase in private consumption within a quarter. Moreover, as a response of a positive US government spending innovation, Canzoneri et al. (2003) predict an increase of USD0.35 in private consumption at the end of the fifth quarter and this increase reaches a peak of USD1.50 after three years.

The impulse response function of the real exchange rate shows the change in the real exchange rate in percentage points as a result of a domestic fiscal expansion. Due to a one dollar government spending shock, the real exchange rate appreciates by 0.9% at the end of the first quarter after the shock. The appreciation in the real exchange rate is effective over a year after the shock and dies off at the end of the fourth quarter. Canzoneri et al. (2003) also presents empirical evidence in favor of appreciation of the US dollar against other currencies as a result of a positive fiscal shock. They state that the spillover effect of a positive US government spending shock on Italy, the United Kingdom and France is a depreciation of the lira, pound and franc, respectively.

To analyze the international effects of US government spending shock, I examine the responses of Canadian GDP and consumption to a positive government spending shock. An expansionary US government spending shock has a positive effect on Canadian output. There is a two-quarter delay between the response of US output and Canadian output. As a result of a one dollar shock to US government spending, Canadian output increases by CAD0.19 at the end of the second quarter and reaches a peak of CAD0.50 at the end of the fourth quarter after the shock. This increase in Canadian output is 11% of the response of US output within a quarter. This finding constitutes empirical evidence in favor of a positive transmission of domestic fiscal shocks to trading partners. This result is parallel to Canzoneri et al. (2003). They present empirical evidence in favor of a positive international transmission of US government expenditure shocks as they find that GDP of the UK, Italy and France increase by 70%, 38% and 75%, respectively, of the increase in US

GDP due to a one dollar US government spending shock. Additionally, Beetsma et al. (2006) and Corsetti (2011) find empirical results in favor of a positive transmission of a domestic fiscal expansion.

Despite of having a persistent effect on Canadian output, a positive US government spending shock does not change Canadian household consumption consistently. The response of Canadian consumption accumulates for three quarters and becomes significant only temporarily at the fourth quarter after the shock. At the fourth quarter, it has a peak effect of CAD0.08 which is 44% of the response of Canadian GDP. These findings show that a positive innovation to US government spending has positive effects on not only the US economy but also on her trading partner, Canada.

### 3.3.4 Robustness Check

For the robustness check, first, I reestimate the model from 1972 to 2013 to question the subsample stability of the results. Second, I adopt an alternative identification scheme to see if the positive response of Canadian output to a US fiscal expansion is affected by the identification scheme.

First, I reestimate the SVAR Model for subsample 1972:Q1-2013:Q1 to understand the impacts in the post Bretton Woods Era. Figure 3.2 shows the impulse response functions of the SVAR estimation for this period. The results are quite consistent and in the same direction as the analysis for period 1957:Q1-2013:Q1. A positive shock to US government expenditure increases US output and consumption and the real exchange rate appreciates. This shock is positively transmitted to the Canadian economy; both GDP and household consumption in Canada increase due to a positive government spending innovation in the US. As a response to a positive US spending shock, Canadian output goes up by CAD0.29, which is 15% of the increase in US output within a quarter for the given period.

Second, I check if the identification scheme affects the results. To do so, I consider the identification scheme of Ramey (2011) which states that a positive US government spending shock increases US output but decreases household consumption. She argues that the standard VAR identification, which is introduced by Blanchard and Perotti (2002), is the reason why most empirical studies find that US consumption increases as a result of a domestic fiscal expansion and adds that this identification scheme of US government spending shocks lacks the "timing" of the shocks. Since defense spending is the source of the volatility of US government spending most of the time, it is crucial to specify the "war dates" while identifying US government spending shocks. To do so, she defines a new variable called "military date" variable which takes the value of one at 1950:Q3 for Korean War, 1965:Q1 for Vietnam War, 1980:Q1 for the Soviet invasion of Afghanistan and 2001:Q3 for 9/11 terrorist attack and takes the value of zero otherwise. She adds that anticipated and unanticipated fiscal shocks have different impacts on private consumption level and since wars are anticipated several quarters before, households cut their consumption down and increase labor hours and this is the reason behind an increase in output and a decrease in consumption during wars.

Ramey (2011) also employs a VAR Model and adopts a Cholesky decomposition in which the military date variable is ordered prior to all variables including non-defense government spending. I estimate the same model by following this narrative approach for 1957:Q1-2013:Q1 and calculate the impulse response functions. Since the sample starts at 1957, the military date variable excludes 1950:Q3 for Korean War and takes the value of one at 1965:Q1, 1980:Q1 and 2001:Q3. The vector of endogenous variables is ordered as; $X_t = [md, \Delta g, \Delta e, \Delta c, \Delta y, \Delta c^*, \Delta y^*]'$ where $md$ stands for military date variable. Same as Ramey (2011), I analyze the effects of all variables due to a positive shock to the military date variable.

Figure 3.3 shows the impulse response functions of the alternative VAR model. The results of the alternative model confirm the findings of the original model. Although there is a decrease in US output at the first quarter as a result of a positive shock to the military date variable, it becomes positive at the second quarter and dies off at the end of the fifth quarter. Even though US household consumption responds with a delay, it is temporarily significant and positive at the third quarter after the shock.

Also similar to the results of the original SVAR model, the real exchange rate appreciates and Canadian output increases. Despite the fact that Canadian consumption goes up within two quarters after the shock, it becomes negative at the sixth quarter.

## 3.4 Conclusion

The notion of international interdependence of economic policies asserts that domestic economy does not only affect, but is also affected by foreign economies. Therefore it is important to understand the dynamic effects of domestic policies on a global level. This study aims to address the dynamic effects of US government spending shocks on the US and Canadian economies.

I adopt the SVAR approach to examine the impulse response of US and Canadian macroeconomic variables to US spending shocks. The SVAR analysis for period 1957:Q1-2013:Q1 shows that a positive innovation to US government spending raises US GDP by USD1.73 within a quarter after the shock. US household consumption also increases due to a positive spending shock as the real exchange rate appreciates. Aside from these domestic impacts, an expansionary fiscal policy also has positive effects on the Canadian economy. Canadian output increases significantly as a result of a US fiscal expansion. The increase in Canadian output reaches 11% of the increase in US output within a quarter after the shock. Given the size of the Canadian economy relative to the US, this impact is quite large. This finding constitutes empirical evidence in favor of a positive transmission of domestic fiscal shocks to trading partners.

Although theoretical literature on spillover effects of fiscal policy is plentiful, there are a small number of studies in the empirical literature. This study helps to fill in this gap, contributing to the empirical literature by examining the domestic and international effects of US government spending shocks on her biggest trading partner, Canada for a long period of time by employing Blanchard and Perotti's (2002) identification restriction on a quarterly data and by stating evidence in favor of a positive international transmission of an expansionary fiscal policy.

Figure 3.1: Impulse Response Functions to a One Unit US Government Spending Shock

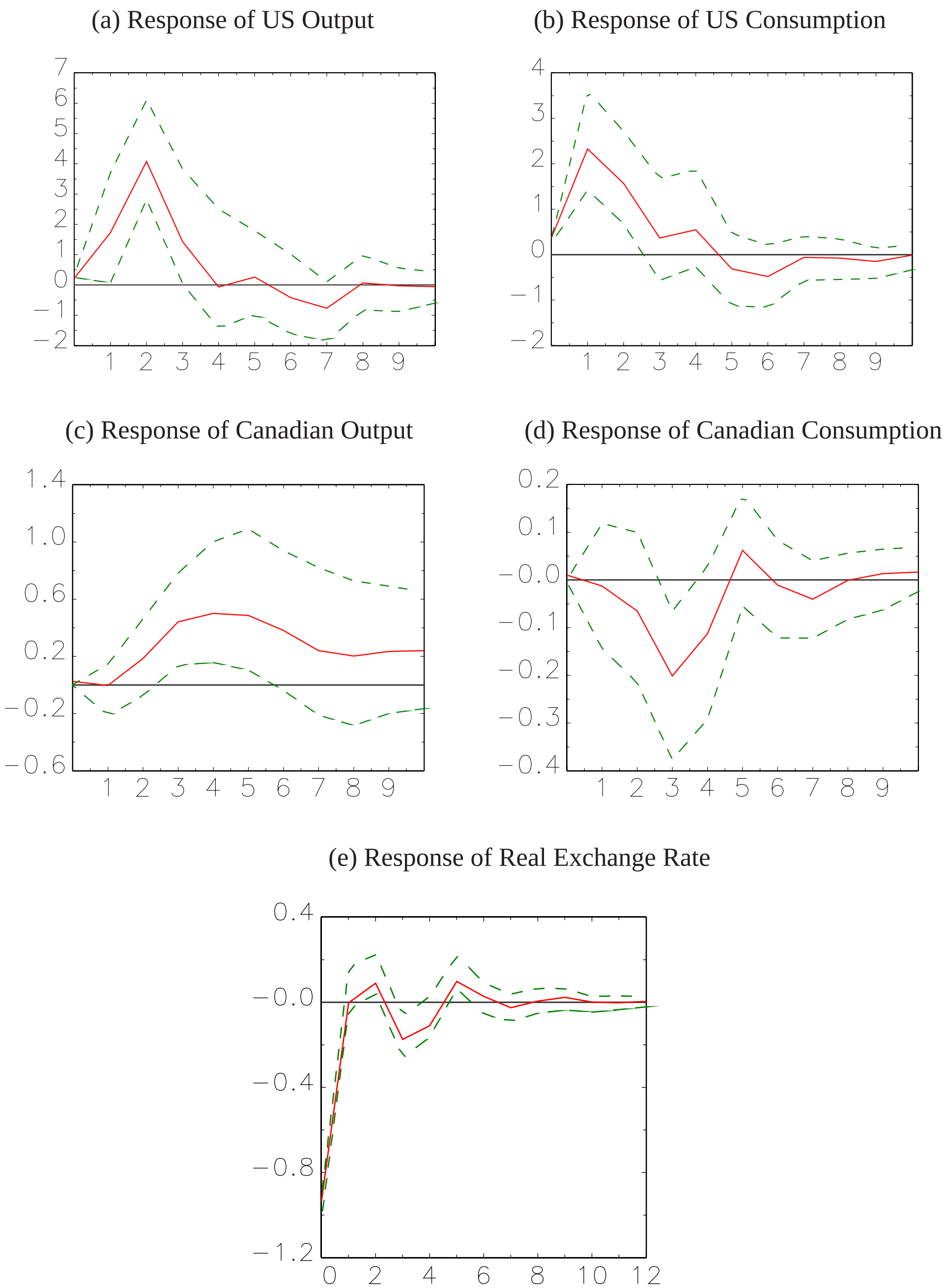
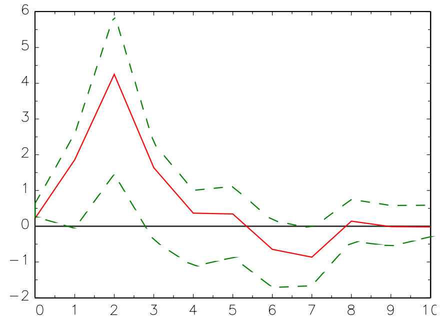


Table 3.1: Definition of Variables

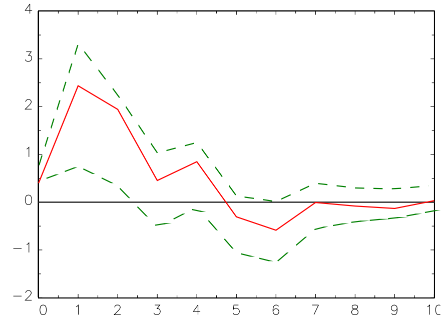
| Variable/Series Name | Definition | Data Source/Calculation |
|---|---|---|
| E | Nominal Exchange Rate (CAD/USD) | IMF-IFS |
| GOVTCONSEXP | Nominal Government Consumption and Investment Expenditure-US | BEA-Bureau of Economic Analysis |
| GDPDUS | GDP Deflator-US | IMF-IFS |
| GDPDC | GDP Deflator-Canada | IMF-IFS |
| CPIUS | Consumer Price Index-US | IMF-IFS |
| CPIC | Consumer Price Index-Canada | IMF-IFS |
| CONSUS | Nominal Household Consumption-US | IMF-IFS |
| CONSC | Nominal Household Consumption-Canada | IMF-IFS |
| GDPUS | Nominal Gross Domestic Product-US | IMF-IFS |
| GDPC | Nominal Gross Domestic Product-Canada | IMF-IFS |
| e | Real Exchange Rate | e=ExCPIUS/CPIC |
| g | Real Government Consumption and Investment-US | g=GOVTCONSEXPx100/GDPDUS |
| y | Real GDP-US | y=GDPUSx100/GDPDUS |
| y* | Real GDP-Canada | y*=GDPCx100 /GDPDC |
| c | Real Household Consumption-US | c=CONSUSx100/GDPDUS |
| c* | Real Household Consumption-Canada | c*=CONSCx100/GDPDC |
| $\Delta$e | First Difference of Real Exchange Rate | $\mathbf{\Delta e = e_t - e_{t-1}}$ |
| $\Delta$g | First Difference of Real Government Consumption and Investment-US | $\mathbf{\Delta g = g_t - g_{t-1}}$ |
| $\Delta$y | First Difference of Real GDP-US | $\mathbf{\Delta y = y_t - y_{t-1}}$ |
| $\Delta$y* | First Difference of Real GDP-Canada | $\mathbf{\Delta y* = y *_t - y*_{t-1}}$ |
| $\Delta$c | First Difference of Real Household Consumption-US | $\mathbf{\Delta c = c_t - c_{t-1}}$ |
| $\Delta$c* | First Difference of Real Household Consumption-Canada | $\mathbf{\Delta c* = c *_t - c*_{t-1}}$ |

Figure 3.2: Impulse Response Functions to a One Unit US Government Spending Shock for period 1972-2013

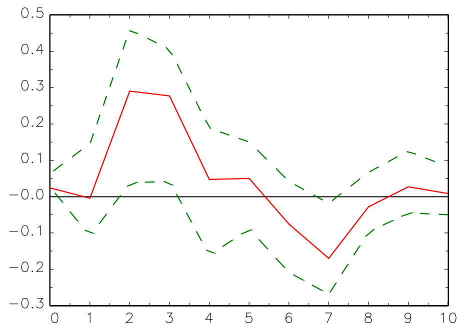
(a) Response of US Output



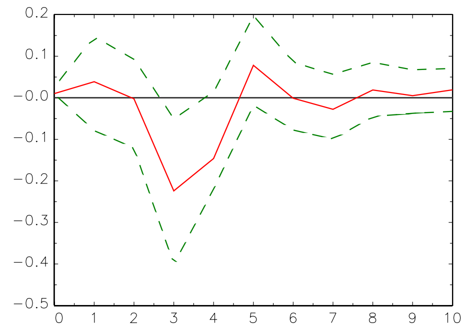

(b) Response of US Consumption




(c) Response of Canadian Output




(d) Response of Canadian Consumption




(e) Response of Real Exchange Rate

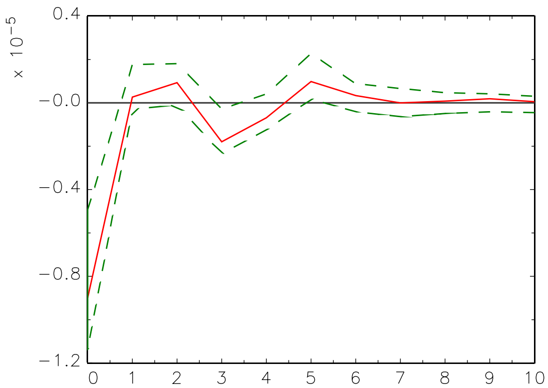
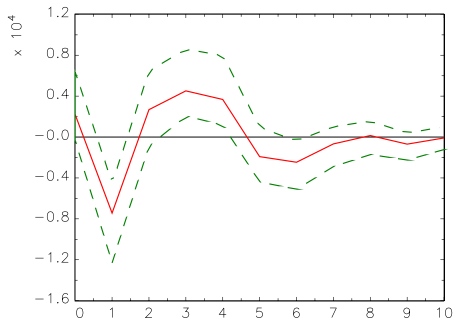
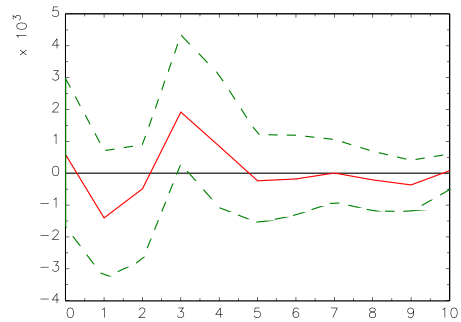


Figure 3.3: Impulse Response Functions to US Government Spending Shocks- Alternative VAR Model

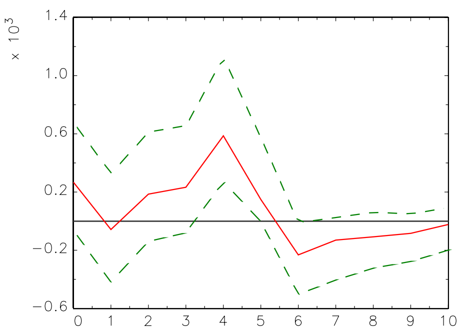
(a) Response of US Output



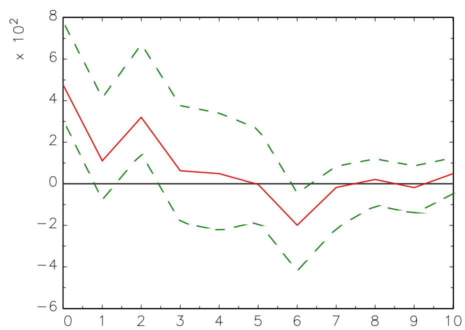

(b) Response of US Consumption




(c) Response of Canadian Output




(d) Response of Canadian Consumption




(e) Response of Real Exchange Rate

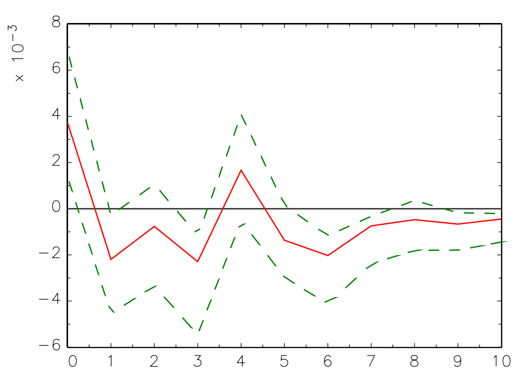


Table 3.2: Unit Root Test Results for Variables

| Variable | ADF | | PP | |
|---|---|---|---|---|
| | w/intercept | w/trend&intercept | w/intercept | w/trend&intercept |
| y | 1.43 | -1.75 | 1.88 | -1.72 |
| y* | 1.28 | -1.91 | 1.45 | -1.95 |
| c | 2.94 | -1.32 | 3.18 | -1.39 |
| c* | 3.44 | -1.05 | 3.36 | -1.07 |
| e | -1.74 | -1.34 | -1.91 | -1.65 |
| g | 3.78 | 0.65 | 2.92 | 0.09 |
| $\Delta$ y | -6.44*** | -9.49*** | -9.34*** | -9.65*** |
| $\Delta$ y* | -7.92*** | -8.09*** | -7.91*** | -8.10*** |
| $\Delta$ c | -6.11*** | -9.55*** | -8.69*** | -9.57*** |
| $\Delta$ c* | -13.02*** | -13.76*** | -13.04*** | -13.74*** |
| $\Delta$ e | -12.51*** | -12.55*** | -12.46*** | -12.50*** |
| $\Delta$ g | -12.15*** | -12.78*** | -12.87*** | -13.10*** |

Augmented Dickey-Fuller (ADF) and Philips Perron (PP) unit root tests results are shown. The null hypothesis states that the variable has unit root. *** denotes that the null hypothesis is rejected at 1% significance level.

# Appendix: Fiscal Policy Coordination

Since a fiscal policy coordination between the US and Canada can create an omitted variable bias for this study, hereby, I question if Canadian fiscal policy instrument should appear in the model as well. I obtain the quarterly data for Canadian government consumption and expenditure for period 1957:Q1-2013:Q1 from IMF-IFS online database. Canada's nominal government consumption and expenditure is deflated by Canada's GDP deflator to get real government consumption and expenditure of Canada. It is called as Canadian government spending and defined in Canadian dollars (CAD). To test if the response of Canadian output is biased due to omission of Canadian government spending, first, I compute the correlation coefficient between US government spending and Canadian government spending to measure the strength of the correlation, if any. Given the variance-covariance values for variables, the correlation coefficient is calculated as -0.03 which indicates a tenuous negative correlation between US and Canadian fiscal policy instruments.

Second, to decide if Canadian government spending variable might appear in the model, I perform Granger causality test. Table 3.3 represents the results of the test. The null hypothesis that Canadian government spending does not Granger cause US government spending is not rejected at 10% significance level since $0.23>0.10$. Also, for the second test, since $0.34>0.10$, it is possible to conclude that US government spending does not Granger cause Canadian government spending. The test results does not support the claim of fiscal policy coordination between two countries.

Since there are limitations to Granger causality test, I include Canadian government spending variable $\Delta g^*$ in the model and then compute the impulse response functions to check if the responses of Canadian and US variables change.

The model is defined as:

$$AX_t = A^*(L)X_{t-1} + B^*Z_t + \epsilon_t \tag{3.4}$$

$$Au_t = \epsilon_t \tag{3.5}$$

$$Z_t = [seasonaldummies, D1990, D1991, D1988, D1994, D2008] \tag{3.6}$$

where $X_t = [\Delta g, \Delta g^*, \Delta y, \Delta c, \Delta e, \Delta y^*, \Delta c^*]'$ is the vector of endogenous variables, $L$ is the lag operator, $_t$ is the vector of structural shocks and $u_t$ is the vector of reduced form residuals. $Z_t$ is the set of exogenous variables for time dummies; D1990 and D1991 are 1990 and 1991 Recession in Canada, D1998 is for 1998 Free trade agreement between Canada and the US, D1994 and D2008 are for 1994 and 2008 Global economic crises, respectively.

The identification restriction matrix $A$ is defined as:

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & 0 & 1 & 0 & 0 & 0 & 0 \\ a_{41} & 0 & a_{43} & 1 & a_{45} & 0 & 0 \\ a_{51} & a_{52} & a_{53} & 0 & 1 & a_{56} & 0 \\ 0 & a_{62} & a_{63} & 0 & a_{65} & 1 & 0 \\ 0 & a_{72} & a_{73} & 0 & a_{75} & a_{76} & 1 \end{bmatrix}$$

Figure 3.4 shows the impulse responses of Canadian government spending to a positive US government spending shock. A positive shock to US government spending does not have a significant effect on Canadian government spending.

Furthermore, Figure 3.5 shows the impulse responses of the rest of the endogenous variables to a positive US government spending shock when Canadian government spending is included in the model. The horizontal axis denotes time measured in quarters and vertical axes are stated in

US dollars for US output and consumption, percentage points for real exchange, Canadian dollars for Canadian variables. A one dollar increase in US government spending increases US output by USD1.34 within a quarter. The shock is transmitted positively to her neighbor. As a response to a one dollar US government spending shock, Canadian output level increases by CAD0.17 within a quarter. These responses are quite similar to the impulse response functions of the original model which excludes Canadian government spending. Since the responses of Canadian and US output and consumption levels are same and the response of Canadian government spending is insignificant, it is possible to conclude that there is no fiscal policy coordination between Canada and the US.

The correlation coefficient between US and Canadian government spending, the Granger causality test results and the impulse response functions of the alternative model do not support the claim that there is an omitted variable bias in the original estimation.

Table 3.3: Granger Causality Test Results

| Null Hypothesis | number of observations | F-stat | p-value |
|---|---|---|---|
| Canadian government spending does not Granger cause US government spending | 210 | 1.21 | 0.23 |
| US government spending does not Granger cause Canadian government spending | 210 | 1.10 | 0.34 |

Figure 3.4: Response of Canadian Government Spending to US Government Spending Shock

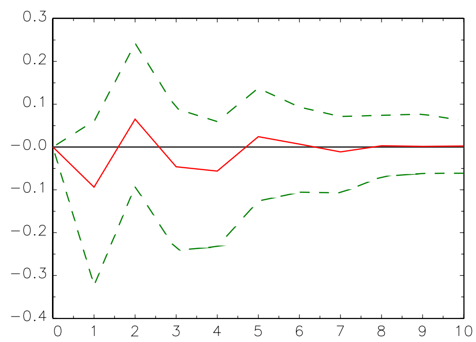
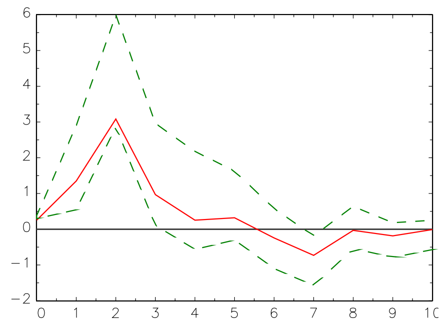
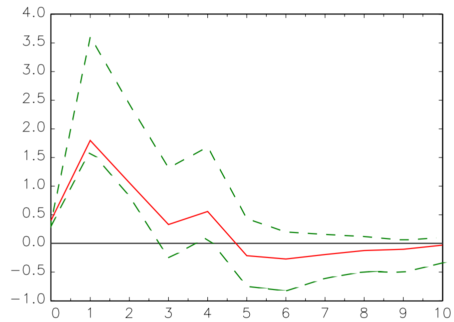


Figure 3.5: Impulse Response Functions to a One Unit US Government Spending Shock

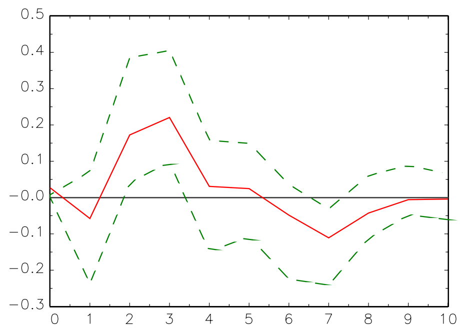
(a) Response of US Output



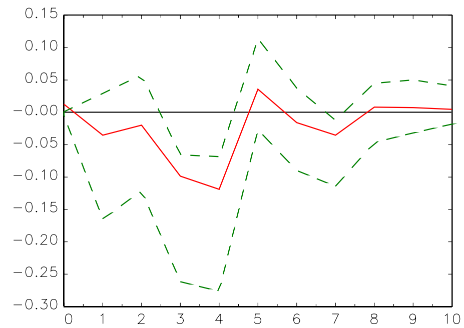

(b) Response of US Consumption



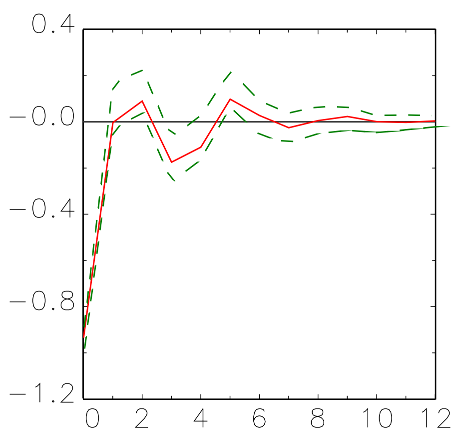

(c) Response of Canadian Output




(d) Response of Canadian Consumption




(e) Response of Real Exchange Rate



# Bibliography


[1] Aarle, B.V., H. Garretsen and N. Gobbin, (2003). “Monetary and Fiscal Policy Transmission in the Euro-area:Evidence from a Structural VAR Analysis.” *Journal of Economics and Business*, 55: 609-638.

[2] Afonso, A. and R. M. Sousa, (2011). “What are the Effects of Fiscal Policy on Asset Markets?” *Economic Modelling*, 28:1871-1890.

[3] Agnello, L. and R. M. Sousa, (2010). “Fiscal Policy and Asset Prices.” NIPE Working Paper no:25/2010.

[4] Akiboty, B. and T. Stratmann, (2008). “Fiscal Policy and Financial Markets.” *The Economic Journal*, 118:1971-1985.

[5] Al Refai, H. M. (2011). “The Impact of the Iraq War on the Country Beta of MENA Markets.” *International Journal of Economics and Finance*, 3.2:12.

[6] Andersen, T. G., T. Bollerslev, F. X. Diebold, and J. G. Wu (2005). “A Framework for Exploring the Macroeconomic Determinants of Systematic Risk.” National Bureau of Economic Research No. w11134.

[7] Andrade, J., and V. K. Teles (2006). “An Empirical Model of the Brazilian Country Risk–An Extension of the Beta Country Risk Model.” *Applied Economics*, 38.11: 1271-1278.

[8] Arfaoui, M., and E. Abaoub (2010). “The Determinants of Systematic Risk: International Evidence From the Macro-Finance Interface.” *Journal of Advanced Studies in Finance*, 2: 119-141.

[9] Arin, K. P., A. Mamun and N. Purushothman, (2009). “The Effects of Tax Policy on Financial Markets: G3 Evidence.” *Review of Financial Economics*, 18:33-46.

[10] Arin, P.K. and F. Koray, (2009). “Beggar thy Neighbour? The Transmission of Fiscal Shocks from the US to Canada.” *Open Economies Review*, 20: 425-434.

[11] Basu, S., D. Deepthi, and J. Reddy (2011). “Country Risk Analysis in Emerging Markets: The Indian Example.” IIM Bangalore Research Paper 326.

[12] Beetsma, R., M. Giuliodori and F. Klaasen. “Trade Spill-overs of Fiscal Policy in the European Union: A Panel Analysis.” *Economic Policy*, 48:640-687.

[13] Betts, C. and M.B. Devereux, (1999). “The International Effects of Monetary and Fiscal Policy in a Two-Country Model.” Discussion paper no:99-10.

[14] Bi, H., and N. Traum (2012). “Estimating Sovereign Default Risk.” *American Economic Review*, 102.3: 161-66.

[15] Bi, H., W. Shen, and S. Yang (2014). “Fiscal Limits, External Debt, and Fiscal Policy in Developing Countries.” Available at papers.ssrn.com.

[16] Blanchard, O. J., (1981). “Output, The Stock Market, and Interest Rates.” *The American Economic Review*, 71:132-143.

[17] Blanchard, O. and R. Perotti, (2002). “An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output.” *The Quarterly Journal of Economics*, 117(4):1329-1368.

[18] Blundell-Wignall, A. and P. Masson, (1985). “Fiscal Policy and the Exchange Rate in the Big Seven: Transmission of US Government Spending Shocks.” *European Economic Review*, 28:11-42.

[19] Canzoneri, M.B., R.E. Cumby and B. Diba, (2003). “New Views on the Transatlantic Transmission of Fiscal Policy and Macroeconomic Policy Coordination.” in M. Buti,

[20] Chatziantoniou, I., D. Duffy and G. Filis, (2013). “Stock Market Response to Monetary and Fiscal Policy Shocks: Multi-Country Evidence.” *Economic Modelling*, 30:754-769.

[21] Cooper, J. C. (1999). “Artificial Neural Networks Versus Multivariate Statistics: An Application From Economics.” *Journal of Applied Statistics*, 26.8, 909-921.

[22] Corsetti, G., P. Pesenti, R. Clarida and J. Frankel, (2007). “The Simple Geometry of Transmission and Stabilization in Closed and Open Economies [with comments].” *NBER International Seminar on Macroeconomics*, 65-129.

[23] Corsetti, G. and G. J. Muller, (2011). “Multilateral Economic Cooperation and the International Transmission of Fiscal Policy.” *NBER Working Paper*, 17708.

[24] Darrat, A. F., (1990). “Stock Returns, Money, and Fiscal Deficits.” *The Journal of Financial and Quantitative Analysis*, 25:387-398.
editor, *Monetary and Fiscal Policies in EMU: Interactions and Coordination*. Cambridge University Press, 283-311.

[25] Devereux, M., (1988). “Non-Traded Goods and the International Transmission of Fiscal Policy.” *The Canadian Journal of Economics*, 21(2):265-278.

[26] Di Gregorio, D. (2005) “Re-thinking Country Risk: Insights from Entrepreneurship Theory.” *International Business Review*, 14.2: 209-226.

[27] Eaton, J., M. Gersovitz, and J. E. Stiglitz (1986). “The Pure Theory of Country Risk.” *European Economic Review*, 30.3: 481-513.

[28] Engle, R. (2002). “Dynamic Conditional Correlation: A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedasticity Models.” *Journal of Business  Economic Statistics*, 20.3, 339-350.

[29] Erb, C. B., Campbell R. Harvey, and T. E. Viskanta (1996a). “Expected Returns and Volatility in 135 Countries.” Available at SSRN 871253.

[30] Erb, C. B., Campbell R. H., and T. E. Viskanta (1996b). “Political Risk, Economic Risk, and Financial Risk.” *Financial Analysts Journal*, 5:29-46.

[31] Fleming, J.M., (1962). “Domestic Financial Policies under Fixed and under Floating Exchange Rates (Politiques finacirieures intrieures avec un systme de taux de change fixe et avec un systme de taux de change fluctuant) (Poltica financiera interna bajo sistemas de tipos de cambio fijos o de tipos de cambio fluctuantes).” *International Monetary Fund*, 9(3):369-380.

[32] Frankel, J.A. and A. Razin, (1985). “Government spending, Debt, and International Economic Interdependence.” *The Economic Journal*, 95(379):619-636.

[33] Frankel, J.A. and A. Razin, (1986). “The International Transmission and Effects of Fiscal Policies.” *The American Economic Review*, 76(2):330-335.

[34] Gali, J., J. Valles and J.D. Lopez-Salido, (2007). “Understanding the Effects of Government Spending on Consumption.” *Journal of the European Economic Association*, 5(1):227-270.

[35] Gangemi, M. A., R. D. Brooks, and R. W. Faff (2000). “Modeling Australias Country Risk: A Country Beta Approach.” *Journal of Economics and Business*, 52.3: 259-276.

[36] Glova, J., and D. Pastor (2013). “Country Risk Modeling Using Time-Varying Fundamental Beta Approach: A Visegrad Group Countries and Romania Perspective.” *Journal of Applied Economic Sciences Quarterly* 8.4, 450-457.

[37] Goldberg, C. S., and J. M. Veitch (2010). “Country Risk and Financial IntegrationA Case Study of South Africa.” *Research in International Business and Finance*, 24.2: 138-145.

[38] Hassan, G. M., and H. M. Al Refai (2012). “Can Macroeconomic Factors Explain Equity Returns in the Long Run? The Case of Jordan.” *Applied Financial Economics*, 22.13: 1029-1041.

[39] Jansen, D. W., Q. Li, Z. Wang and J. Yang, (2007). “Fiscal Policy and Asset Markets: A Semiparametric Analysis.” *Journal of Econometrics, Forthcoming*

[40] Lanoie, P., and S. Lemarbre (1996). “Three Approaches to Predict the Timing and Quantity of LDC Debt Rescheduling.” *Applied Economics*, 28.2, 241-246.

[41] Marshall, A., T. Maulana, and L. Tang (2009). “The Estimation and Determinants of Emerging Market Country Risk and the Dynamic Conditional Correlation GARCH Model.” *International Review of Financial Analysis*, 18.5:250-259.

[42] Masson, P. and M. Knight, (1986). “International Transmission of Fiscal Policies in Major Industrial Countries.” *International Monetary Fund*, 3(3):387-438.

[43] Matsuoka, H. (2015). “Fiscal Limits and Sovereign Default Risk in Japan.” *Journal of the Japanese and International Economies*.

[44] Muller, G.J., (2008). “Understanding the Dynamic Effects of Government Spending on Foreign Trade.” *Journal of International Money and Finance*, 27:345-371.

[45] Mundell, R.A., (1968).*International Economics*. Macmillan, New York.

[46] Muwando, S., and V. Gumbo (2013). “Country Risk Model for Zimbabwe.” Available at pspchv.com.

[47] Nath, H. K. (2008). “Country Risk Analysis: A Survey of the Quantitative Methods.” Available at SSRN 1513494.

[48] Oetzel, J. M., R. A. Bettis, and M. Zenner (2001). “Country Risk Measures: How Risky Are They?.” *Journal of World Business*, 36.2: 128-145.

[49] Perotti, R., (2007). “In search of Transmission Mechanism of Fiscal Policy.” *NBER International Seminar on Macroeconomics*.

[50] Ramey, V. A., (2011). “Identifying Government Spending Shocks: It’s all in the Timing.” *The Quarterly Journal of Economics*, 126(1):1-50.

[51] Rodrguez, L. C., I. Montiel, and T. Ozuna (2014). “A Conceptualization of How Firms Engage in Corporate Responsibility Based on Country Risk.”*Business & Society*, 53.5: 625-651.

[52] Shah, A., (1984). “Crowding Out, Capital Accumulation, the Stock Market , and Money-Financed Fiscal Policy.” *Journal of Money, Credit and Banking*, 16: 461-473.

[53] Sharpe, W. F. (1964). “Capital asset prices: A theory of market equilibrium under conditions of risk.” *The Journal of Finance*, 19.3, 425-442.

[54] Sokolova, A. (2014). “Fiscal Limits and Monetary Policy: Default vs. Inflation.” *Economic Modelling*.

[55] Svensson, L.E.O., (1987). “International Fiscal Policy Transmission.” *The Scandinavian Journal of Economics*, 89(3):305-334.

[56] Tavares, J. and R. Valkanov, (2003). “The Neglected Effect of Fiscal Policy on Stock and Bond Returns.” FEUNL Working Paper No:413.

[57] Ulku, N., and S. Baker (2014). “Country World Betas: The link Between the Stock Market Beta and Macroeconomic Beta.” *Finance Research Letters*, 11.1:36-46.

[58] Verma, R., and G. Soydemir (2006). “Modeling Country Risk in Latin America: A Country Beta Approach.” *Global Finance Journal*, 17.2: 192-213.

[59] Verma, R., and P. Verma (2014). “Country Risk and Macroeconomic Factors: Evidence from Asian Markets.” *Journal of Applied Business and Economics*, 16.5: 51.

[60] Yang, Y., X. Sun, X. Zhu, J. Li, and D. Wu (2012) “Dynamic Behavior of Country Risk in the BRICS Countries: From the Perspective of Time-varying Correlation.” *Business Intelligence and Financial Engineering (BIFE)*,Fifth International Conference on. pp. 313-317. IEEE.

[61] Yim, J., and H. Mitchell (2005). “Comparison of Country Risk Models: Hybrid Neural Networks, Logit Models, Discriminant Analysis and Cluster Techniques.” *Expert Systems with Applications*, 28.1: 137-148.