Analysing and Forecasting the Canadian Economy Using AKM and VAR Modelling

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Abstract

What should the Bank of Canada's next policy rate be? Employing two approaches to capture model uncertainty, we use an Augmented Keynesian Model (AKM) for our endogenous variables and Vector Autoregressive Model (VAR) for our exogenous variables to predict Canada's real GDP with an endogenous policy rate. Our quarterly time series data is from 2000Q1-2023Q2 to capture the relevance of globalisation on our model and the increasing shift towards other trading partners when compared to the United States. We use our forecasts from periods 2023Q3 until 2025Q2 to predict the stable decrease in policy rate on a 25-point basis every quarter until 2024Q2 where we receive a total decrease by 0.5% going into 2025Q2.

1.Introduction

The Bank of Canada's goal it to promote the economic and financial welfare of Canada. The bank achieves this goal through four key areas which are; monetary policy, financial system, currency, and funds management (Bank of Canada, 2023). This paper dives into implementing changes in the monetary policy rate. As the bank employs various models and frameworks, we have developed our own Augmented Keynesian Model (AKM) paired with Vector Auto Regressions (VAR's). This paper as previously suggested aims to predict the monetary policy rate set by the Bank of Canada for the next two years (2023Q3-2025Q2). By evaluating the Bank of Canadas goal of a 2% inflation rate and applying both aggerate demand and supply aspects to our model we see a closer relation between our model and the monetary policy response.

Afterwards, this study explores our augmented Keynesian model by analyzing the interaction between inflation expectations, aggregate demand, and the labour market. This model offers insights into the potential monetary policy rate the Bank of Canada could predict. Understanding the augmented Keynesian model's nuances provides a better understanding of the economic variables influencing the Bank of Canada's decision-making process. Furthermore, this paper investigates the application of Vector Autoregressions (VAR) as an analytical tool to help forecast trends across our exogenous variables. The VAR models contributes to enhancing the forecast precision of anticipated monetary policy rate adjustments by factoring our endogenous variables. We also look into the reasoning for each variable and potential risks that they may pose to our recommendation. By merging insights from the Bank of Canada's goals, the augmented Keynesian model and Vector Autoregressions formulate a comprehensive forecast for the future monetary policy rate. The direct goal of these forecasts is to yield an appropriate response to persisting inflation that the Bank of Canada continues to deal with in the past quarters.

We used a collection of economic theory, econometric analysis, and AKM modelling techniques, to forecast the Bank of Canada's monetary policy rate which offers valuable insights into the details influencing the countries monetary policy choices.

Model and Assumptions

2.1 AKM Structure

2.1.1 Consumption

$$g_t^C = C_0 + C_1\left((1-\tau_t)\, g_t^Y\left(1-\frac{g_t^G}{Y}\right)\right) + C_2 g_t^{HP} + C_3 g_t^{Pop} + C_4 g_t^{CCI} + C_5 g_t^{GF}$$

Using our Augmented Keynesian model, we've adjusted the reduced form model studied in class (EC310D). The C_0 captures autonomous consumption in the Canadian economy. As such, we have adjusted our disposable income within our model. τ represents the tax rate imposed from the government where (1-τ)* Y) captures total disposable income ceteris paribus. By adding our $\left(1-\frac{g_t^G}{Y}\right)$, we can capture shocks in our government expenditure and adjust accordingly. The overall coefficient of these two combined shows the marginal propensity to consume. We capture our changes in household wealth (Real Housing Price) by adding $C_2 g_t^{HP}$ which highlights changes in the housing price which is later estimated in our paper (see page _). Our coefficient shows growth in each unit of real housing prices effect on consumption. As overall population is a driver of consumption, we have added $C_3 g_t^{Pop}$ into the model as it captures overall increases in populations effect on consumption. This variable is meant to capture both immigration and birth increases to population. Consumer confidence is a driver of consumption as higher confidence allows market participants to consume more. This variable is captured within our equation under $C_4 g_t^{CCI}$. The coefficient is each increase in the index leads to % growth in consumption. The $C_5 g_t^{GF}$ is the Global Food Price Index (GFI) where each unit of increase in GF index has an overall effect on consumption.

2.1.2 Residential Investment

Our investment function is broken down into two parts: residential and non-residential investment. We have used an extension of our model of residential investment from EC310D, the "Reduced-Form Model". We have extended from our basic model to include new aspects such as consumer confidence, immigration, and non-permeant residents. Real interest rate captures the effect of real rates on investment as it increases the cost of borrowing when driven up it is negative. Housing price is externally calculated but the effect on residential investment captures preferences to purchase a house as returns are going up, consumer confidence shows as consumers are feeling more confident about the economy, they are more likely to purchase residential housing. Net immigration displays the increased demand for supply increasing developers' incentive to build more housing with the increase in demand.

$$g_t^{RI} = \psi 0 + \psi 1 g_t^R + \psi 2 g_{t-1}^{HP} + \psi 3 g_t^{CCI} + \psi 4 (g_{t-8}^{IM} + g_{t-5}^{NPR})$$

The residential investment constant, $\psi 0$ shows the autonomous residential investment ceteris paribus. The $\psi 1$ shows the growth rate in marginal propensity of investment. The coefficient $\psi 2$, displays with a unitary increase in real housing price index effect on residential investment. The $\psi 3$ illustrates the effect of increase in the consumer confidence index on residential

investment. Our $\psi 4$ is the addition of both immigration and non-permanent residents and the coefficient represents the increase in consumption for every net immigrant in the economy.

2.1.3 Non-Residential Investment

We have broken our NRI (Non-Residential Investment) into five key variables to help identify changes on Non-Residential Investment. We have introduced the real interest rate ($NRI_1 g_t^R$), real oil price index ($NRI_2 g_t^{Oil}$), Toronto Stock Exchange index ($NRI_3 g_t^{TSX}$), consumer confidence index ($NRI_4 g_{t-1}^{CCI}$) and business confidence index ($NRI_5 g_{t-4}^{BCI}$). Real interest rate captures the effect of increased borrowing costs, real oil prices capture the effect of increased variable costs in transportation, TSX index captures the movement of investment of public capital, consumer confidence index shows the how concept price taking on firm's effects capital investment, and business confidence highlights the effect of confidence of business and the effect it has on private capital.

$$g_t^{NRI} = NRI_0 + NRI_1 g_t^R + NRI_2 g_t^{Oil} + NRI_3 g_t^{TSX} + NRI_4 g_{t-1}^{CCI} + NRI_5 g_{t-4}^{BCI}$$

The non-residential equation is also broken up and calculated using various endogenous variables. NRI_0 is used to estimate the autonomous amount of non-residential investment in the economy. $NRI_1 g_t^R$ The change in interest rate affects non-residential investment, which contains a negative coefficient consistent with macroeconomic theory. $NRI_2 g_t^{Oil}$ is the effect of the Real Oil price on NRI as each increase in the real oil price index leads to increase in the NRI. The $NRI_3 g_t^{TSX}$ shows an increase in the coefficient of the Toronto Stock Exchanges positive effect on NRI. The $NRI_4 g_{t-1}^{CCI}$ shows the positive coefficient of increase of consumer confidence on firms' expansionary investment into capital. Finally, the coefficient of $NRI_5 g_{t-4}^{BCI}$ shows the effect on the increase of the business confidence index's effect on total non-residential investment.

2.1.4 Exports

Using our new Canadian effective exchange rate, we capture trade balance within our exports equation. Using and extension of the Reduced-Form model, we can forecast using our Real Canadian Effective Exchange Rate, GDP of the United States, and real oil prices. Looking to the variables within exports, $g_t^{Y^{us}}$ shows the effect of Canadas largest trading partner, The United States effect on exports within Canada. As The United States GDP increases, we see a higher propensity to export. Real Canadian Effective Exchange Rate g_t^{CEER} shows the real Canadian purchasing power parity across the world which captures a higher price to change CAD, so it leads to a higher number of exports. Finally, oil (g_t^{Oil}) is a big indicator of potential exports as it captures the impulse to export more oil when prices are higher.

$$g_t^X = X_0 + X_1 g_t^{Y^{us}} + X_2 g_t^{CEER} + X_3 g_t^{Oil}$$

The $X0$ coefficient is the autonomous investment in the economy. The coefficient, X_1 represents the growth in exports from an increase in the GDP of the United States. OBJb has a coefficient where it showcases the positive effect in the increase in the Canadian Effective Exchange Rate.

Finally, X_3 showcases the effect of real oil price on exports and the impulse to export oil when the price is higher.

2.1.5 Imports

Using the same extended equation in CEER, the model of imports has been extended from the Reduced-Form Model. Include inside of the import's estimation equation, g_t^Yn is the Canadian GDP, g_t^{CEER} is the Canadian Effective Exchange Rate, $g_t^{YChina}$is the GDP of China, g_t^{YUS} is the GDP of the United States, and g_t^{Oil} is the effect of oil on imports as it is one of the top imports of Canada.

$$g_t^M = M_0 + M_1 g_t^Y + M_2 g_t^{CEER} + M_3 g_t^{YChina} + M_4 g_t^{YUS} + M g_t^{Oil}$$

The coefficient M_0 shows the autonomous imports of Canada ceteris paribus. Our M_1 displays the positive effect of increases in the Canadian GDP to import value. M_2 shows the negative coefficient of the Canadian Effective Exchange Rate (CEER) where an increase in the rate creates a decrease in the propensity to import. M_3 and M_4 shows the effect in change in China and United States GDP, respectively. Each show an increase in foreign gross domestic's products effect on Canadas total imports. Finally, M_5 shows the effect of oil on imports. It shows with each increase in the index of real oils effect on total imports.

2.1.6 Canadian Effective Exchange Rate (CEER)

Canadian Effective Exchange Rate shows the effective exchange rate that the Canadian economy faces globally. The $(R_t - R_t^{US})$ shows the differential in the Canadian to United States interest rate. The g_{t-4}^{Oil} shows the lagged for period effect of real oil price on the exchange rate which assumes the full transition from raw to refined product. Finally, g_t^{CEERI} showcases the weighted effect of Canadian Effective Exchange Rate (excluding the United States) on the actual Canadian Effective Exchange Rate. The index/rate takes the weight of trade between each country and has that rate be affected by that rate. The main methodology was to have both the world target rate separate from the aggerated rest of the world and to be able to shock the model for the United States real interest rate.

$$\epsilon_t = \epsilon_0 + \epsilon_t(R_t - R_t^{US}) + \epsilon_2 g_{t-4}^{Oil} + \epsilon_3 g_t^{CEERI}$$

The constant ϵ_0 displays all the stable factors that influence the CEER, ϵ_1 captures appreciation in the exchange rate when the subtraction of the United States from Canada is positive. The ϵ_2 constant shows the between real oil price increase and the growth rate in the real exchange rate. Finally, ϵ_3 visualizes the relationship in the changes in the Canadian Effective Exchange Rate (excluding the United States) effect on the total interest rate.

2.1.7 Taylor Rule

The Taylor rule is meant to project the interest rate target for the Bank of Canada. This Taylor rule is an extension of the reduced model. I_t represents the interest rate, $(\pi_t - 2\%)$ represents the bank's target rate, $\frac{Y_t}{Y_t^P} - 1$ represents the output gap, and R_t^{US} represents the real interest rate of the United States.

$$I_t = I_0 + I_1(\pi_t - 2\%) + I_2(\frac{Y_t}{Y_t^P} - 1) + I_3 R_t^{US}$$

I_1 shows the increased response to inflation in the economy, I_2 shows the adjustment response to business cycles, and I_3 shows the increased effect of the real interest rate of the United States on the overnight rate.

2.1.8 Phillips Curve

The estimation for inflation is done with the Phillips curve. This equation is derived purely from the Reduced-Form Model as studied in EC310D. The two aspects of the curve are the inflation expectations as captured by π^e, and the output gap as captured by $\frac{Y_t}{Y_t^P}$.

$$\pi_t = \alpha_0 + \alpha_1 \pi_t^e + \alpha_2(\frac{Y_t}{Y_t^P} - 1)$$

The constant, α_0 shares all the other factors that influence inflation, α_1 shows the increase in inflation due to inflation expectations rising, and α_2 shows the growth in inflation due to the output gap.

2.1.9 Real Housing Price

Real housing price was calculated through this developed regression. g_{t-1}^{HP} shows the one period lagged housing prices effect on current housing price. This is added to make the housing prices stickier and more moderate in growth and decrease. g_t^R is the overnight rate's effect on housing price. This captures the effect of nominal rates on housing prices as an increase in the overnight rate will add to a discount in the housing price. Finally, $g_t^{RLumber}$ is the overall effect of real lumber prices on housing. When lumber prices are lower, we expect a lower housing price as lumber is a key input cost of building housing.

$$g_t^{HP} = HP_0 + HP_1 g_{t-1}^{HP} + HP_2 g_t^R + HP_3 g_t^{RLumber}$$

HP_0 captures the autonomous housing price ceteris paribus. HP_1 shows the effect of the lagged housing price on current housing price, HP_2 shows the increase in % policy rates effect on real housing price, and finally HP_3 shows the effect of the real price of lumber on real housing prices as both are indexed.

2.2 Vector Autoregression Model

We used various VAR tests to be able to predict future behaviours of our exogenous variables. The variables were obtained from reputable sources and the accuracy of the data was reviewed by our group to ensure consistency and accuracy amongst our mode.

2.2.1 Consumer Confidence Index

The consumer confidence index was an important variable for us to include in our model as consumer confidence is paramount to many decisions in the economy. Inflation expectations, consumption and investments rely heavily on consumer confidence. We performed a lag length criteria test on the CCI variable and determined a lag length of 5 lags was the most appropriate for this variable. This is further verified by the Akaike criterion being the lowest for a 5-lag equation.

$$g_t^{CCI} = \beta_0 + \beta_1 g_{t-1}^{CCI} + \beta_2 g_{t-2}^{CCI} + \beta_3 g_{t-3}^{CCI} + \beta_4 g_{t-4}^{CCI} + \beta_5 g_{t-5}^{CCI}$$

2.2.2 Business Confidence Index

Similar to Consumer Confidence, the Business confidence index (BCI) is also vital to our model as Business confidence effects many aspects of our model as well. Business confidence influences our non-residential investment positively, which aligns with macroeconomic theory. BCI was regressed upon itself using a VAR operation and a lag length criterion was done to determine the number of lags required. After preforming the test, the Akaike criterion was the lowest for a 4-lag equation.

$$g_t^{BCI} = \beta_0 + \beta_1 g_{t-1}^{BCI} + \beta_2 g_{t-2}^{BCI} + \beta_3 g_{t-3}^{BCI} + \beta_4 g_{t-4}^{BCI}$$

2.2.3 Population

Population is also a variable which we felt we needed to include in our model as its useful for forecasting consumption. Our coefficient for population in the consumption equation is positive which coincides with what we believe to happen, as population grows in a nation that nation increases their consumption. We regressed population on itself as intuitively population seems to grow in a linear pattern. We performed lag length criteria test to determine the appropriate lag length and determined the number of lags to choose based off of the lowest Akaike criterion value. After the test we determined a lag length of 8 was the most appropriate.

$$g_t^{Pop} = \beta_0 + \beta_1 g_{t-1}^{Pop} + \beta_2 g_{t-2}^{Pop} + \beta_3 g_{t-3}^{Pop} + \beta_4 g_{t-4}^{Pop} + \beta_5 g_{t-5}^{Pop} + \beta_6 g_{t-6}^{Pop} + \beta_7 g_{t-7}^{Pop} + \beta_8 g_{t-8}^{Pop}$$

2.2.4 Global Food Price Index

The Global Food Price Index is a crucial variable in our model. It's used in the consumption equation, and its coefficient is positive, which aligns with our expectations. As global food prices increase, consumption in a nation also tends to increase. We regressed the Global Food Price Index on itself, as it seems to follow a pattern that can be captured by a linear model. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 4 was the most suitable for this variable.

$$g_t^{GF} = \beta_0 + \beta_1 g_{t-1}^{GF} + \beta_2 g_{t-2}^{GF} + \beta_3 g_{t-3}^{GF} + \beta_4 g_{t-4}^{GF}$$

2.2.5 Lumber Price Index

The Lumber Price Index is used in the real house price equation, and its coefficient is positive, which aligns with our expectations. As lumber prices increase, the real house price also tends to increase. We regressed the Lumber Price Index on itself, as it seems to follow a pattern that can be captured by a linear model. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 7 was the most suitable for this variable.

$$g_t^{RLumber} = \beta_0 + \beta_1 g_{t-1}^{RLumber} + \beta_2 g_{t-2}^{RLumber} + \beta_3 g_{t-3}^{RLumber} + \beta_4 g_{t-4}^{RLumber} + \beta_5 g_{t-5}^{RLumber} + \beta_6 g_{t-6}^{RLumber} + \beta_7 g_{t-7}^{RLumber}$$

2.2.6 Immigrants

The Immigrant's variable is used in the residential investment equation, and its coefficient is positive, which aligns with our expectations. As the number of immigrants increases, residential investment in a nation also tends to increase. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 8 was the most suitable for this variable.

$$g_t^{IM} = \beta_0 + \beta_1 g_{t-1}^{IM} + \beta_2 g_{t-2}^{IM} + \beta_3 g_{t-3}^{IM} + \beta_4 g_{t-4}^{IM} + \beta_5 g_{t-5}^{IM} + \beta_6 g_{t-6}^{IM} + \beta_7 g_{t-7}^{IM} + \beta_8 g_{t-8}^{IM}$$

2.2.7 Non-Permanent Residents

Similarly, to Immigrants, Non-permanent residents are used in the residential investment equation, and its coefficient is positive, which aligns with our expectations. As the number of non-permanent residents increases, residential investment in a nation also tends to increase. We regressed the 'Non-Permanent Residents' variable on itself, as it seems to follow a pattern that can be captured by a linear model. To determine the appropriate lag length, we performed a lag

length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 5 was the most suitable for this variable.

$$g_t^{NPR} = \beta_0 + \beta_1 g_{t-1}^{NPR} + \beta_2 g_{t-2}^{NPR} + \beta_3 g_{t-3}^{NPR} + \beta_4 g_{t-4}^{NPR} + \beta_5 g_{t-5}^{NPR}$$

2.2.8 Toronto Stock Exchange Index

The Toronto Stock Exchange (TSX) is used in the non-residential investment equation, and its coefficient is positive, which aligns with our expectations. As the TSX increases, non-residential investment in a nation also tends to increase. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 5 was the most suitable for this variable.

$$g_t^{TSX} = \beta_0 + \beta_1 g_{t-1}^{TSX} + \beta_2 g_{t-2}^{TSX} + \beta_3 g_{t-3}^{TSX} + \beta_4 g_{t-4}^{TSX} + \beta_5 g_{t-5}^{TSX}$$

2.2.9 Real Oil Price

The Real Oil Price is a key variable in our model. It's used in the non-residential investment equation, exports, imports, and the Canadian Effective Exchange Rate (CEER). The coefficient is negative for non-residential investment and CEER, which aligns with our expectations. As the Real Oil Price increases, non-residential investment and CEER tend to decrease. However, it has a positive effect on exports and imports, meaning as the Real Oil Price increases, both exports and imports tend to increase. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 3 was the most suitable for this variable.

$$g_t^{Oil} = \beta_0 + \beta_1 g_{t-1}^{Oil} + \beta_2 g_{t-2}^{Oil} + \beta_3 g_{t-3}^{Oil}$$

2.2.10 GDP of United States

The GDP of the United States is a significant variable in our model. It's used in the export's equation, and its coefficient is positive, which aligns with our expectations. As the GDP of the United States increases, exports also tend to increase. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 6 was the most suitable for this variable.

$$g_t^{YUS} = \beta_0 + \beta_1 g_{t-1}^{YUS} + \beta_2 g_{t-2}^{YUS} + \beta_3 g_{t-3}^{YUS} + \beta_4 g_{t-4}^{YUS} + \beta_5 g_{t-5}^{YUS} + \beta_6 g_{t-6}^{YUS}$$

2.2.11 Real Interest Rate of United States

The Real Interest Rate of the United States is used in the Canadian Effective Exchange Rate equation, and its coefficient is negative, which aligns with our expectations. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the

lowest Akaike criterion value. After conducting the test, we determined that a lag length of 6 was the most suitable for this variable.

$$g_t^{RUS} = \beta_0 + \beta_1 g_{t-1}^{RUS} + \beta_2 g_{t-2}^{RUS} + \beta_3 g_{t-3}^{RUS} + \beta_4 g_{t-4}^{RUS} + \beta_5 g_{t-5}^{RUS} + \beta_6 g_{t-6}^{RUS}$$

2.2.12 GDP of China

The GDP of China is used in the import's equation, and its coefficient is negative, which aligns with our expectations. As the GDP of China increases, imports tend to decrease. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 8 was the most suitable for this variable.

$$g_t^{YChina} = \beta_0 + \beta_1 g_{t-1}^{YChina} + \beta_2 g_{t-2}^{YChina} + \beta_3 g_{t-3}^{YChina} + \beta_4 g_{t-4}^{YChina} + \beta_5 g_{t-5}^{YChina} + \beta_6 g_{t-6}^{YChina} + \beta_7 g_{t-7}^{YChina} + \beta_8 g_{t-8}^{YChina}$$

2.2.13 Canadian Effective Exchange Rates (Excluding the United States)

The Canadian Effective Exchange Rate (Excluding the United States) was used in our Canadian Effective Exchange rate to boost the accuracy of the equation. It has a negative coefficient which aligns with our expectations. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 3 was the most suitable for this variable.

$$g_t^{CEERI} = \beta_0 + \beta_1 g_{t-1}^{CEERI} + \beta_2 g_{t-2}^{CEERI} + \beta_3 g_{t-3}^{CEERI}$$

2.2.14 Government Expenditure

Government Expenditures are used in the consumption equation, and its coefficient is positive, which aligns with our expectations. As Government Expenditures increase, consumption also tends to increase. We regressed Government Expenditures itself, as it seems to follow a pattern that can be captured by a linear model. To determine the appropriate lag length, we performed a lag length criteria test and based our decision on the lowest Akaike criterion value. After conducting the test, we determined that a lag length of 4 was the most suitable for this variable.

$$g_t^{Gov} = \beta_0 + \beta_1 g_{t-1}^{Gov} + \beta_2 g_{t-2}^{Gov} + \beta_3 g_{t-3}^{Gov} + \beta_4 g_{t-4}^{Gov}$$

3.1.1 Augmented Keynesian Model Estimations (AKM)

In our AKM model we used the components of GDP to model aggregate demand. The interpretations of β coefficients are all consistent with economic intuition. A β coefficient of 0.5 for C1 on consumption represents an increase of 0.5 in the growth rate of consumption holding all else constant. All assumptions are consistent with economic intuition.

Table 1: Consumption:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
C_0	-973912***	204664.6	-4.758576	0.990274	22.31865
C_1	0.559643***	0.050799	11.01673		
C_2	299917***	71186.14	4.213137		
C_3	0.028526***	0.002198	12.97544		
C_4	1206.618	1947.901	0.619445		
C_5	81.71147	185.5327	0.440416		
* p < 0.10, ** p < 0.05, *** p < 0.01					

Table 2: Residential Investment:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
RI_0	883.185	623.7697	1.415883	0.150379	20.12496
RI_1	102633.2***	35527.8	2.888813		
RI_2	32982.18	81457.14	0.404902		
RI_3	3702.961***	1090.802	3.394715		
RI_4	0.007279	0.016674	0.436561		
* p < 0.10, ** p < 0.05, *** p < 0.01					

For RI: We took the first difference therefore that is why many are not significant.

Table 3: Non-Residential Investment:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
NRI_0	-1261882***	253836.6	-4.971238	0.765517	22.60178
NRI_1	-797362.2***	184712.1	-4.316784		
NRI_2	127793***	13428.83	9.516317		
NRI_3	4.772534***	0.67902	7.028559		
NRI_4	9794.702***	1939.028	5.051347		
NRI_5	3710.214*	1413.223	2.625356		
* p < 0.10, ** p < 0.05, *** p < 0.01					

Table 4: Exports:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
X_0	112355.6**	56009.15	2.006023	0.774921	23.24934
X_1	19.96621***	1.205442	16.5634		
X_2	120332.8***	44836.52	2.683811		
X_3	3304.599	28076.79	0.117699		

* p < 0.10, ** p < 0.05, *** p < 0.01

Table 5: Imports:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
M_0	-306521.6***	58863.63	-5.207316	0.979104	22.04368
M_1	0.615471***	0.057372	10.72765		
M_2	-32658.77	25331.52	-1.289254		
M_3	-1.065828	0.787042	-1.35422		
M_4	-12.80384**	6.027244	-2.124328		
M_5	33919.47**	15388.74	2.204175		
* p < 0.10, ** p < 0.05, *** p < 0.01					

Table 6: Exchange Rate (CEER):

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
E_0	2.44267***	0.12389	19.71645	0.742949	-2.641445
E_1	-0.844798	0.731291	-1.155215		
E_2	-0.220402***	0.034722	-6.347674		
E_3	-0.011856***	0.001154	-10.27263		
* p < 0.10, ** p < 0.05, *** p < 0.01					

Table 7: Taylor Rule:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
I_0	1.490587***	0.187312	7.957759	0.630075	-6.439518
I_1	0.741044***	0.094543	7.838157		
I_2	0.073308	0.067463	1.086644		
I_3	0.619655***	0.05944	10.42489		
* p < 0.10, ** p < 0.05, *** p < 0.01					

Table 8: Phillips Curve:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
π_0	0.004135***	0.001381	2.995022	0.750704	-7.077292
π_1	0.812991***	0.054385	14.94882		
π_2	0.129862***	0.043751	2.968178		
* p < 0.10, ** p < 0.05, *** p < 0.01					

Table 9: Real Housing Price:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
HP_0	0.009091	0.009218	0.986274	0.991664	-7.077435
HP_1	0.967362***	0.011097	87.17497		
HP_2	-0.095539*	0.054151	-1.764292		
HP_3	0.011219***	0.00255	4.399583		
* p < 0.10, ** p < 0.05, *** p < 0.01					

3.1.2 Vector Autoregressive Model Estimations (VAR)

Table 10: Business Confidence Index:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
BCI_0	5.294443	-2.46728	2.14586	0.948455	0.833494
BCI_1	1.668232	-0.10365	16.0955		
BCI_2	-1.103398	-0.19508	-5.65603		
BCI_3	0.61204	-0.19349	3.16309		
BCI_4	-0.229791	-0.10125	-2.26957		

Table 11: Consumer Confidence Index:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
CCI_0	4.25393	-3.19398	1.33186	0.9063	1.397763
CCI_1	1.274659	-0.09191	13.869		
CCI_2	-0.547803	-0.14519	-3.77292		
CCI_3	0.440704	-0.14643	3.00971		
CCI_4	-0.381738	-0.14236	-2.68155		
CCI_5	0.171491	-0.09124	1.87955		

Table 12: Canadian Effective Exchange Rate Index (CEER):

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
$CEERI_0$	12.15741	-4.89623	2.48301	0.830603	4.8527
$CEERI_1$	1.065072	-0.10217	10.4243		
$CEERI_2$	-0.378559	-0.14608	-2.59151		
$CEERI_3$	0.208158	-0.10025	2.07636		

Table 13: Real Interest Rate of United States:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
πUS_0	0.005154	-0.00152	3.38865		
πUS_1	1.308412	-0.0902	14.5062		
πUS_2	-0.444752	-0.13481	-3.29905		
πUS_3	0.155396	-0.12633	1.23006	0.840787	-7.185451
πUS_4	-0.636404	-0.12617	-5.04417		
πUS_5	0.793816	-0.13453	5.90067		
πUS_0	-0.386682	-0.0995	-3.88609		

Table 14: Population:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
Pop_0	-82577.3	-31273.4	-2.6405		
Pop_1	1.873738	-0.09581	19.5577		
Pop_2	-1.354078	-0.19797	-6.83981		
Pop_3	0.700401	-0.21225	3.29995		
Pop_4	0.453068	-0.16629	2.7246	0.999918	23.33737
Pop_5	-1.557904	-0.16036	-9.71504		
Pop_6	1.237907	-0.21356	5.79642		
Pop_7	-0.680635	-0.20991	-3.24249		
Pop_8	0.331614	-0.11244	2.9493		

Table 15: Net Non-Permanent Residents

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
NPR_0	3338.83	-3635.3	0.91845		
NPR_1	0.759837	-0.10024	7.57995		
NPR_2	-0.06284	-0.10347	-0.60732	0.599213	23.38757
NPR_3	0.048929	-0.10167	0.48124		
NPR_4	0.775157	-0.11022	7.03282		
NPR_5	-0.543605	-0.13026	-4.1731		

Table 16: Real Lumber

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
$RLumber_0$	0.353633	-0.12393	2.85346		
$RLumber_1$	1.048805	-0.11031	9.50821		
$RLumber_2$	-0.604797	-0.14853	-4.07176		
$RLumber_3$	1.068282	-0.1635	6.53365	0.774423	-1.031929
$RLumber_4$	-0.80455	-0.18133	-4.4369		
$RLumber_5$	0.495406	-0.15666	3.16229		
$RLumber_6$	-0.70267	-0.1819	-3.86289		
$RLumber_7$	0.286161	-0.14218	2.01262		

Table 17: Immigrants

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
IM_0	-3554.588	-10497.7	-0.33861		
IM_1	0.672397	-0.10569	6.36176		
IM_2	-0.130904	-0.16233	-0.8064		
IM_3	0.298849	-0.19269	1.55089		
IM_4	0.067596	-0.19152	0.35294	0.530257	22.01597
IM_5	-0.213713	-0.18556	-1.15173		
IM_6	0.09667	-0.19059	0.50723		
IM_7	-0.162443	-0.2008	-0.80898		
IM_8	0.462557	-0.15644	2.95674		

Table 18: Global Food:

Variable	Coefficient	Std. Error	t-Statistic	Adjusted R^2	Akaike Info Criterion
GF_0	4.040629	-2.55901	1.57898		
GF_1	1.327587	-0.10497	12.6474		
GF_2	-0.715975	-0.16828	-4.25477	0.942828	6.402446
GF_3	0.509174	-0.16879	3.01669		
GF_4	-0.154695	-0.10601	-1.45919		

Table 19: Government Expenditure & TAU:

	G	τ
C	-19748.66 -6282.75 [-3.14332]	0.014718 -0.00765 [1.92355]
G_{t-1}	0.994115 -0.00662 [150.161]	1.37E-08 -8.10E-09 [1.70007]
τ_{t-1}	155413.7 -38820.3 [4.00341]	0.869713 -0.04728 [18.3957]
Adjusted R^2	0.996121	0.798709
Akaike Info Criterion	19.34426	-7.892556
Akaike Info Criterion	11.42128	

Table 20: US Real Interest Rate & GDP

	RUS	YUS
c	0.01117 -0.00735 [1.52012]	184.06670 -252.95800 [0.72766]
RUS_{t-1}	1.31318 -0.10654 [12.3260]	-157.90690 -3667.17000 [-0.04306]
RUS_{t-2}	-0.42729 -0.15675 [-2.72591]	334.52980 -5395.57000 [0.06200]
RUS_{t-3}	0.09408 -0.14798 [0.63571]	2872.99300 -5093.83000 [0.56401]
RUS_{t-4}	-0.58492 -0.14805 [-3.95073]	-4878.81700 -5096.25000 [-0.95733]
RUS_{t-5}	0.72070 -0.15621 [4.61372]	2966.54500 -5376.93000 [0.55172]
RUS_{t-6}	-0.31205 -0.10733 [-2.90735]	-3101.91800 -3694.46000 [-0.83961]
YUS_{t-1}	-0.00001 0.00000 [-3.41876]	0.74027 -0.11232 [6.59077]
YUS_{t-2}	0.00001 0.00000 [2.03187]	0.09799 -0.14940 [0.65591]
YUS_{t-3}	0.00000 0.00000 [-0.57042]	0.03870 -0.15157 [0.25529]
YUS_{t-4}	0.00000 0.00000 [1.11411]	0.07379 -0.15146 [0.48717]
YUS_{t-5}	0.00000 0.00000 [0.55273]	0.03235 -0.15121 [0.21393]
YUS_{t-6}	0.00000 0.00000 [-0.91986]	0.01440 -0.11737 [0.12265]
Adjusted R^2	0.86523	0.98800
Akaike Info Criterion	-6.82516	14.06771
Akaike Info Criterion	7.21394	

Table 21: China Real Interest Rate & GDP

	RChina	YChina
C	0.00322 -0.00199 [1.61482]	468.11900 -135.81000 [3.44687]
$RChina_{t-1}$	1.18765 -0.11321 [10.4906]	1269.89500 -7708.73000 [0.16473]
$RChina_{t-2}$	-0.11817 -0.17354 [-0.68097]	-1697.59900 -11816.40000 [-0.14367]
$RChina_{t-3}$	-0.32829 -0.16319 [-2.01168]	-5503.12200 -11112.00000 [-0.49524]
$RChina_{t-4}$	-0.28557 -0.14978 [-1.90663]	-6886.18400 -10198.60000 [-0.67521]
$RChina_{t-5}$	0.65264 -0.15297 [4.26635]	15102.90000 -10416.30000 [1.44993]
$RChina_{t-6}$	-0.45285 -0.17038 [-2.65784]	-5872.78900 -11601.70000 [-0.50620]
$RChina_{t-7}$	0.04723 -0.17601 [0.26830]	-622.44600 -11985.00000 [-0.05194]
$RChina_{t-8}$	0.08946 -0.10540 [0.84871]	-3930.82000 -7177.21000 [-0.54768]
$YChina_{t-1}$	0.00000 0.00000 [-0.29848]	0.54571 -0.10417 [5.23868]
$YChina_{t-2}$	0.00000 0.00000 [-2.19511]	0.15481 -0.12093 [1.28014]
$YChina_{t-3}$	0.00000 0.00000 [1.11083]	0.06638 -0.12712 [0.52216]
$YChina_{t-4}$	0.00000 0.00000 [-0.72222]	0.60748 -0.11317 [5.36767]
$YChina_{t-5}$	0.00000 0.00000 [0.34964]	-0.55047 -0.11232 [-4.90083]
$YChina_{t-6}$	0.00000 0.00000 [2.38828]	-0.17875 -0.12891 [-1.38655]
$YChina_{t-7}$	0.00000 0.00000 [-1.17992]	-0.08199 -0.13887 [-0.59044]
$YChina_{t-8}$	0.00000 0.00000 [0.56680]	0.47320 -0.12120 [3.90439]
Adjusted R^2	0.84241	0.99732
Akaike Info Criterion	-6.93957	15.31766
Akaike Info Criterion	8.37401	

4. Forecasts

4.1.1 Endogenous Model Forecasts

Note all graphs recorded in year over year growth rate

Figure 1.0

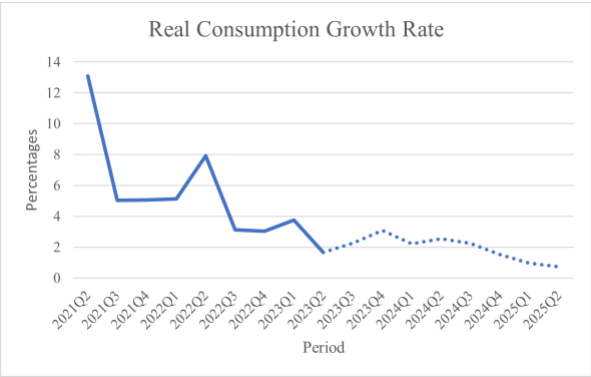


Figure 2.0

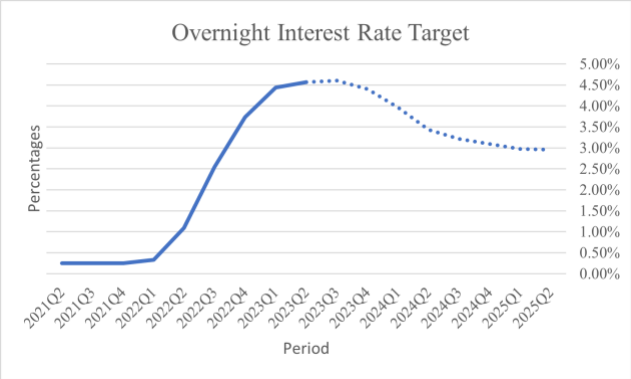


Figure 3.0

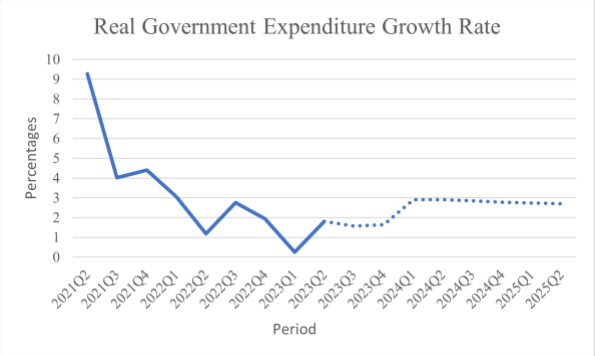


Figure 4.0

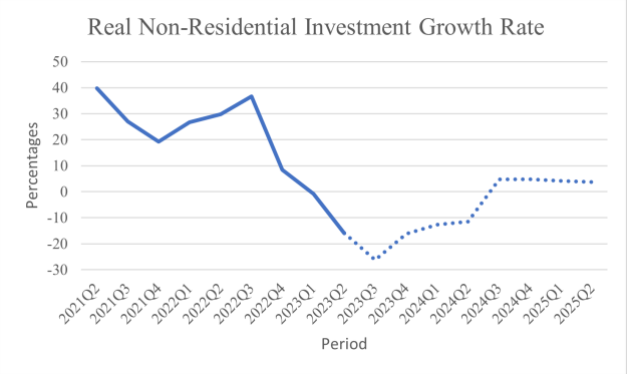


Figure 5.0

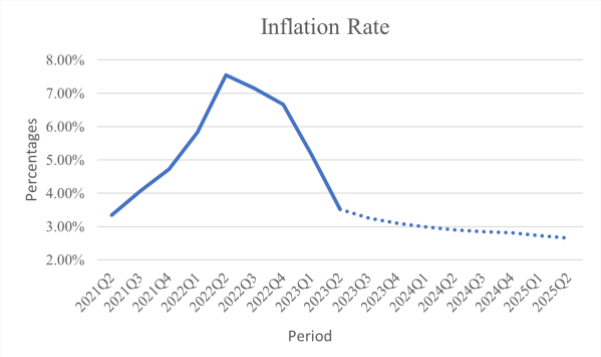


Figure 6.0

Figure 7.0

Figure 8.0

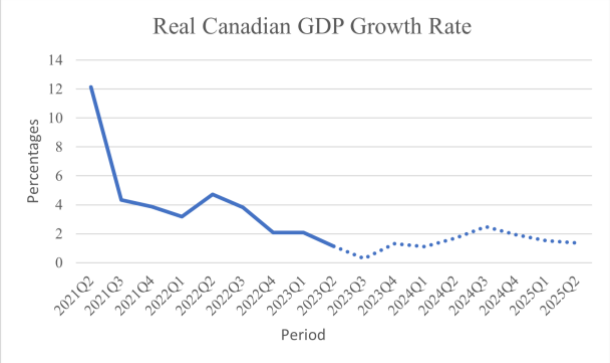


Figure 9.0

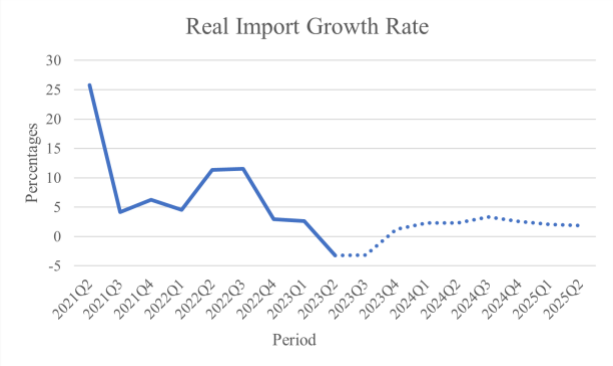
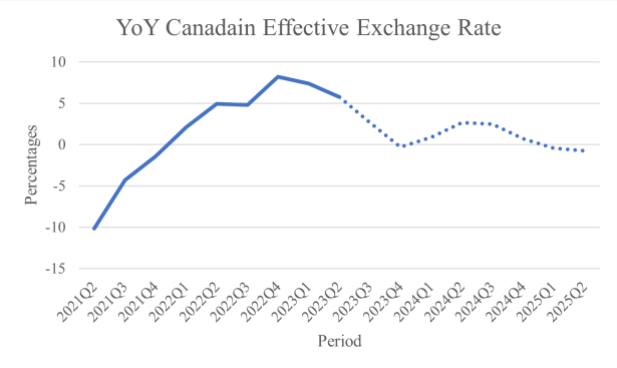


Figure 10.0



4.1.2 Exogenous Variable Forecasts

Figure 11.0

Figure 12.0

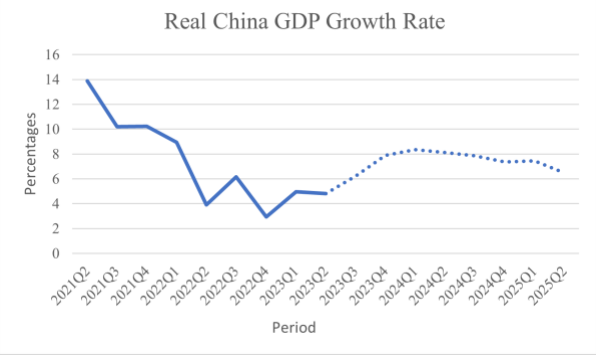


Figure 13.0

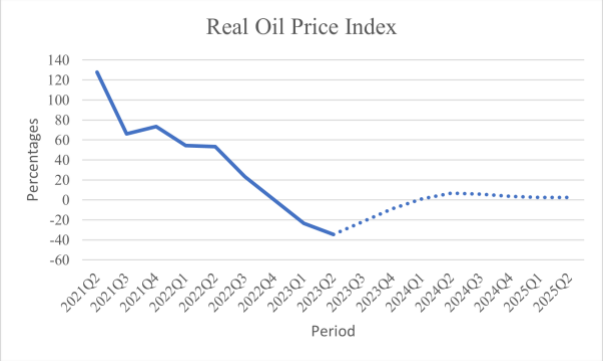


Figure 14.0

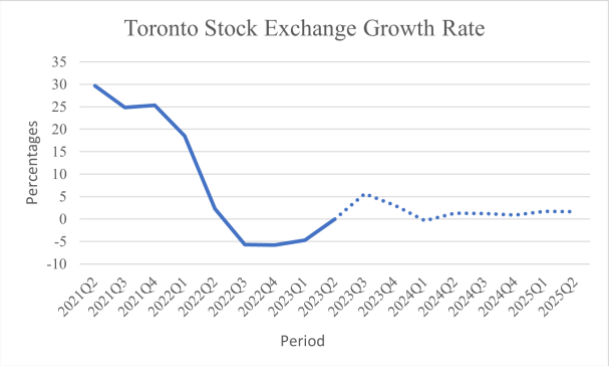


Figure 15.0

Figure 16.0

Figure 17.0

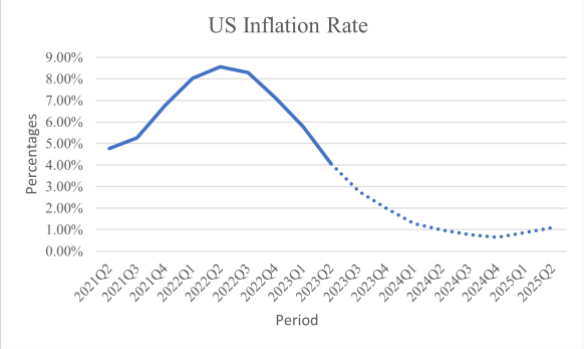


Figure 18.0

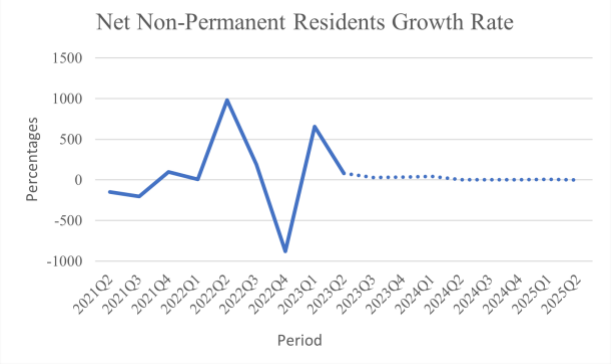


Figure 19.0

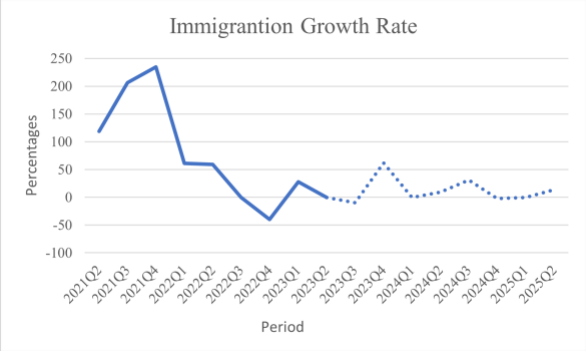
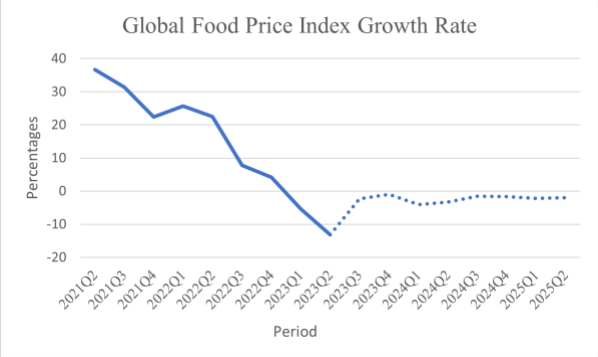


Figure 20.0



5.Monetary Policy Recommendation

5.1.1 Policy Rate Recommendation and Explanation

The monetary policy rate is drastically affected by the muted growth of the Canadian GDP as an effect of persisting interest rates. Consumer, Business, and inflation expectations help drive this muted growth as they contribute most to the muted increase in their respective equations. Consumption as the largest part of GDP, shows steady increases from our projections at around 1.75%.

It is important to note that within our projection models, we expect our GDP (Gross Domestic Product) to grow at a slower pace when compared to the potential GDP. This is the key driver within both the inflation equation (Figure 5.0) and the policy rate equation (Figure 2.0). Regarding patterns of future growth and the predictions of our model we will first begin by analysing our endogenous equations, components of GDP. The we will take into account our exogenous variables and the interplay within our model, followed by our predictions regarding the future behaviours of the Canadian economy and our recommendation to the Bank of Canada regarding the interest rate decision.

Starting with the largest component of GDP, consumption, we can see in Figure 1.0 an eventual decrease in the growth rate of consumption, albeit still remaining positive. High levels of consumption can be explained by very low interest rates in 2020-2021 and in 2022 by Canadians digging into their household savings. These two factors are what drove consumption to high levels. Now as high interest rates are making consumption more expensive and as Canadians begin to clear out their savings our model projects decrease of the growth rate of consumption. Government Spending (Figure 3.0) shows government spending increasing in the first quarter of 2024 and to continue to grow steadily into the future. Government spending remains constant over time, the high levels of government spending seen in 2020 can be attributed to high government consumption when the interest rates were near zero. Moving over to investments, we broke up investments into non-residential and residential investments. Non-residential investment (Figure 4) shows a rebound in the growth rate in Q1 2024 and the rate stabilizing and remaining constant in 2025. Residential Investment (Figure 6) follows the same pattern, after very high growth rate in the 2020-2022 period, levels have now returned to normal and will continue to grow with a steady forwards trajectory. Increases in Investment are pushed heavily

by consumption expectations (Figure 1.0) and by population growth (Figure 20.0) in our model. Moving onto the final component of GDP, net exports. This was also broken up into Exports (Figure 7.0) and Imports (Figure 9.0) to better capture the moment in both. The growth rate of exports is expected to fall in the coming periods but still remain positive, as the effects of slower than expected US GDP growth (Figure 11.0) influence our Export decisions. Imports will rise mainly due to the expected increase in the Real Price of Oil (Figure 13.0). As the price of Oil internationally raised our dollar value of imports will also rise.

Our Exogenous variables we regressed using AR and VAR methods. Taking a look at the data from our international trading partners we can see that they are crucial to our analysis. As the United States is Canada's largest trading partner, the GDP of the United States (Figure 11.0), and the US Inflation Rate (Figure 17.0) were variables we felt needed to be included in our model. The US along with many nations across the world have been facing tough inflationary pressures and our model predicts a nice smooth return to Bank of Canada and Federal Reserve inflation targets, by 2025 inflation should ease. The real GDP of China (Figure 12) is also expected to grow steadily by Q2 2024.

Other key exogenous variables we needed to include all relate to commodity prices. We used the Global Food Index (Figure 21.0), Global Lumber Index (Figure 15.0) and Oil Price Index (Figure 13.0) in our model to predict various behaviours in the Canadian economy. These commodities were all priced extremely high in the period of 2020-2022 due to low interest rates and very high levels of inflation. Now with inflationary controls working our model predicts the prices of all of these commodities to rise naturally once inflation has been controlled.

We expect investment expenditures to drive GDP growth, this is going to be due to the muted effects of consumption growth, the steady rise of government expenditures and lower than expected growth rates in exports and imports. Overall, the Canadian economy is not going to grow at any significant rate and our model suggests the growth rate will remain between 1.5%-2.0% in 2024 through 2025.

The goal of the Bank of Canada is to maintain inflation at the 2% target, in the coming periods we will observe inflation levels falling to the 2% target, but this will require effort from the Bank of Canada. We suggest after analysing our model that at the next meeting (Dec 6) the Bank of Canada hold the interest rate at the current 5% level, and at the next meeting to drop the interest rate by 25bps. This will align with the Bank of Canada's inflation expectations.

6. Risk Analysis

With the recent uncertainty revolving around the Canadian and Global economies, extra measures must be taken when testing out forecasts. Within this part of the report, we will be discussing the current major risks and their impacts. We will shock our model for certain variables and see how the forecasted model will react. The main risks that we anticipate are i) increased Oil prices ii) Increasing House Prices iii) decreasing Consumer Confidence levels. These shocks will show us changes in our forecasted variables. Specifically, it will give us a baseline for anticipated GDP and inflation. This in turn will aid our decision-making for the future interest rate decisions.

6.1.1 Risk: Increased Oil Prices

Oil Prices are crucial to the current global economies for several main reasons. Firstly, many industries rely on oil for production costs. Furthermore, since oil is a major source of production of goods, it can increase/decrease the cost of certain items based on its own which in turn affects inflation. Lastly, countries that rely on oil can see big trade imbalances take place. Recent geopolitical tensions in the middle east between Israel and Palestine can spark discrepancies for global oil production. Subsequently, this will increase oil prices. We decided to shock our model by increasing the price of West Texas Intermediate. The effects of the shock can be seen below.

Figure 22.0

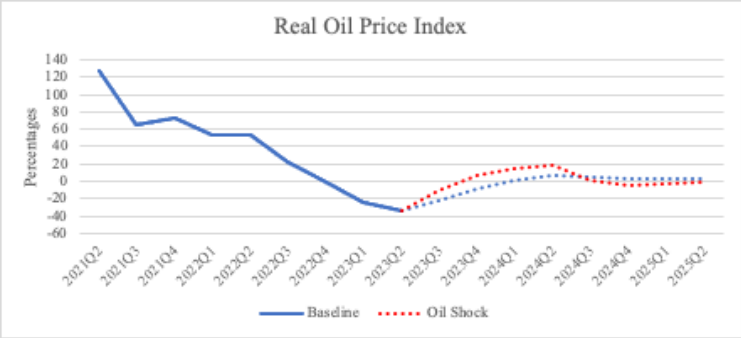


Figure 23.0

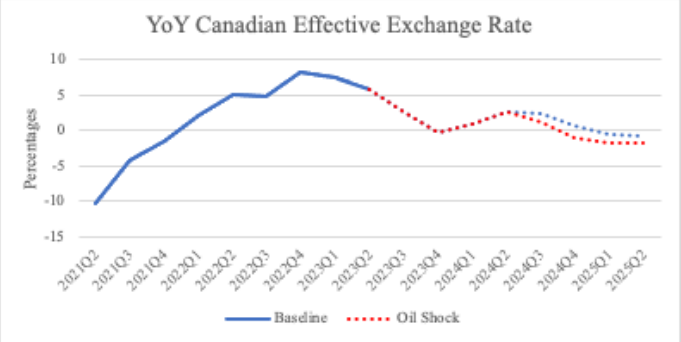


Table 22: GDP Growth after Shock

2023Q2	2023Q3	2023Q4	2024Q1	2024Q2	2024Q3	2024Q4	2025Q1	2025Q2
1.122 (Baseline)	0.277	1.324	1.103	1.695	2.482	1.935	1.523	1.360
1.122147 (Oil Shock)	0.532	1.644	1.362	1.896	2.309	1.663	1.319	1.217

The shock that we applied to the WTI price was similar to the volatility that happened during the start of the Ukraine war in 2022. Both the middle east and Russia are major global exporters of oil and therefore can potentially have similar impacts. There have been a couple of changes within our variables after this shock. Initially our CEER decreased from our baseline assumptions. There are a couple of ways that this can take place such as increases in inflation as

well as Global economic slowdown which can be seen in Figure (3) with slightly lower GDP levels after 2024Q3. In hand with this, we see our consumption and imports slightly increase. Other increased variables were consumption, interest rate, imports and GDP.

6.1.2 Risk: Increased Real House Prices

House Prices in Canada have been seeing a rise in recent years. There have been many data releases that breaking down all the negative aspects of housing in Canada. Around 40-50% of Canadian are living in unaffordable housing which is classified by spending more than thirty percent of income on shelter cost. This is also accompanied by the constant increase in population which recently surpassed forty million in Canada. This brings up competition for ownership and rent since housing starts have been very ambiguous in the past couple of years due to the increased interest rates and geopolitical commodity uncertainties. These factors have been reflected in the recent increases housing price indexes. Moreover, a higher population through the increase in immigration and non-permanent residents will only hike the prices even more. We decided to increase the real housing prices variable to see how it would affect the overall Canadian economy and the finding can be found below.

Figure 24.0

Figure 25.0

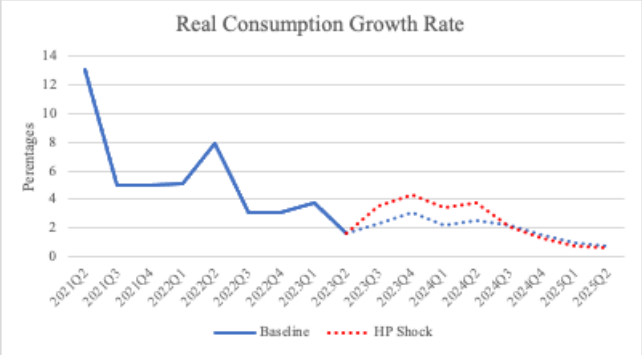


Table 23: Interest Rate Changes

2023Q2	2023Q3	2023Q4	2024Q1	2024Q2	2024Q3	2024Q4	2025Q1	2025Q2
4.57% (Baseline)	4.60%	4.40%	3.96%	3.43%	3.21%	3.09%	2.97%	2.96%
4.57% (HP Shock)	4.68%	4.51%	4.11%	3.61%	3.40%	3.29%	3.18%	3.17%

As seen by the increased house prices shock, our model predicts them to still return to baseline predictions by 2024Q3. We see an increase in consumption which can be related to higher home prices provided the wealth effect. In addition, increasing levels of home equity can provide homeowners with access to extra loans and increased consumption. All of this will enlarge consumption which consequently increases inflation. This is why we see increased levels of

Interest rates in Figure (6) indicating longer than expected times to get interest rates and inflation back to target. Other increased variables were imports, Residential investment and GDP.

6.1.3 Risk: Decrease in Consumer Confidence Index Levels

The final risk is based on the fact that within Canada, Consumer Confidence will drop which is due to several factors. The Consumer Confidence indicator shows an indication of future developments of household consumptions and savings. This sentiment is based on the current economic state, unemployment and expected financial situations. We are forecasting that CCI should drop more and become a greater risk since individuals are currently running low on savings from Covid. In addition, we are approaching a recessionary stage within many job markets and are anticipating many layoffs or non-hiring cycles. We decided to decrease our CCI to 2022 lows.

Figure 26.0

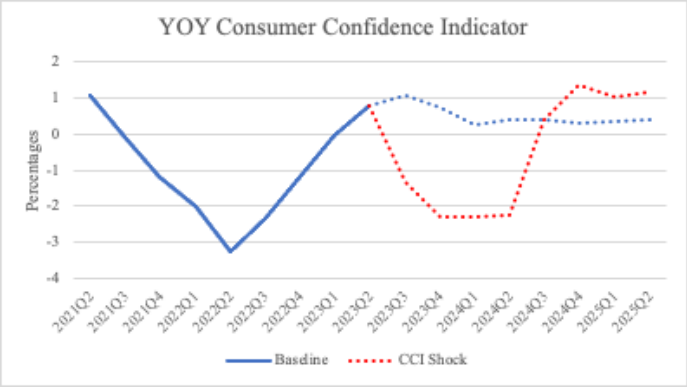


Figure 27.0

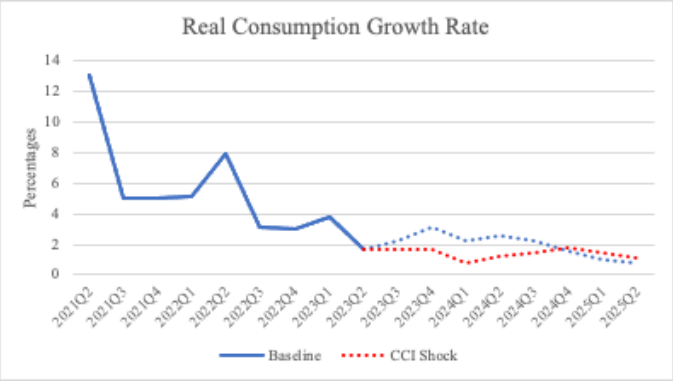


Table 24: Interest Rate Changes

2023Q2	2023Q3	2023Q4	2024Q1	2024Q2	2024Q3	2024Q4	2025Q1	2025Q2
4.57% (Baseline)	4.60%	4.40%	3.96%	3.43%	3.21%	3.09%	2.97%	2.96%
4.57% (HP Shock)	4.53%	4.13%	3.56%	2.96%	2.68%	2.53%	2.40%	2.38%

Figure 28.0

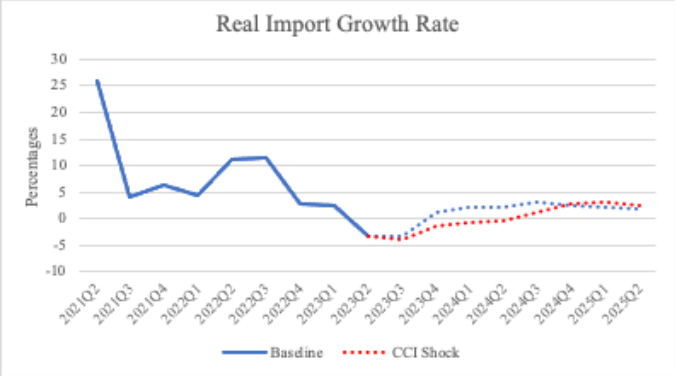
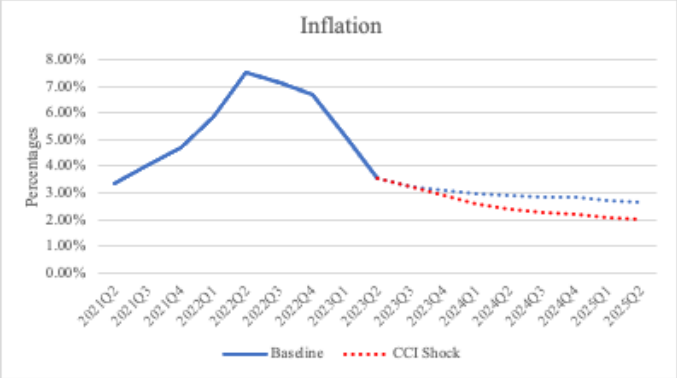


Figure 29.0



From Figure 7 we see our CCI drop but then increase going into 2025. This is paired with a decrease in consumption which is reasonable since the consumer sentiment has a correlation with consumption. Since consumption will be lower, we see the effects on inflation take place in Figure 11. Even lower inflation will allow the banks to lower interest rates at a faster rate which can be seen in Figure 9.

7. Conclusion

In order to build as comprehensive a model as possible the Bank of Canada uses various models and forecasts when evaluating the potential trajectory of the Canadian economy. In this paper we have described the features of our Augmented Keynesian Model (AKM) in great length. We have also explained the reasoning behind our equations and how they were derived. In our new model we used a VAR system to predict the behaviours of our exogenous variables both in our baseline predictions and for our risk scenarios. Through the use of our AKM and VAR estimation structures, our model provides us with an all-encompassing prediction of the behaviour of the Canadian economy. Our model allows us to be able to predict the future movement of the overnight target rate, and we predict the Bank of Canada to hold the rate at a steady 5.00% and then decrease the overnight rate by 25-bps.

In future iterations of this model some things that would improve the accuracy of our model would be to: 1) utilize Monte-Carlo simulations to predict the probabilities of our risk occurring. 2) Attempt to use more complex methods for predicting behaviours of our exogenous variables. 3) Break up consumption into durable and non-durable goods and break up our import/exports into services/commodities to better capture behaviour of variables in the model. Breaking up components of GDP, similarly to how we broke up residential and non-residential investments will greatly improve our model and will allow us to make more specific predictions about future behaviour.

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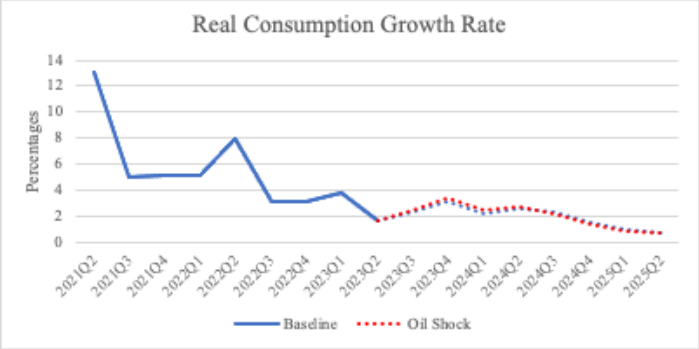
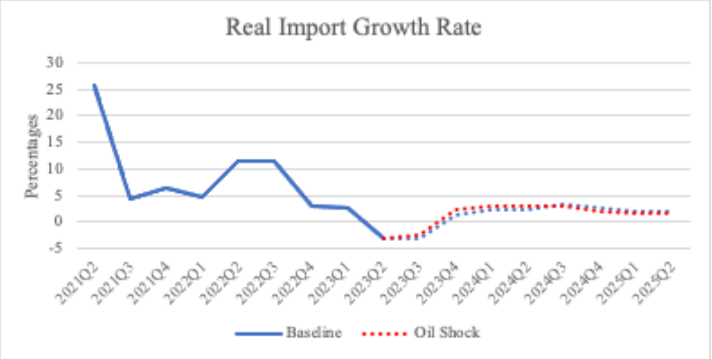
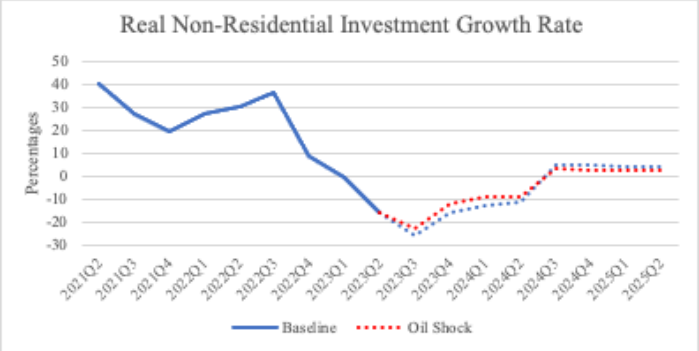
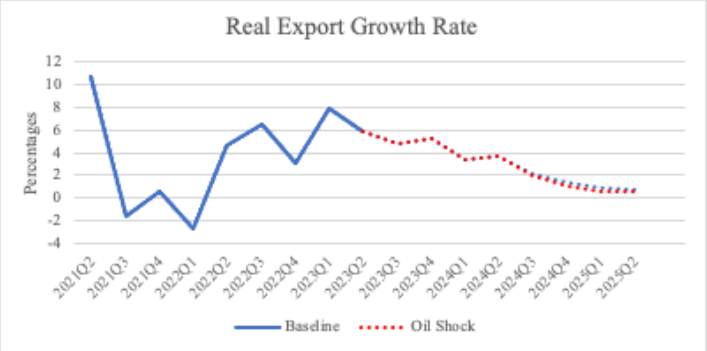
9. Appendix

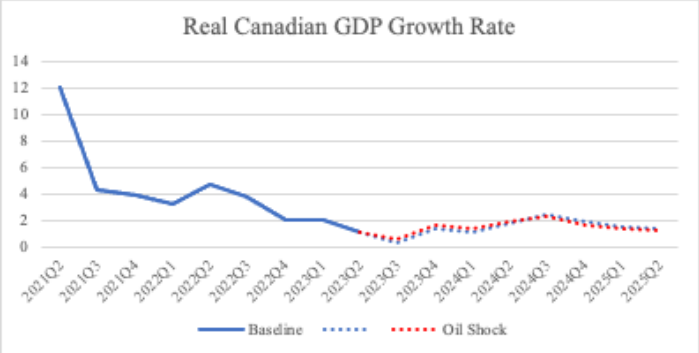
Risk: Increased Oil Prices Extended Graphs:

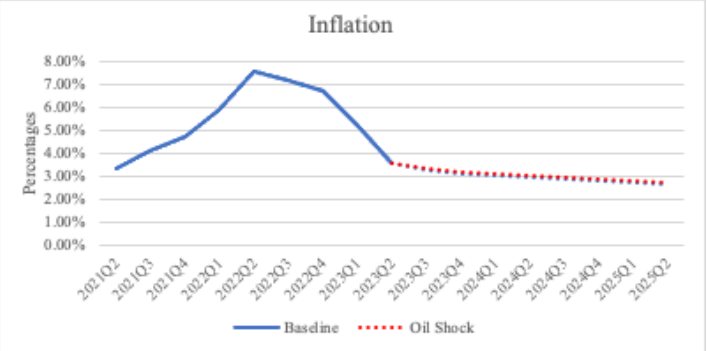




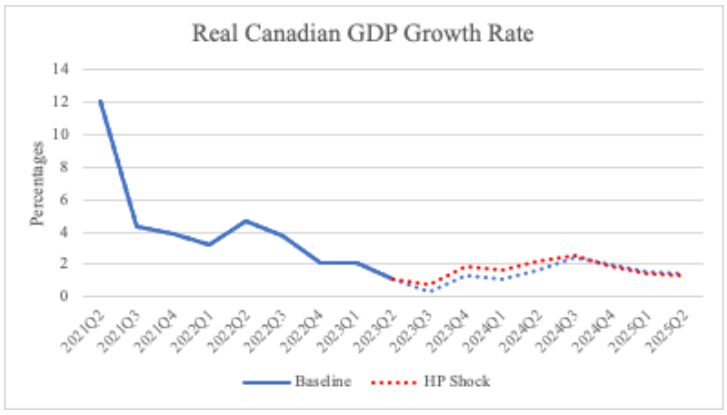


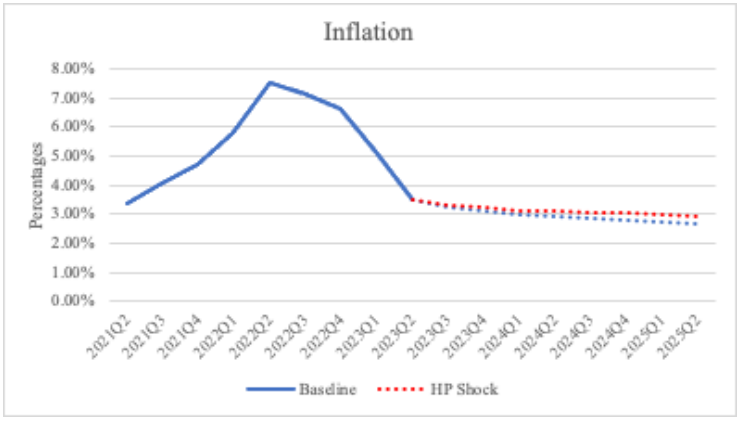


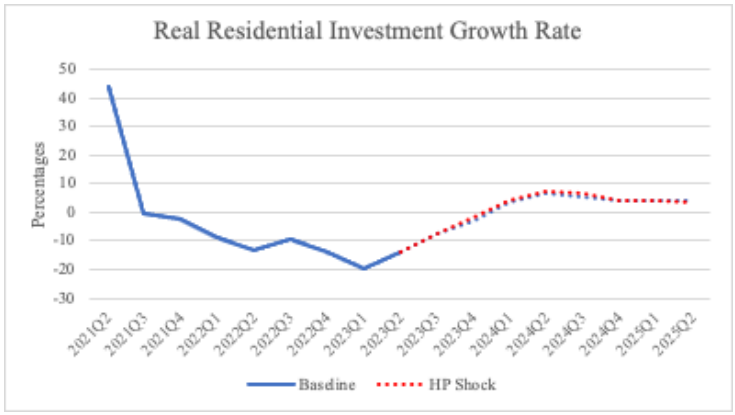


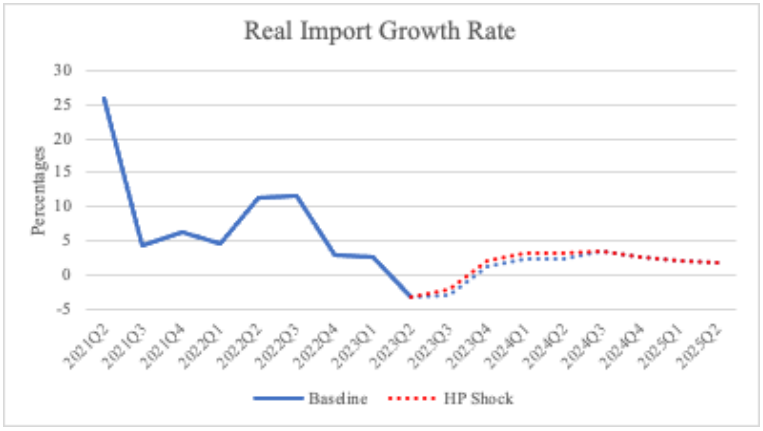


Risk: Increased Real House Prices Extended Graphs:

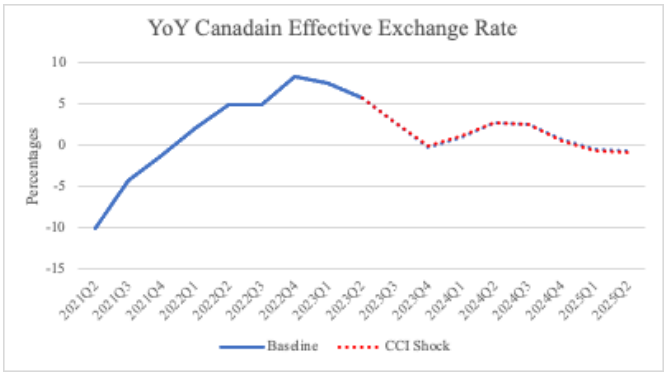


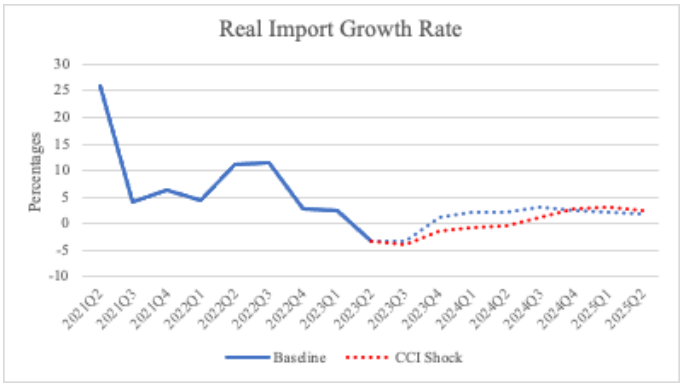


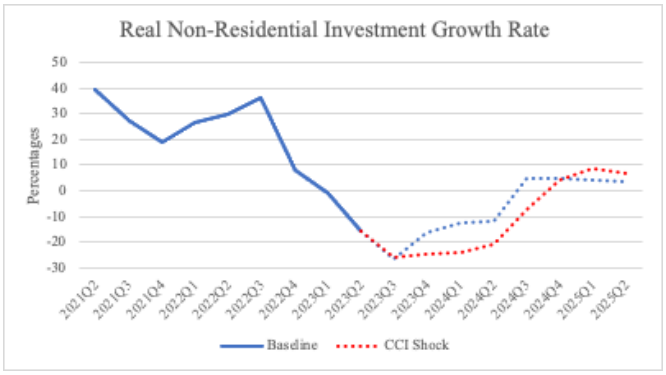




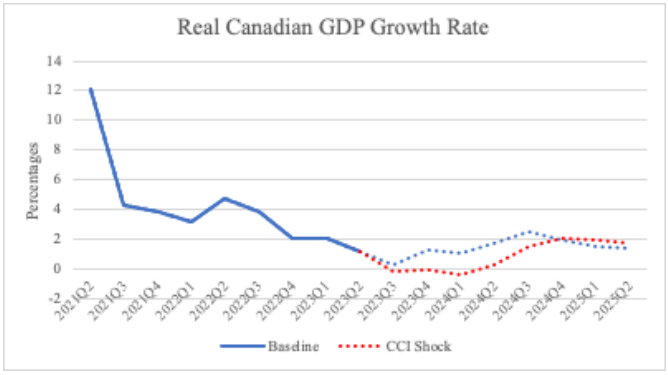
Risk: Decrease in Consumer Confidence Index Levels Extended Graphs:

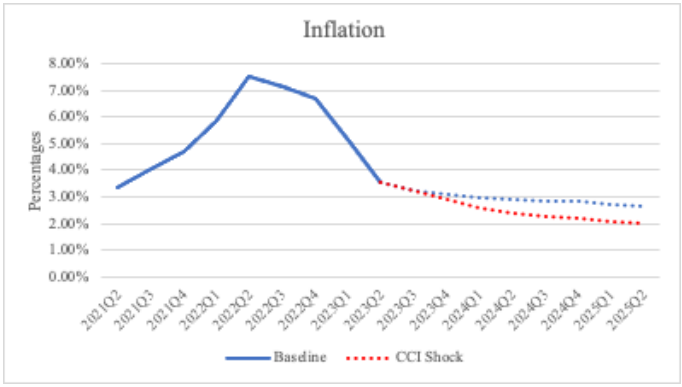





Real Non-Residential Investment Growth Rate
Percentages
50
40
30
20
10
0
-10
-20
-30
2021Q2
2021Q3
2021Q4
2022Q1
2022Q2
2022Q3
2022Q4
2023Q1
2023Q2
2023Q3
2023Q4
2024Q1
2024Q2
2024Q3
2024Q4
2025Q1
2025Q2
Baseline
CCI Shock


Real Housing Price
Percentages
12
10
8
6
4
2
0
-2
-4
-6
2021Q2
2021Q3
2021Q4
2022Q1
2022Q2
2022Q3
2022Q4
2023Q1
2023Q2
2023Q3
2023Q4
2024Q1
2024Q2
2024Q3
2024Q4
2025Q1
2025Q2
Baseline
CCI Shock


Real Canadian GDP Growth Rate
Percentages
14
12
10
8
6
4
2
0
-2
2021Q2
2021Q3
2021Q4
2022Q1
2022Q2
2022Q3
2022Q4
2023Q1
2023Q2
2023Q3
2023Q4
2024Q1
2024Q2
2024Q3
2024Q4
2025Q1
2025Q2
Baseline
CCI Shock


Inflation
Percentages
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
2021Q2
2021Q3
2021Q4
2022Q1
2022Q2
2022Q3
2022Q4
2023Q1
2023Q2
2023Q3
2023Q4
2024Q1
2024Q2
2024Q3
2024Q4
2025Q1
2025Q2
Baseline
CCI Shock