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Bank of Canada Monetary Policy Competition

The Governor's Challenge

Agenda

What are we facing?

○

Snapshots of the Global & US Economies

○

The Canadian Economy

Trends

Forecasts

Risks

○

Policy Recommendation

What are we facing?

An increase in macroeconomic activity, yet poor recovery from the COVID-19 shock, requiring accommodative policy

Chronic supply chain bottlenecks and excessive accommodative policy potentially promoting the threat of persistently high inflation

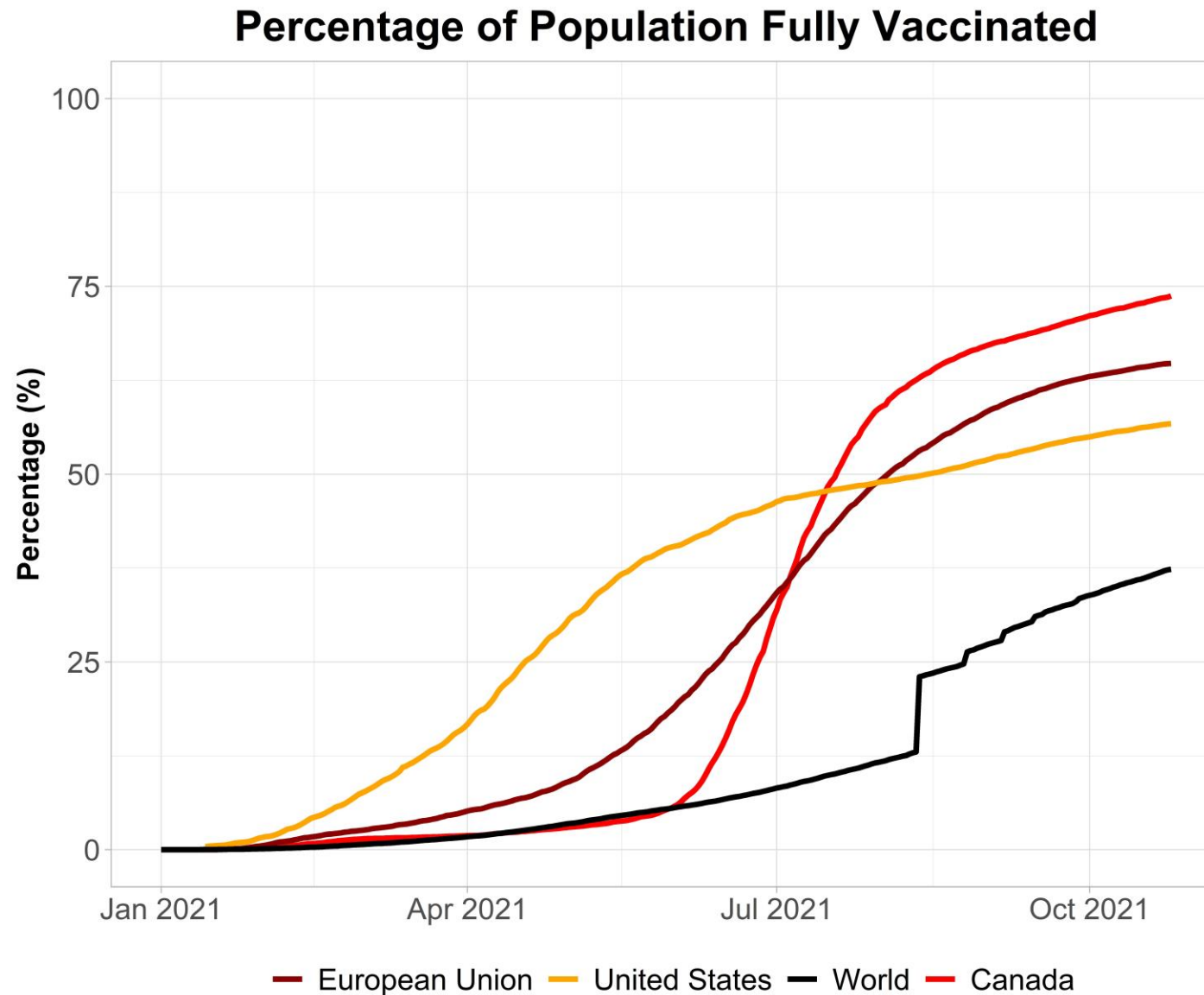
OUR OBJECTIVE TODAY

Recommend a policy that will aid the Bank of Canada in navigating this dilemma.

A Snapshot of the Global Economy

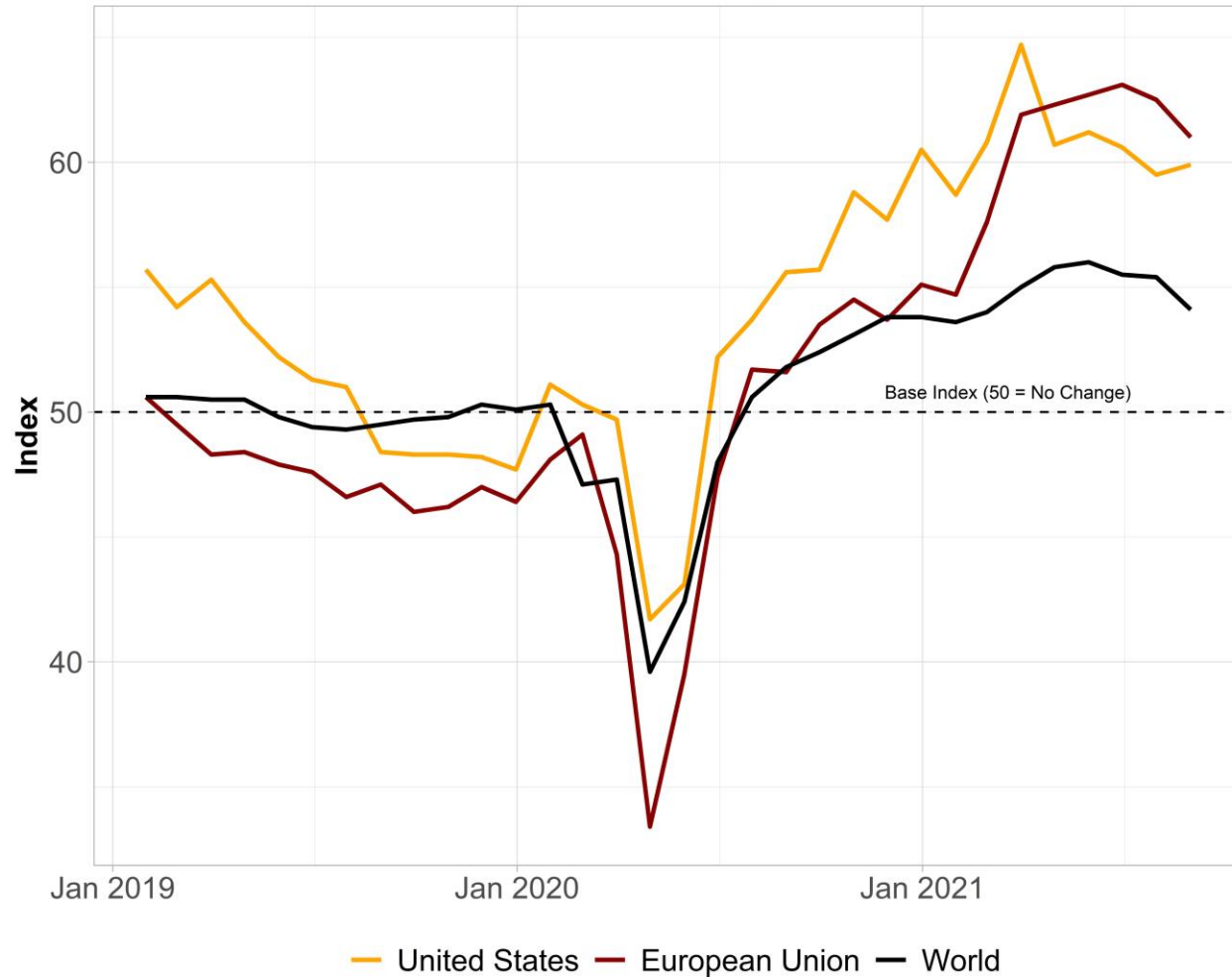
- Rising Vaccine Coverage
- Gradual Rebound in Economic Activity
- Accommodative Monetary Policy

Rising Vaccine Coverage in Developed Nations

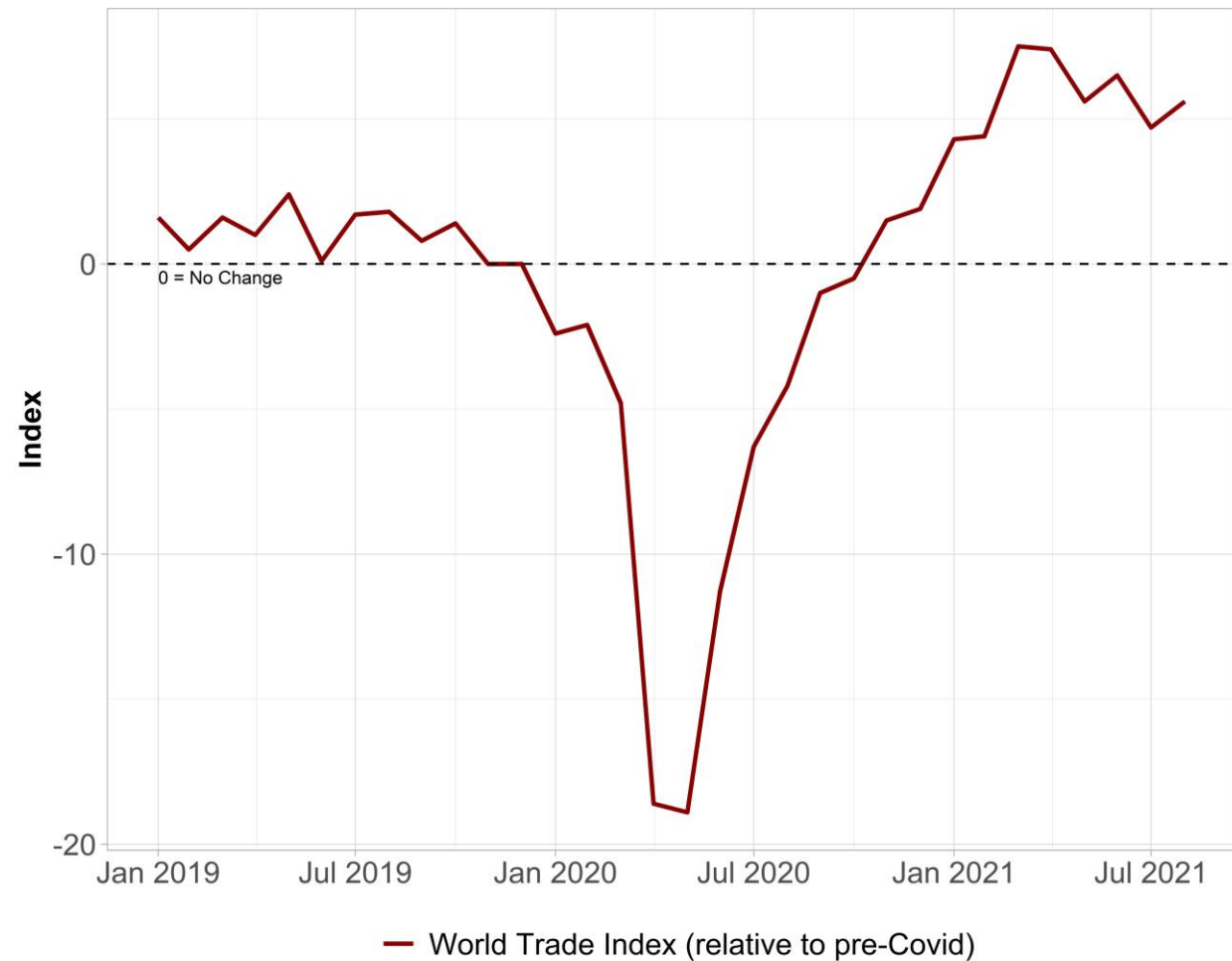


Increased Manufacturing Activity and Trade with Reopening of Economies

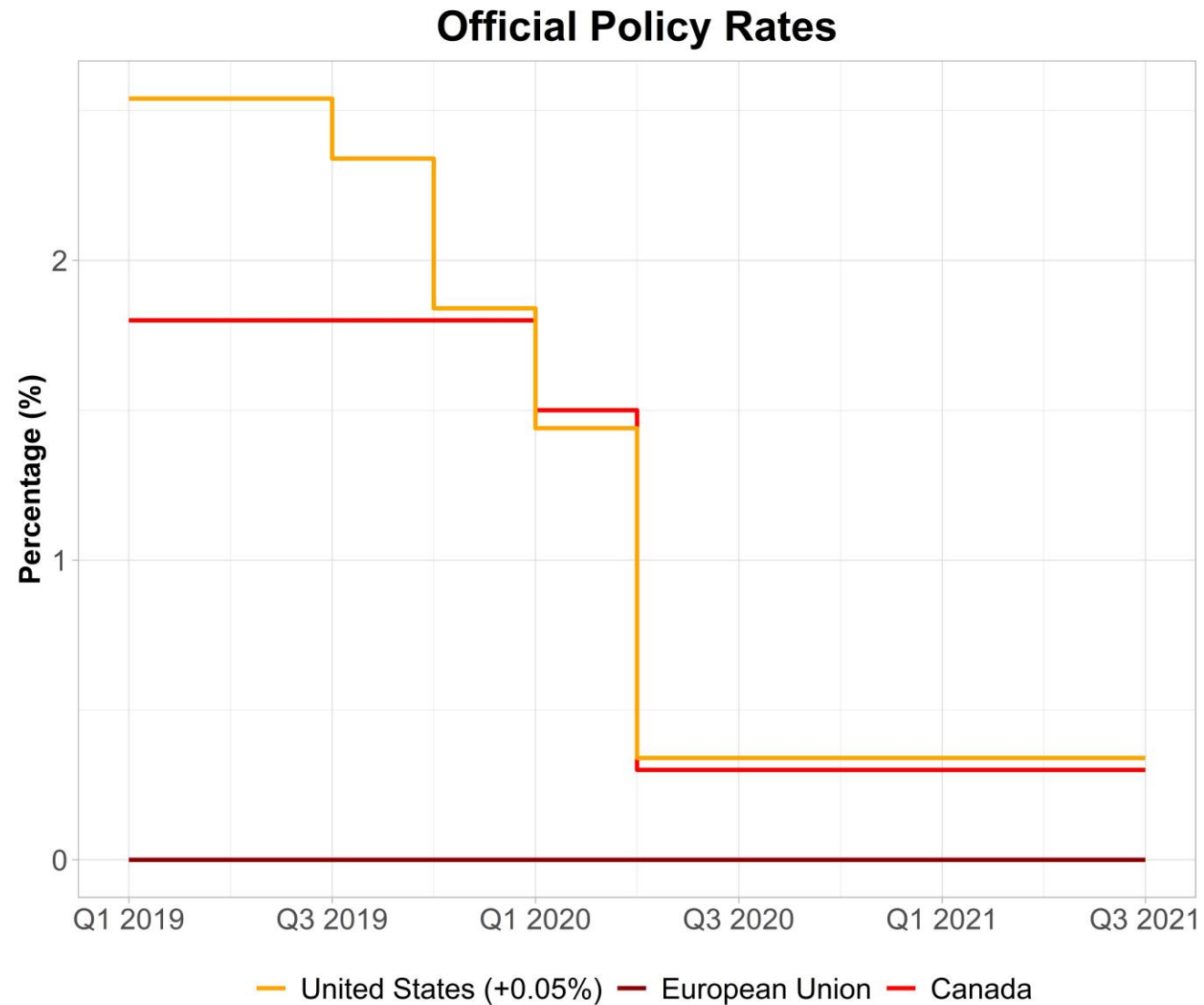
Manufacturing PMI



World Trade (Merchandise)



Low Policy Rates to Ease Economic Recovery

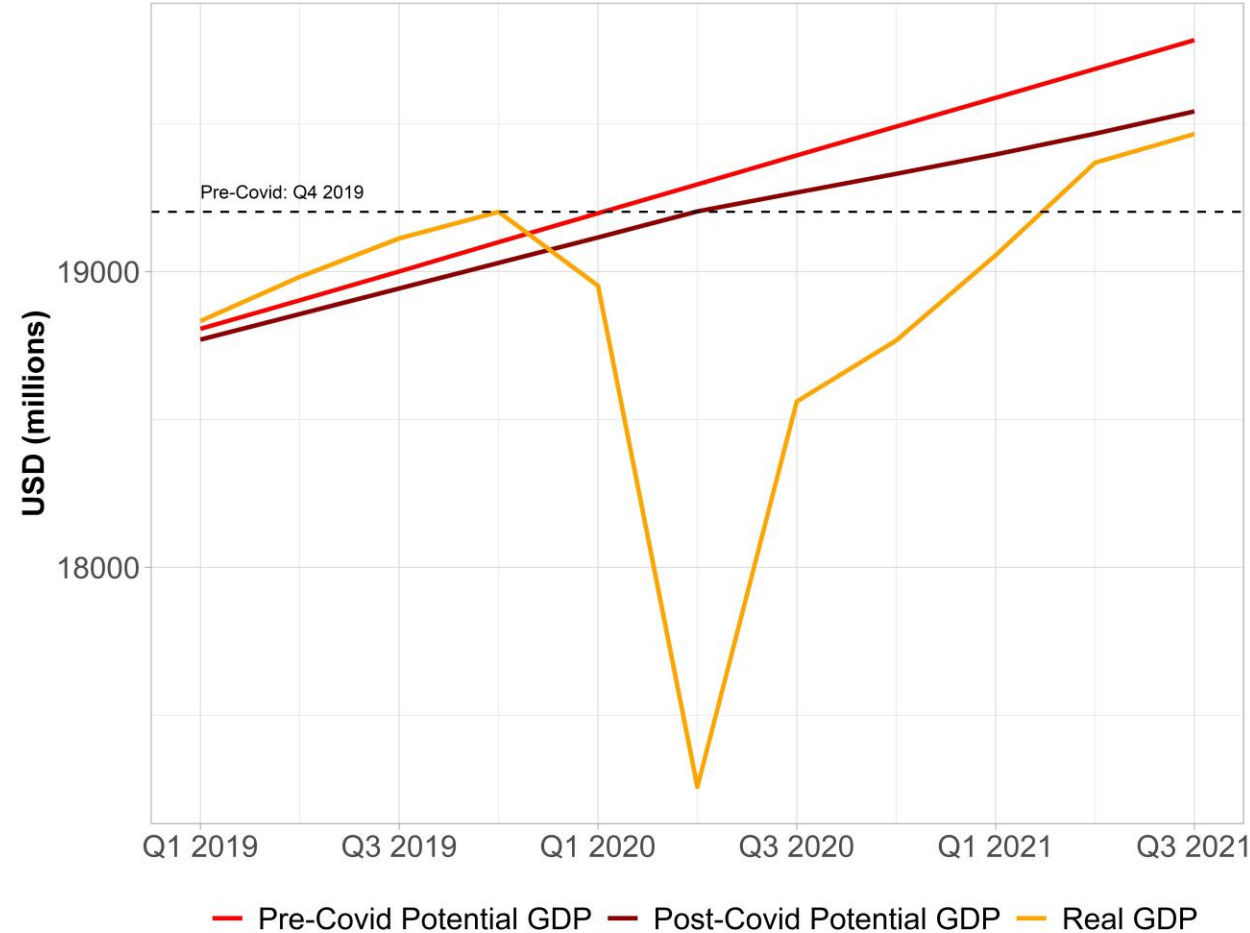


The US Economy

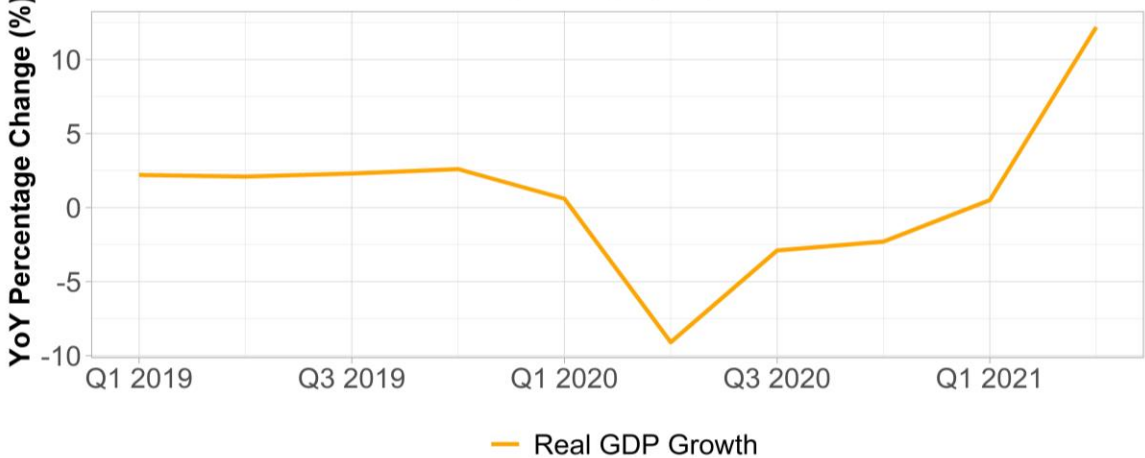
- Strong recovery from the COVID-19 crisis
- Evidence of supply chain bottlenecks
- Rising Inflation

Strong US Recovery with Output Surpassing Pre-Pandemic Levels

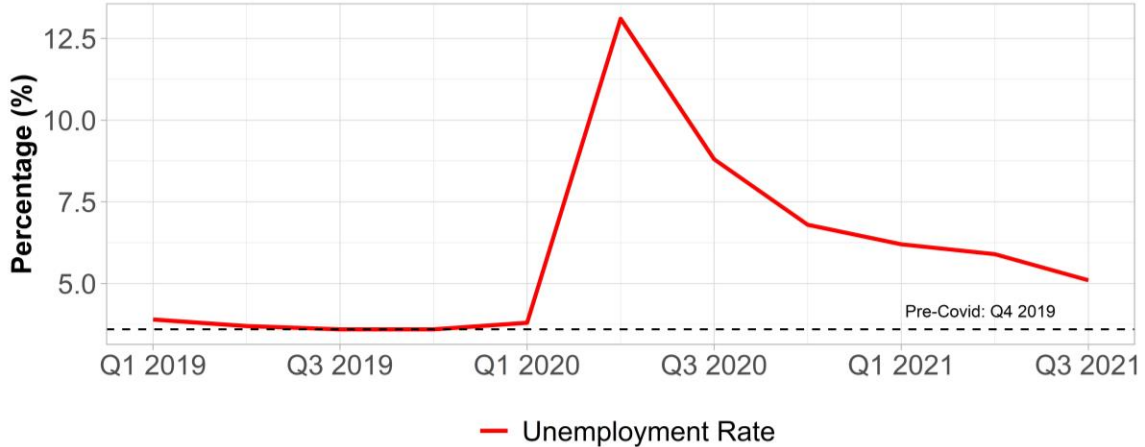
Level of Real GDP to Potential



GDP Growth

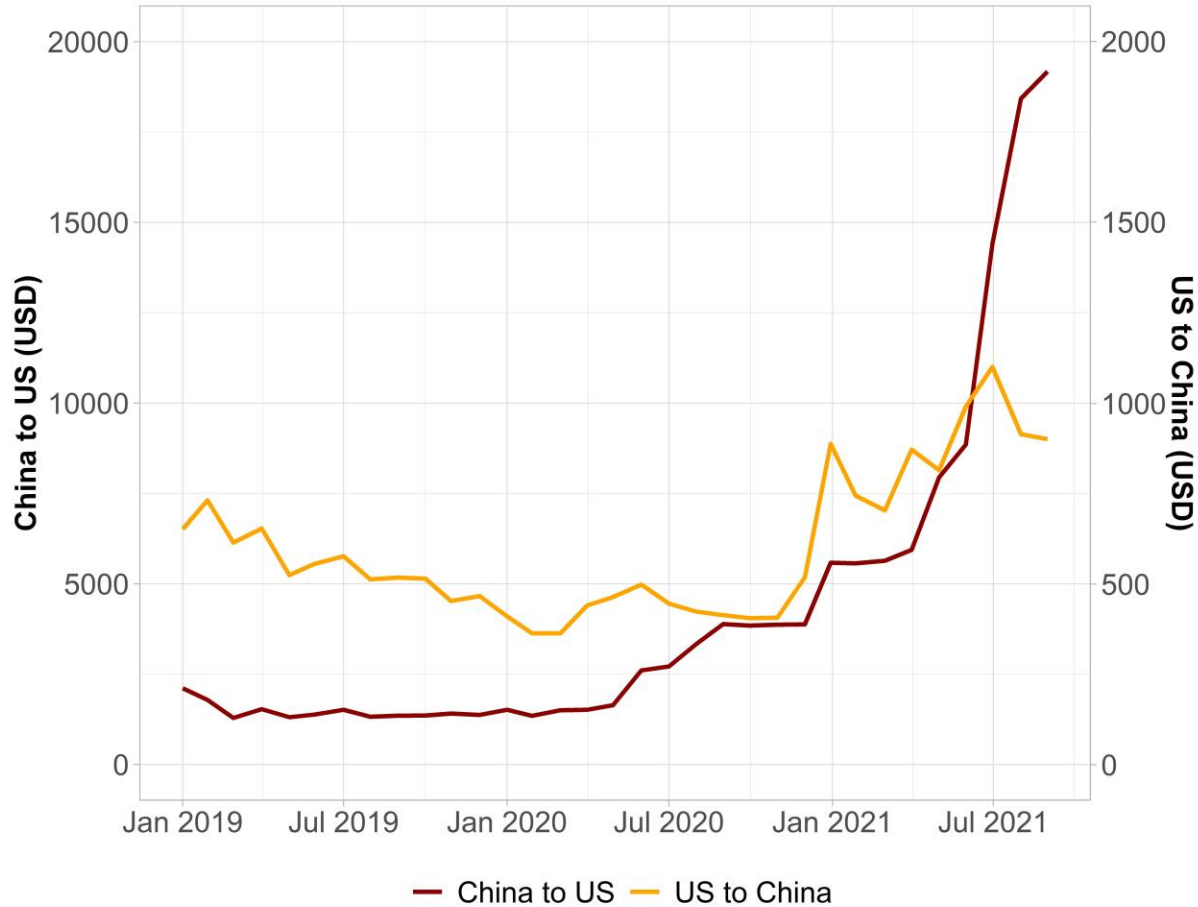


Unemployment

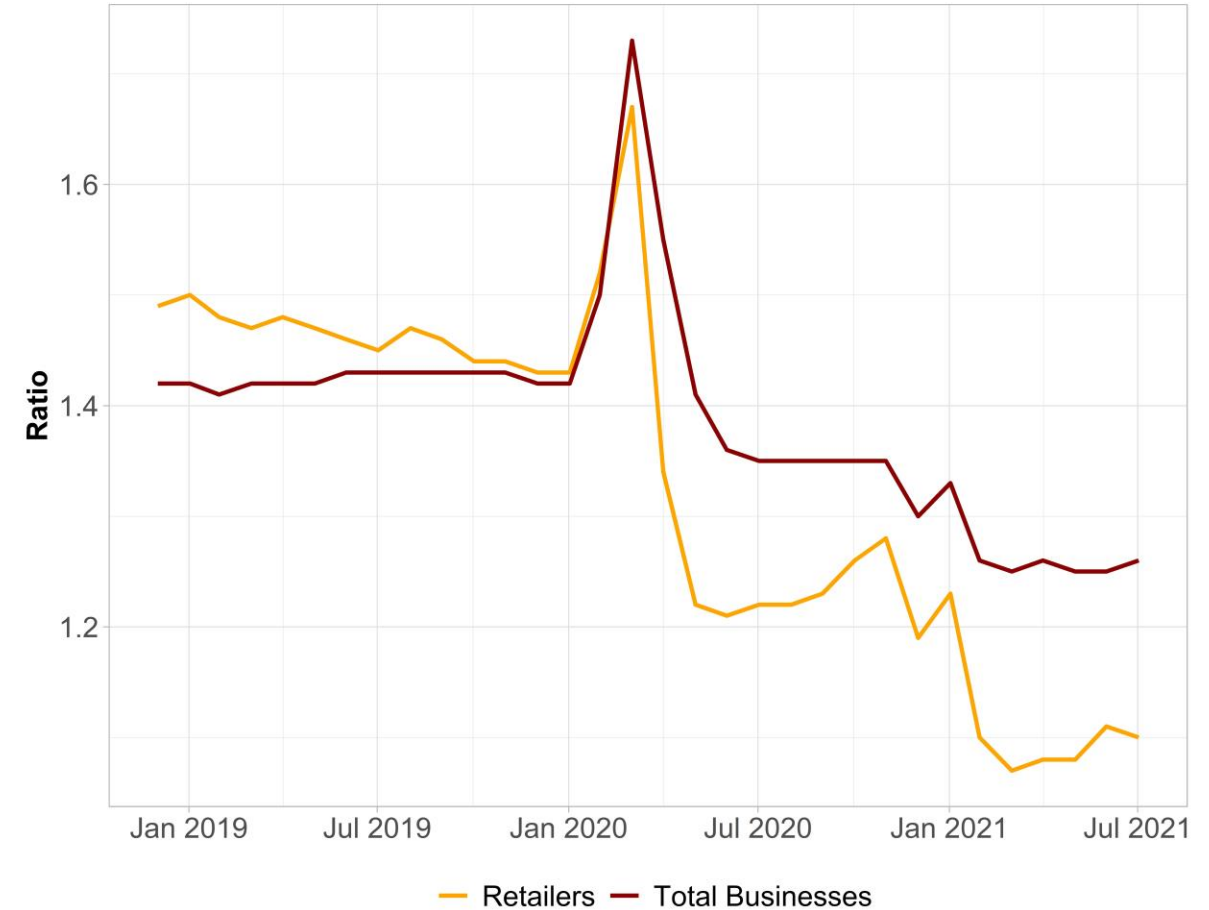


Disruptions in Supply Chains Persist with Decreasing Inventories

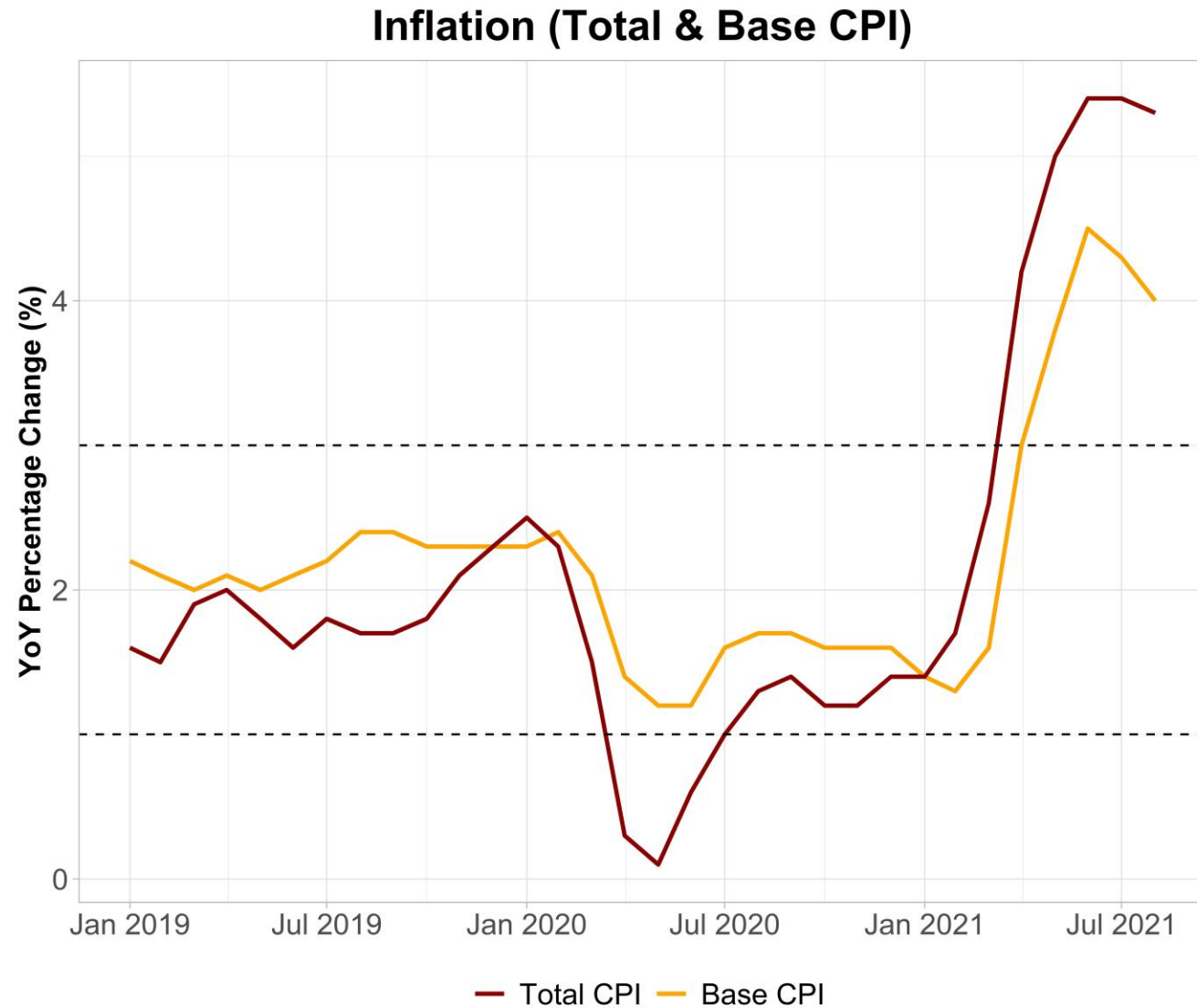
Freight Shipping Cost (US - China)



Inventories to Sales Ratio



Rising US Inflation Rates Exceeding the Target Range

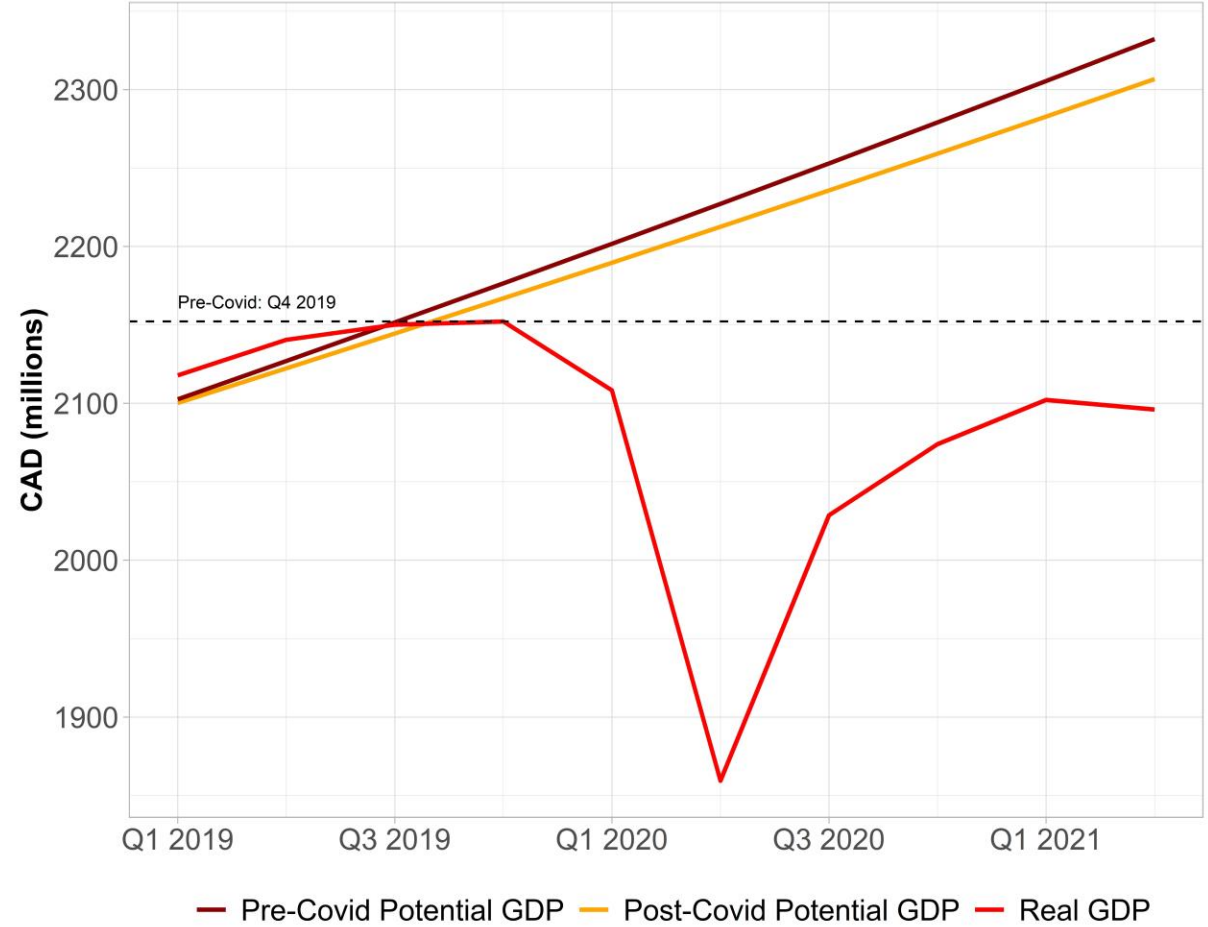


The Canadian Economy

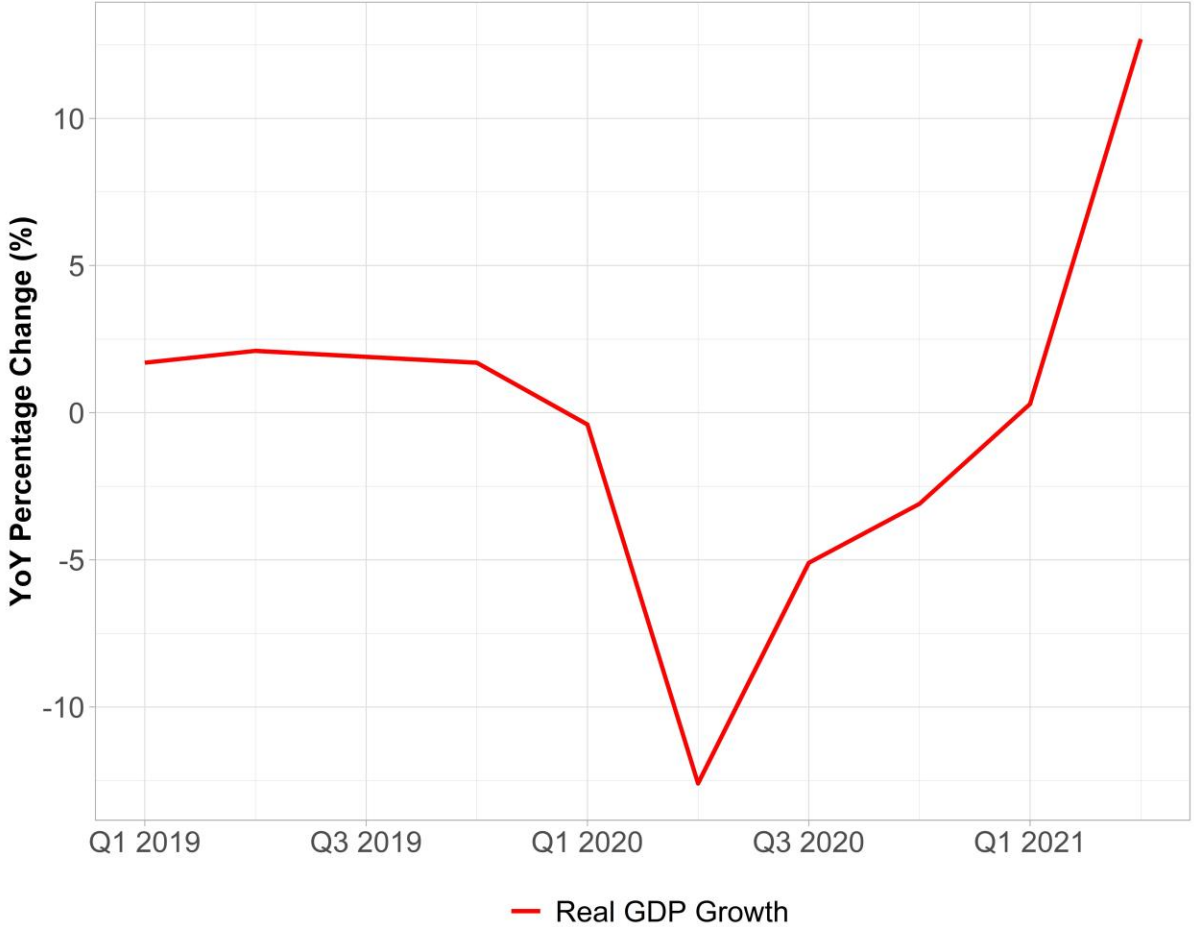
- Sub-par economic recovery from the COVID-19 crisis
- Rising optimism with recovering labor market
- Worsening supply chain trends
- Rising inflation rates
- High Bank of Canada asset levels

Canadian Output Short of Pre-Pandemic and Potential Levels

Level of Real GDP to Potential

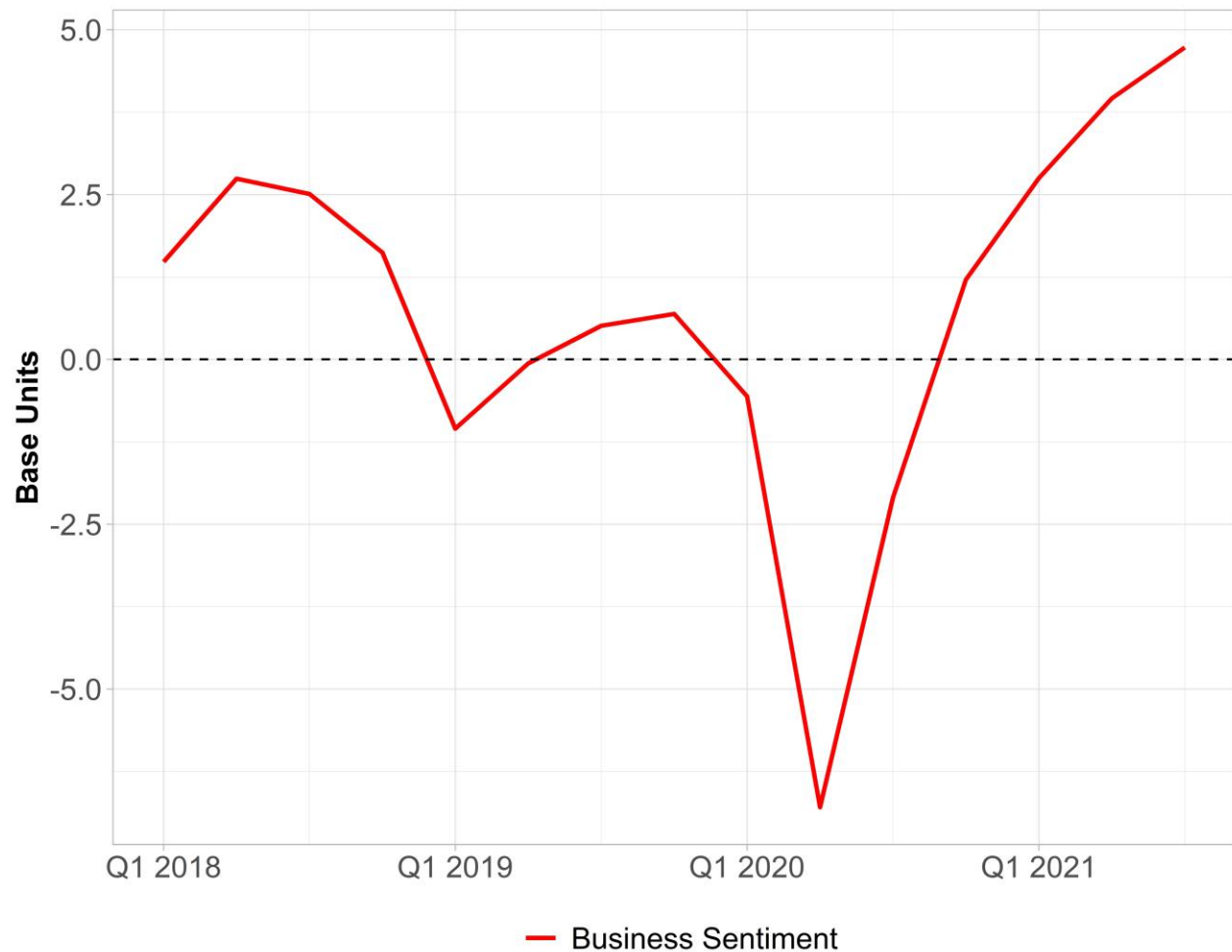


GDP Growth

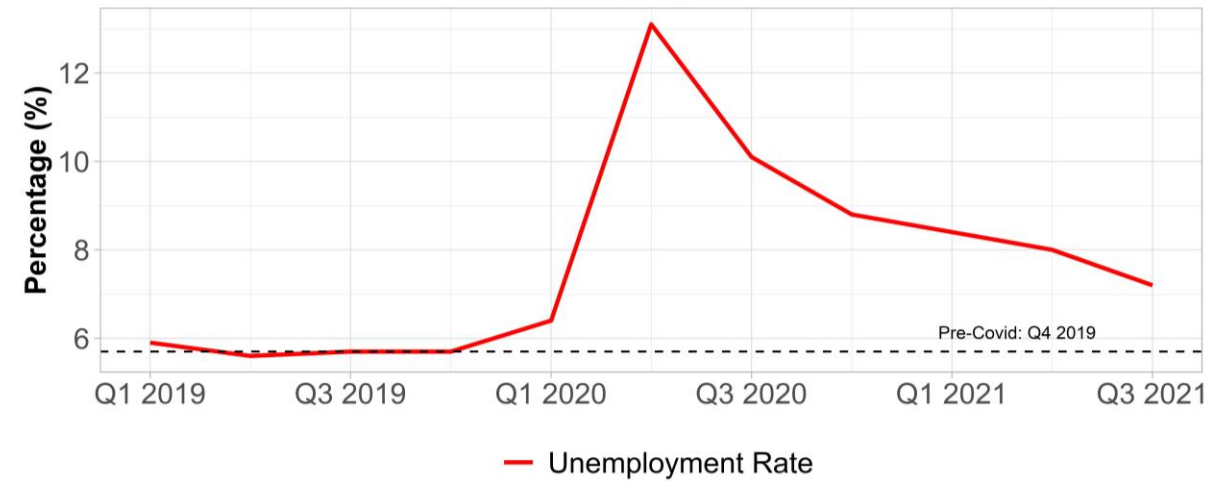


Increased Optimism in the Private Sector with Gradually Recovering Labor Market

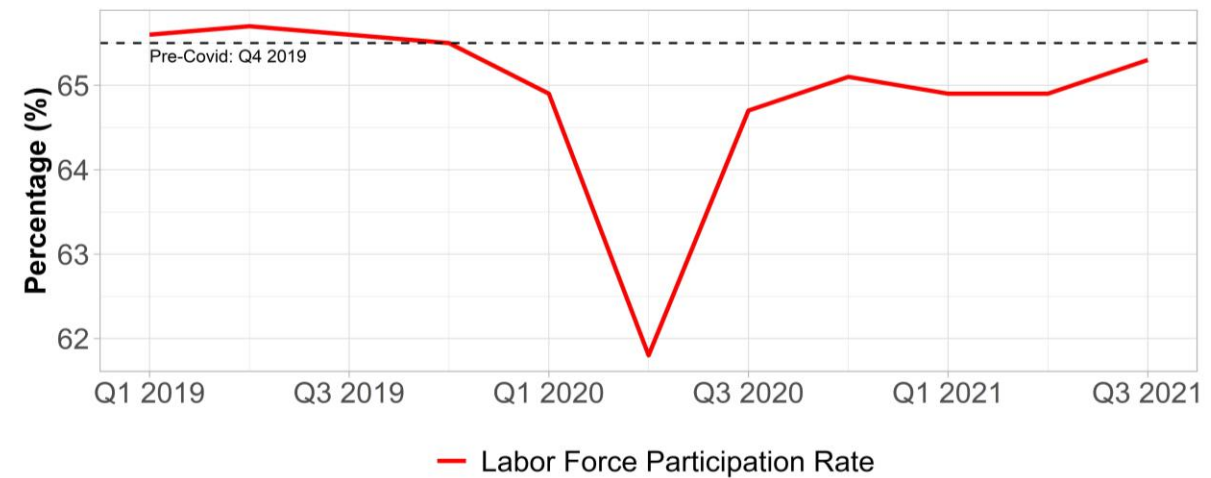
Business Sentiment



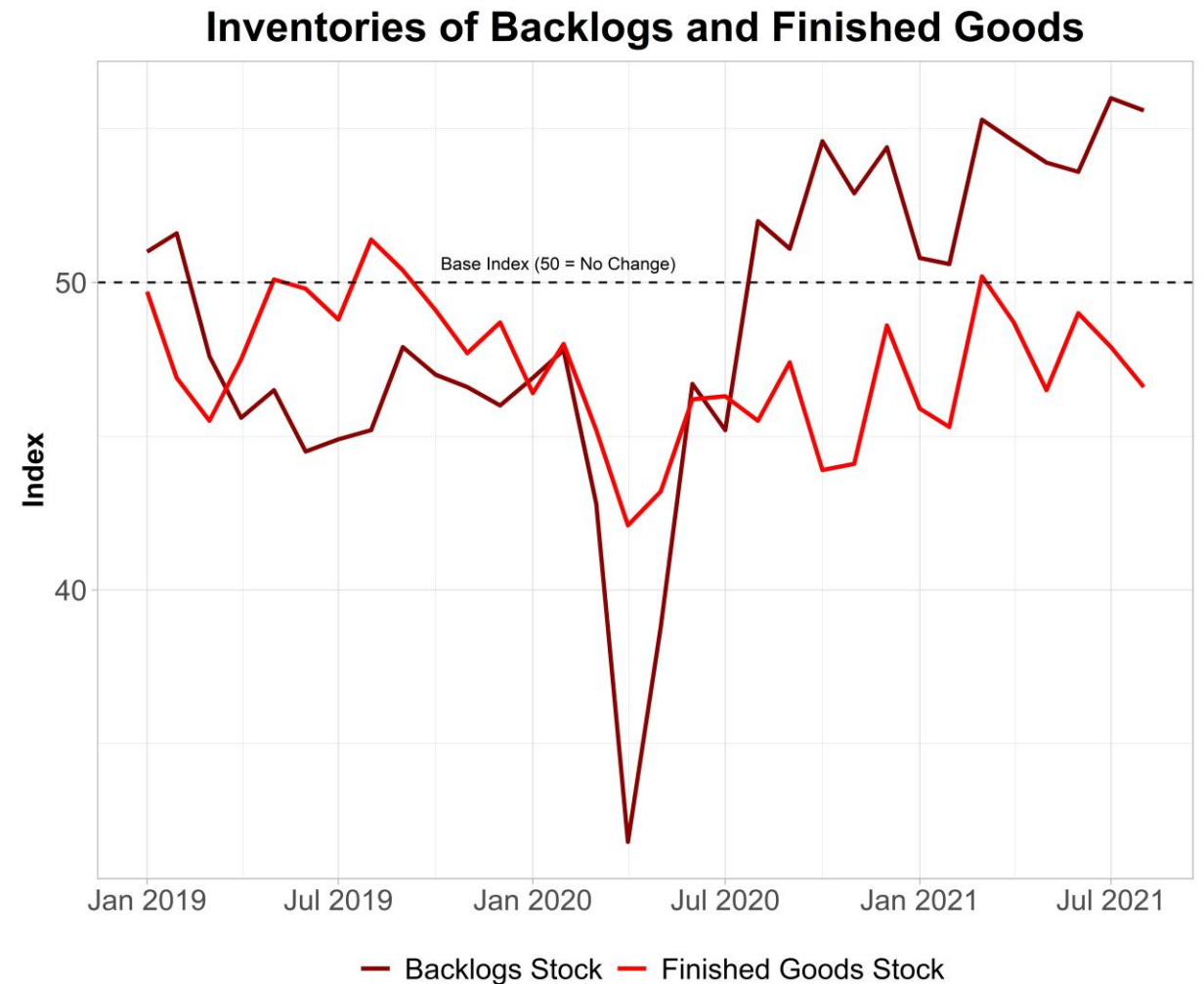
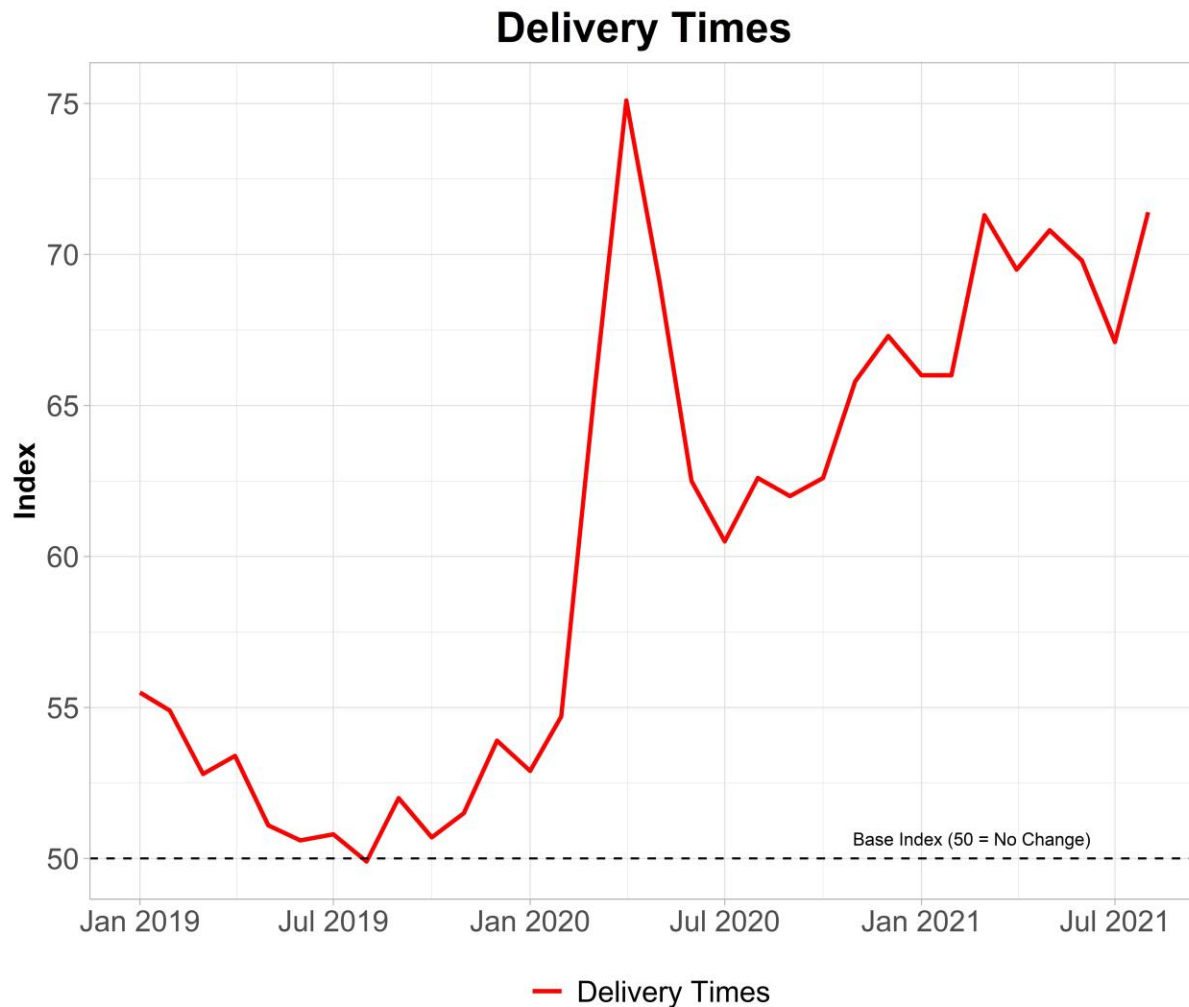
Unemployment



Labor Force Participation

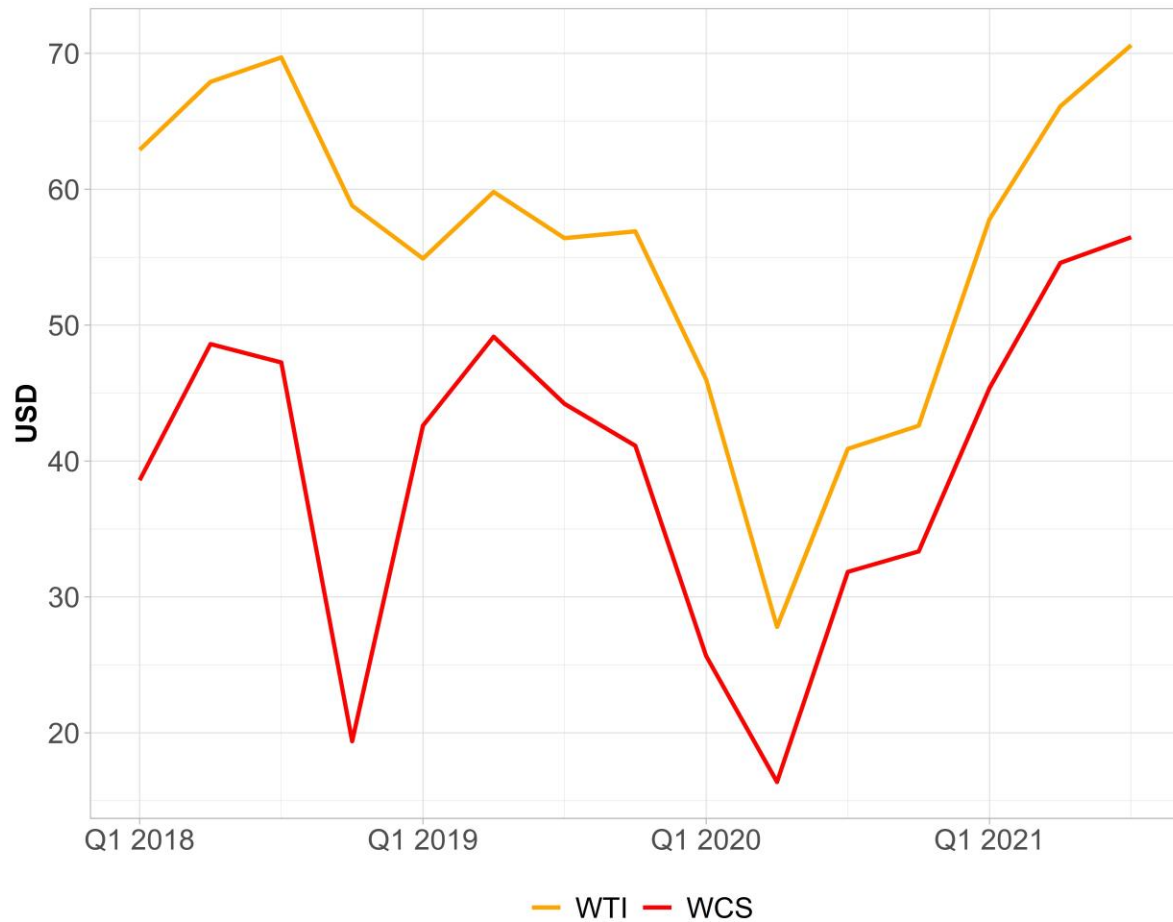


Persistence of Bottlenecks with Higher Delivery Times Increasing Backlogs

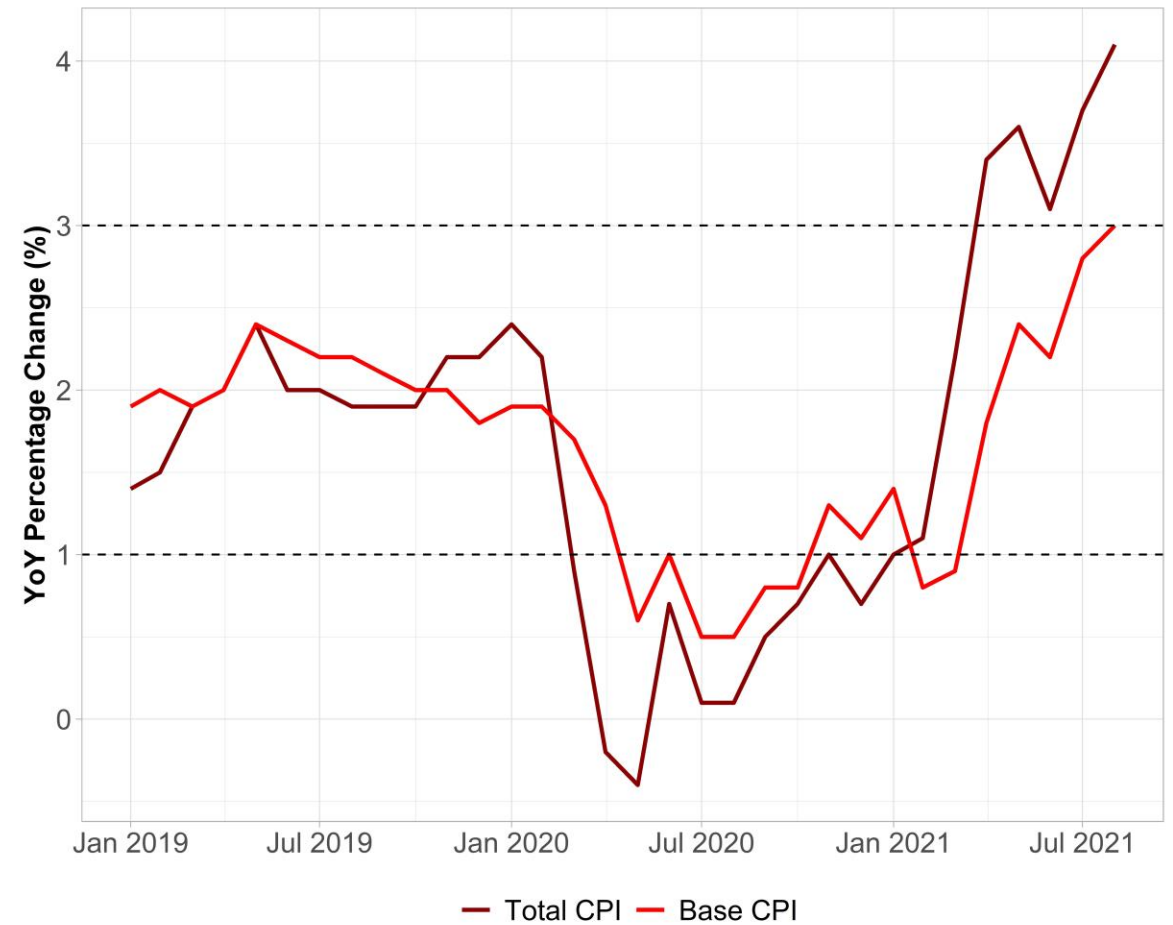


Rising Oil Prices and Inflation

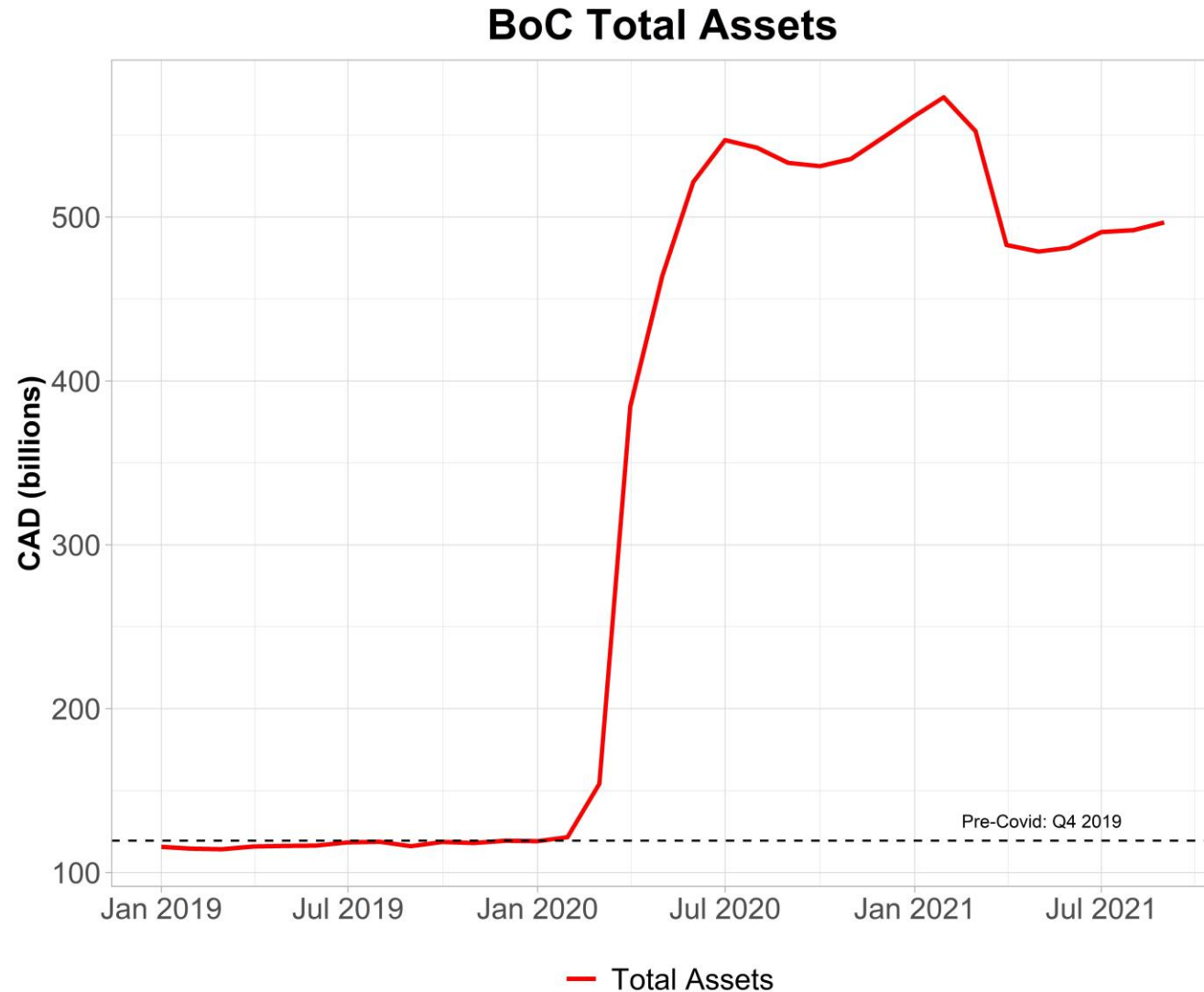
Oil Prices: WTI & WCS



Inflation (Total & Base CPI)



Emergency QE Program Leaves BoC with Historically High Assets Levels



Forecasts

- GDP and its components
- Models of inflation
ARDL, LSTM, VARX
- Unemployment considerations

Forecasts of GDP & Components

- **Model - VARX:**

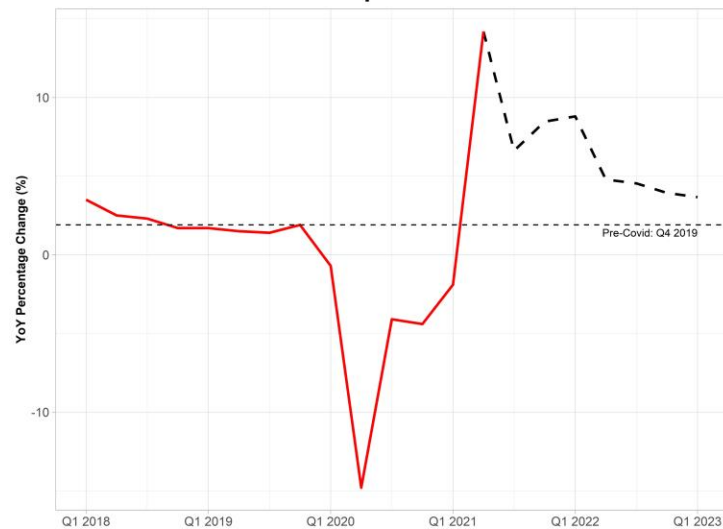
Endogenous: GDP Growth , Consumption Growth, Investment Growth, Gov. Spending Growth,
Exports Growth, Imports Growth (all YoY%)

Exogenous: US GDP Growth (YoY%), Diff. of WTI, Diff. of Federal Funds Rate,
Diff. of BoC Overnight Rate

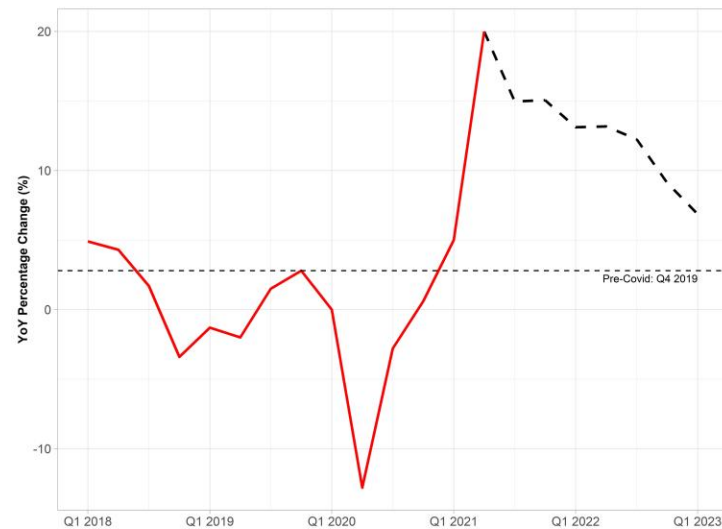
$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \beta_3 Y_{t-3} + \beta_4 Y_{t-4} + \\ \phi(L_{0/4})(GDP_{t-l}^{US}) + \gamma(L_{0/4})\Delta WTI_{t-l} + \theta(L_{0/4})\Delta FFR_{t-l} + \\ \rho(L_{0/4})\Delta BOC_{t-l}$$

Components of GDP Forecasts

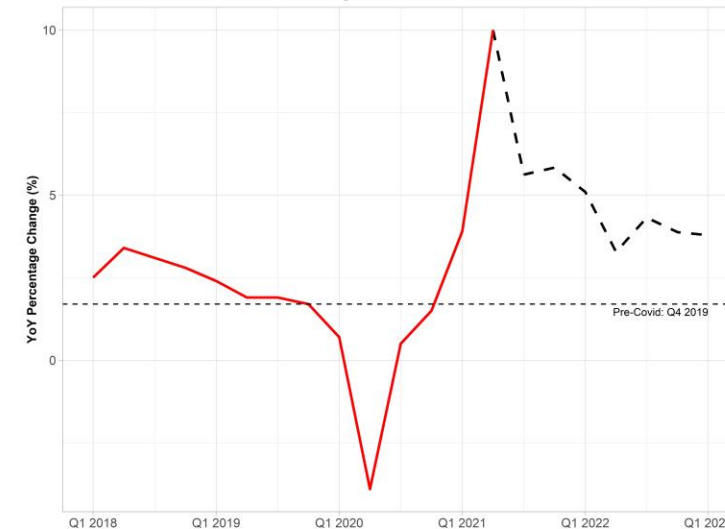
Consumption Growth



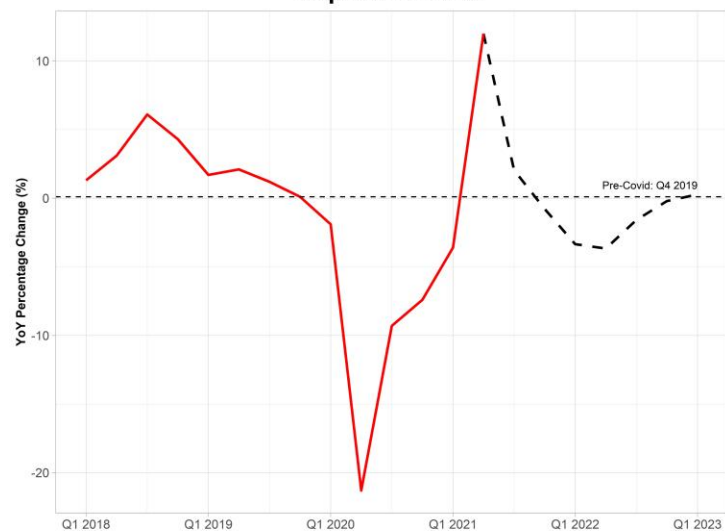
Investment Growth



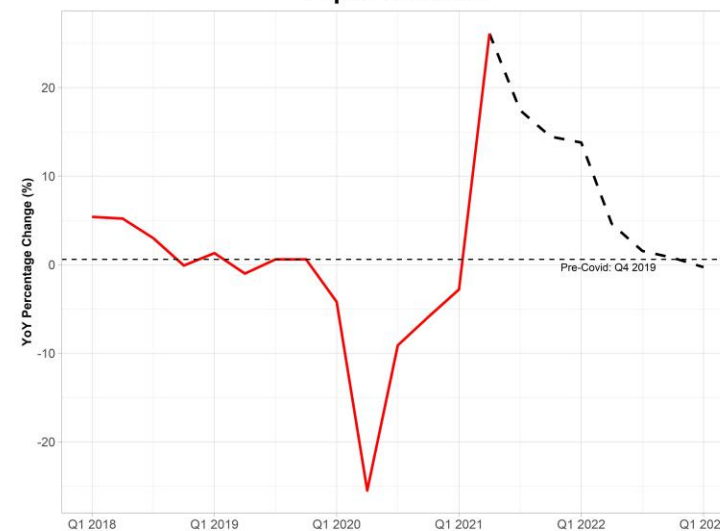
Gov. Expenditure Growth



Exports Growth



Imports Growth



Forecast of GDP Growth



Forecasted Period	Growth Rate (YoY)	GDP at t - 4	Forecast Levels	Pre-Covid Gap
Q3 2021	7.46	2004.6	2154.0	-39.9
Q4 2021	6.60	2049.4	2184.6	-70.5
Q1 2022	5.00	2077.2	2181.1	-67
Q2 2022	2.76	2071.2	2128.4	-14.3
Q3 2022	2.75	2154.0	2213.3	-99.2
Q4 2022	2.85	2184.6	2246.9	-132.8
Q1 2023	3.27	2181.1	2252.4	-138.3

Forecasts of Inflation

- **Model #1 - ARDL:**

Endogenous: Inflation (Base CPI YoY%)

Exogenous: Input Prices, Stock of Finished Goods

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \theta(L_{0/1}) \text{GOODS_STOCK}_{t-l} + \rho(L_{0/1}) \text{INPUT_PRICE}_{t-l}$$

- **Model #2 - LSTM**

Endogenous: Inflation (Base CPI YoY%)

- **Model #3 - VARX:**

Endogenous: Inflation (Base CPI YoY%),

Unemployment

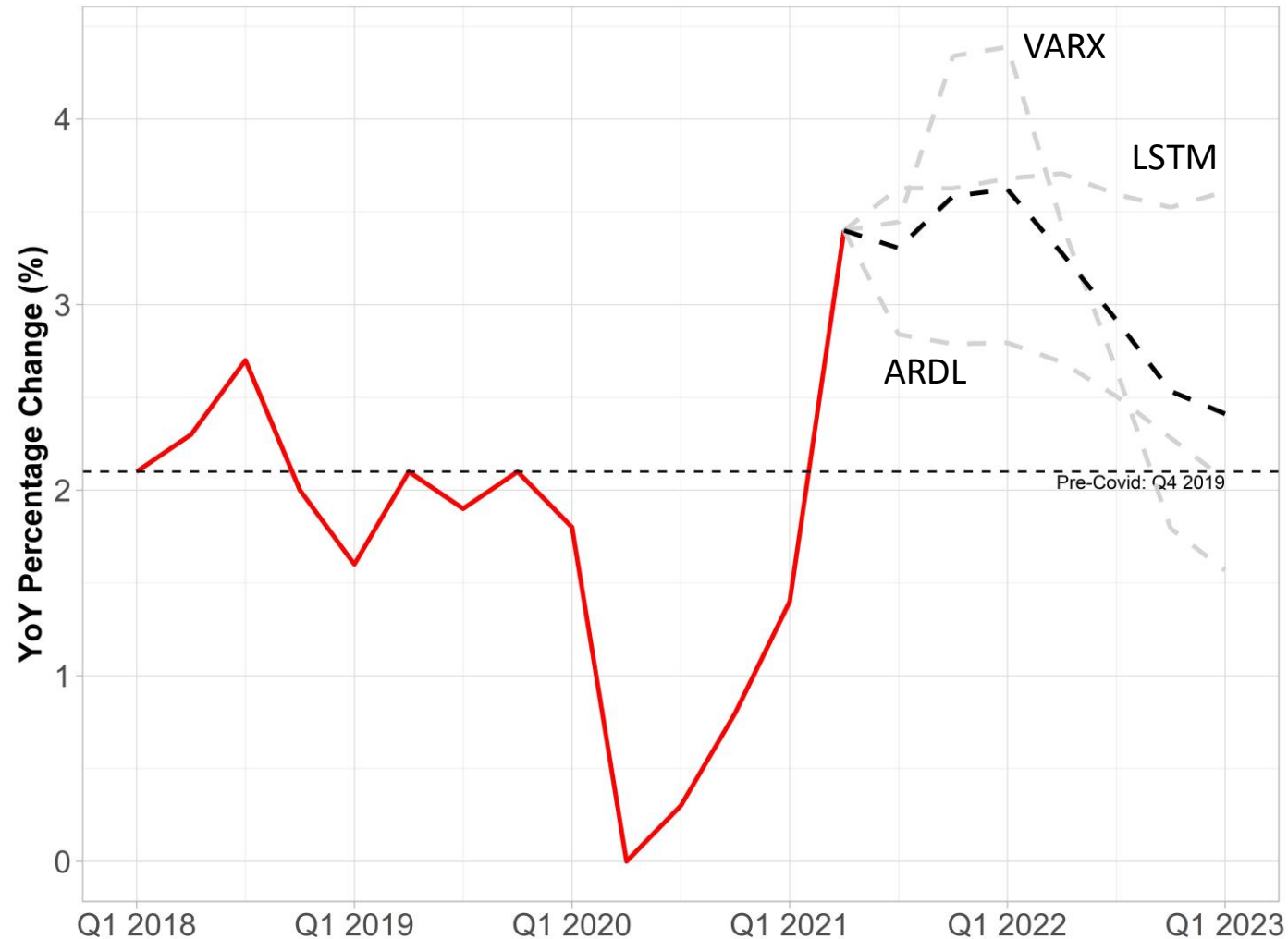
Exogenous: US GDP Growth (YoY%), Diff. of WTI,

Diff. of Federal Funds Rate, Diff. of BoC Overnight Rate, US Input Prices, Diff. Of BoC asset levels

$$X_t = \beta_0 + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \beta_3 X_{t-3} + \beta_4 X_{t-4} + \phi(L_{0/4}) \text{GDP}_{t-l}^{US} + \gamma(L_{0/4}) \Delta \text{WTI}_{t-l} + \theta(L_{0/4}) \Delta \text{FFR}_{t-l} + \rho(L_{0/4}) \Delta \text{BOC}_{t-l} + \delta(L_{0/4}) \text{INPUT_PRICE}_{t-l}^{US} + \lambda \Delta \text{BOC_ASSETS}_t$$

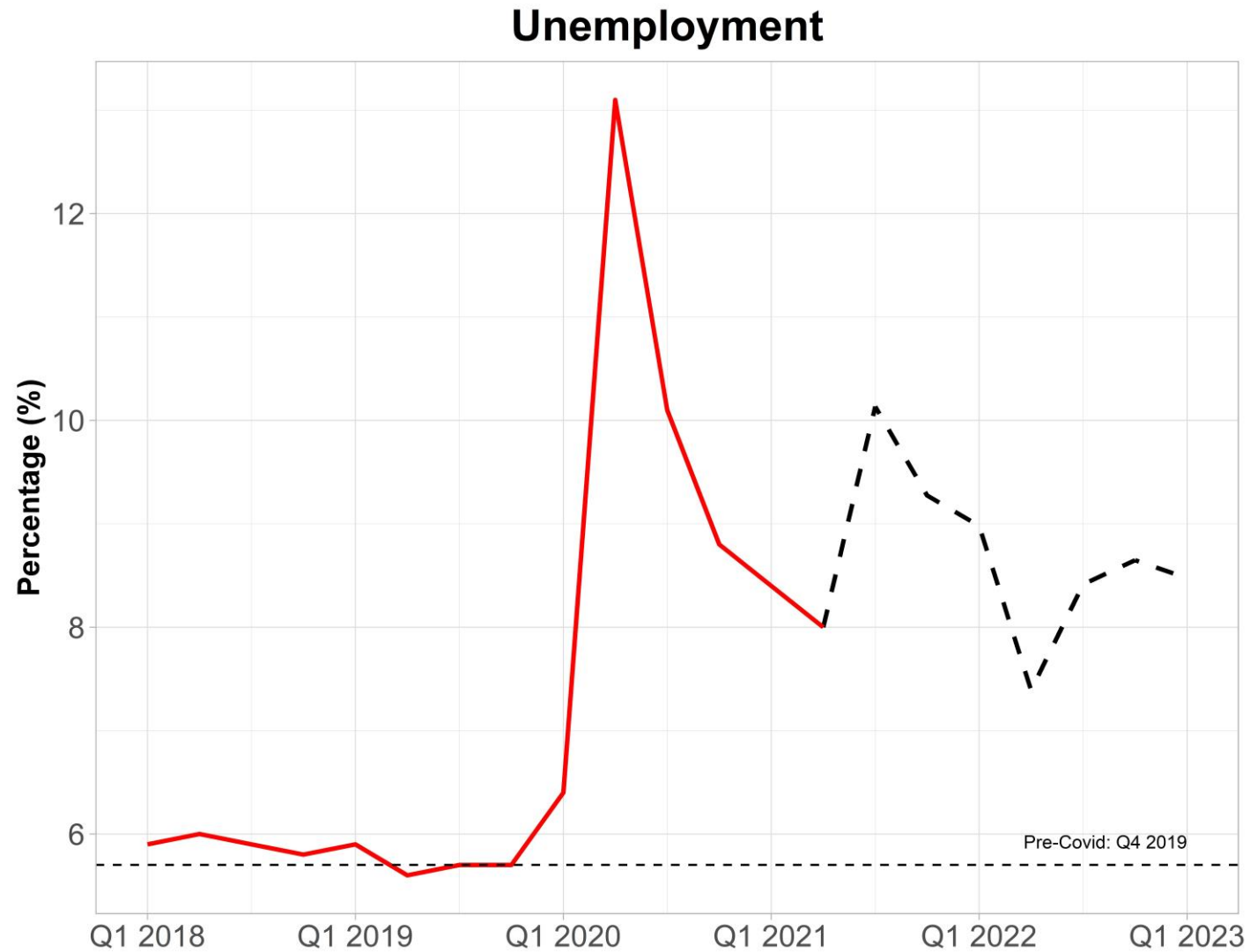
Combined Average of Inflation Forecasts

Combined Forecast



Forecasted Period	ARDL	LSTM	VARX	Average
Q3 2021	2.84	3.63	3.45	3.30
Q4 2021	2.79	3.63	4.34	3.59
Q1 2022	2.79	3.68	4.39	3.62
Q2 2022	2.69	3.71	3.44	3.28
Q3 2022	2.51	3.60	2.65	2.92
Q4 2022	2.28	3.52	1.79	2.53
Q1 2023	2.06	3.61	1.57	2.41

Forecast of Unemployment - VARX

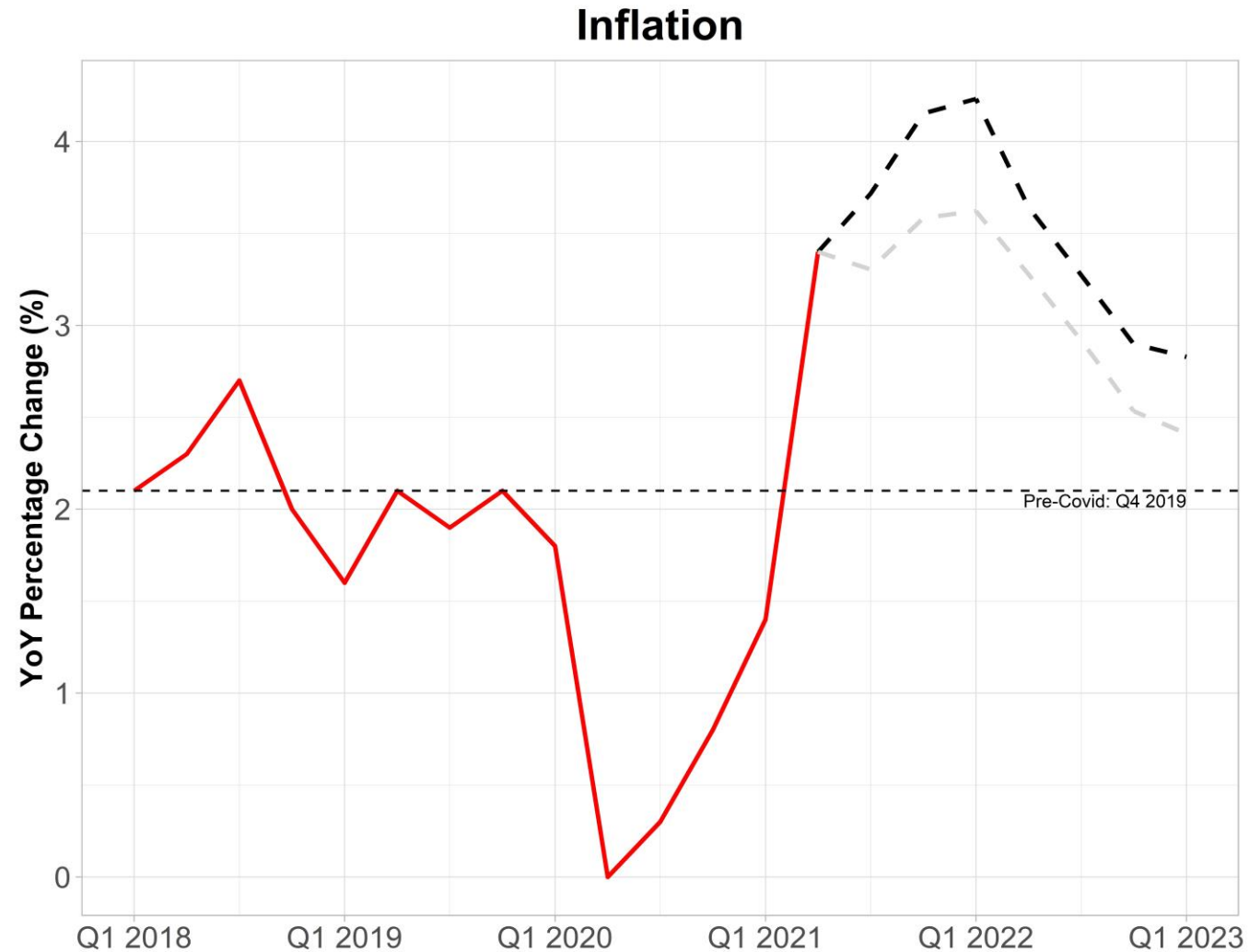


Risks

- Worsening of supply chain disruptions
- Early increases in the FFR
- Expectation downturn with the end of QE

Risk #1: Worsening of Supply Chain Disruptions

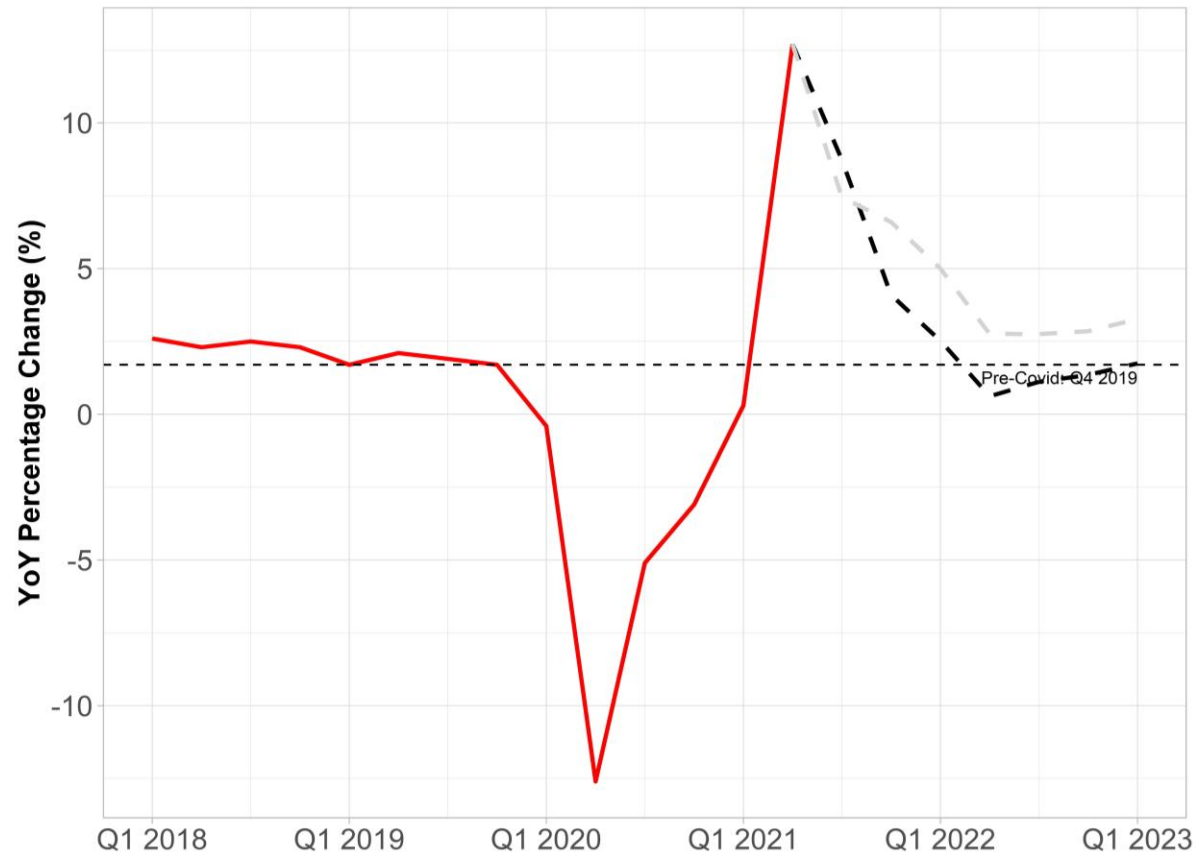
Canada: +16% input prices, +8% stocks goods ; US: +13% input prices



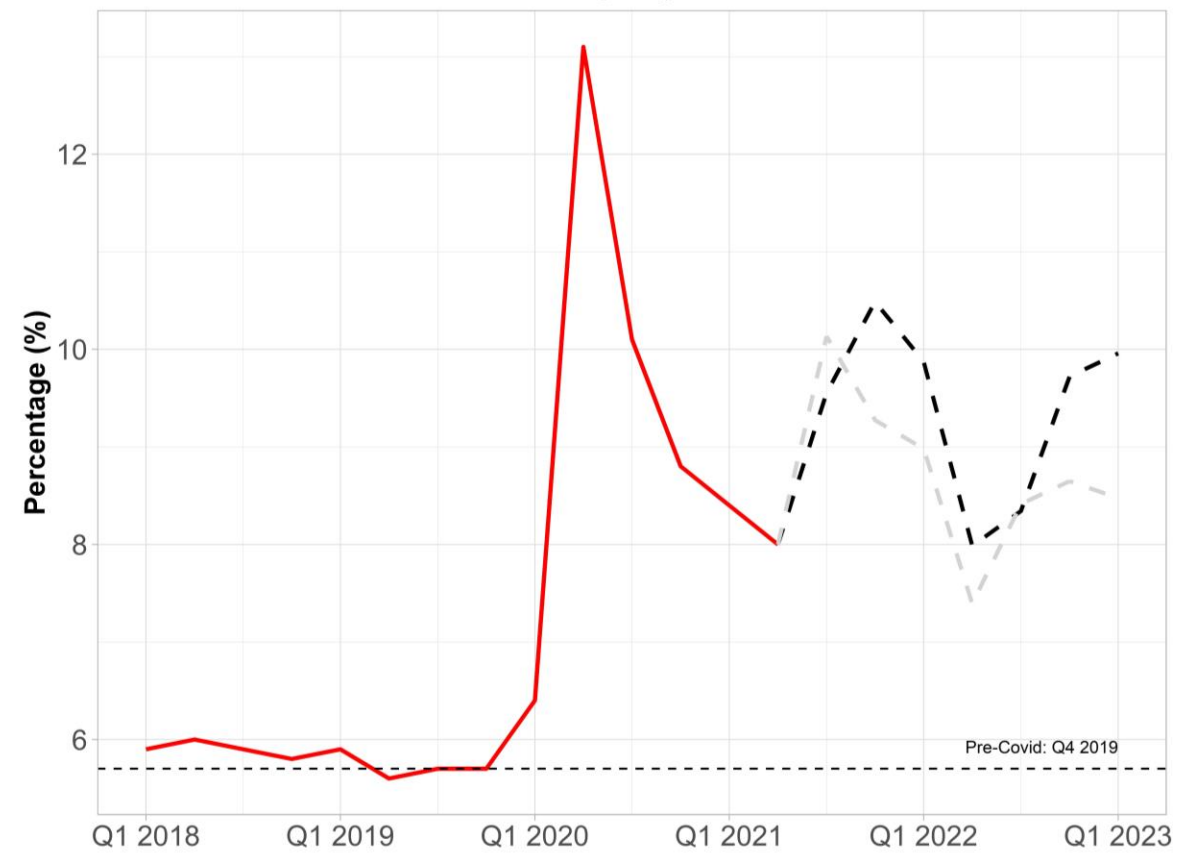
Risk #2: Early Increases in the Federal Funds Rate

Q4 2022: FFR 1.5% (+1.25bp), GDP growth (YoY) 1% (-2%)

GDP Growth



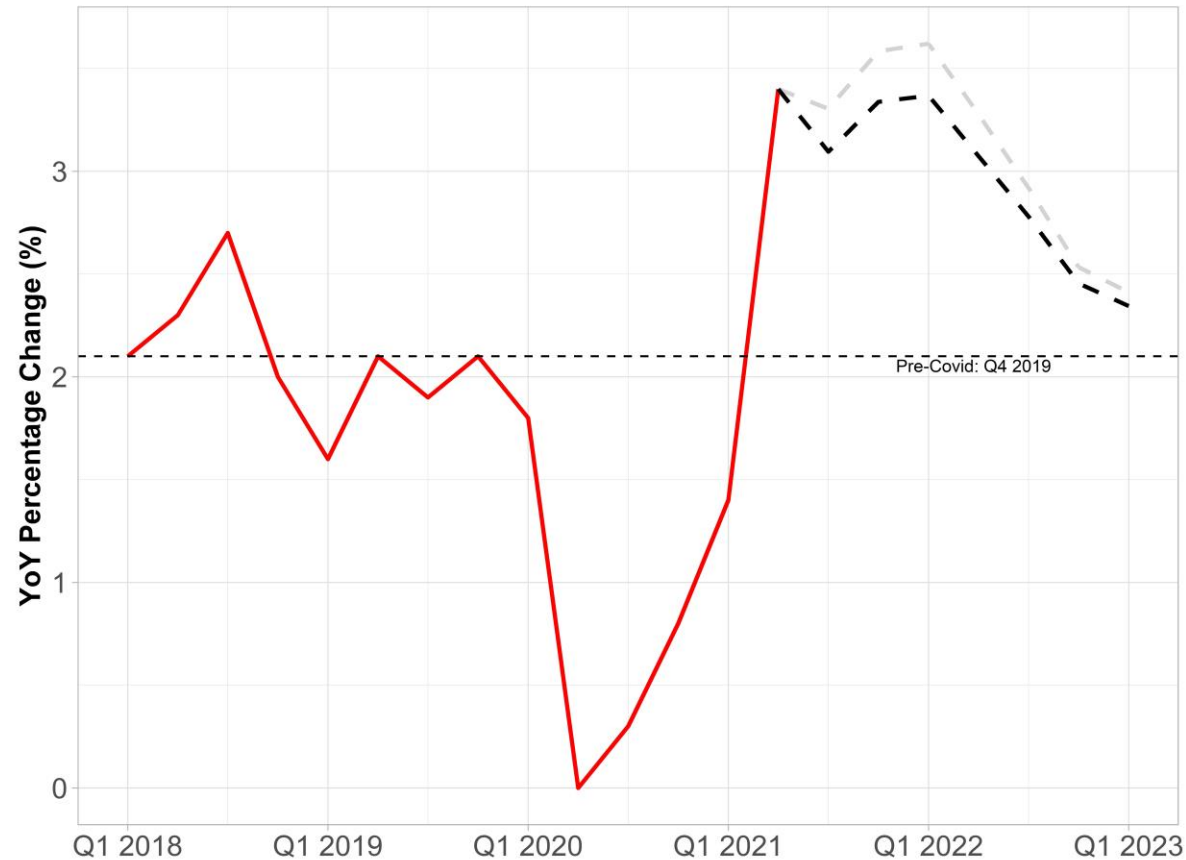
Unemployment



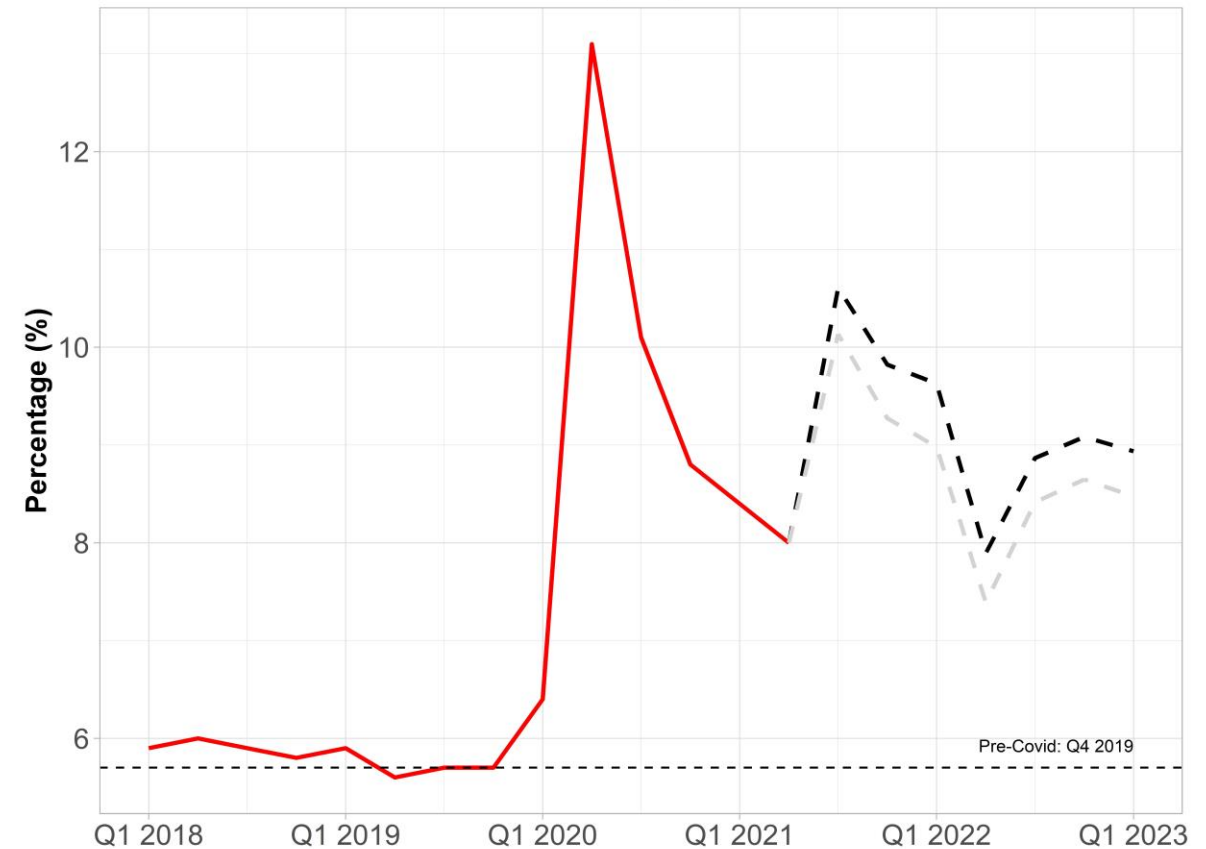
Risk #3: Downturn in Private Expectations with the End of QE

With Q4 2022: -7% BoC asset levels

Inflation



Unemployment

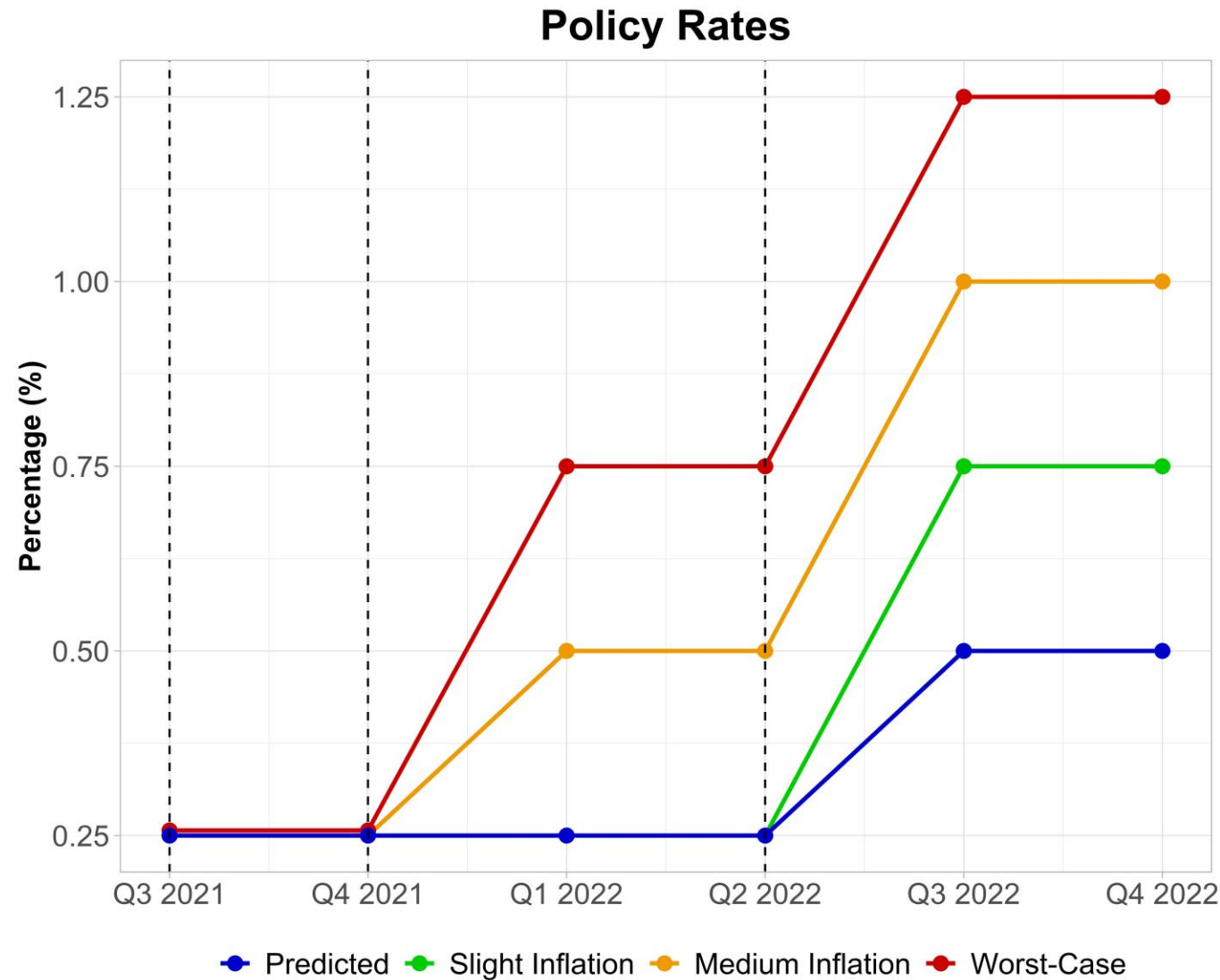


Maintain **0.25%** policy rate



- Maintaining the policy rate to not compromise growth in domestic output, with GDP expected to reach pre-COVID 19 levels by the end of **Q2 2022**
 - Understanding that historically (2000-2021) trends in inflation wane off after 4 quarters
 - Facilitating a transition towards a policy rate away from the zero lower bound, within the neighborhood of pre-pandemic levels

Conditional Policy Paths



Possible Inflation Scenarios

Q4 2021: $\pi \gg 4\%$
Q1-Q2 2022: $\pi > 3.6\%$
Q3-Q4 2022: $\pi > 2.5\%$

Q4 2021: π around 4%
Q1-Q2 2022: $\pi > 3.6\%$
Q3-Q4 2022: $\pi > 2.5\%$

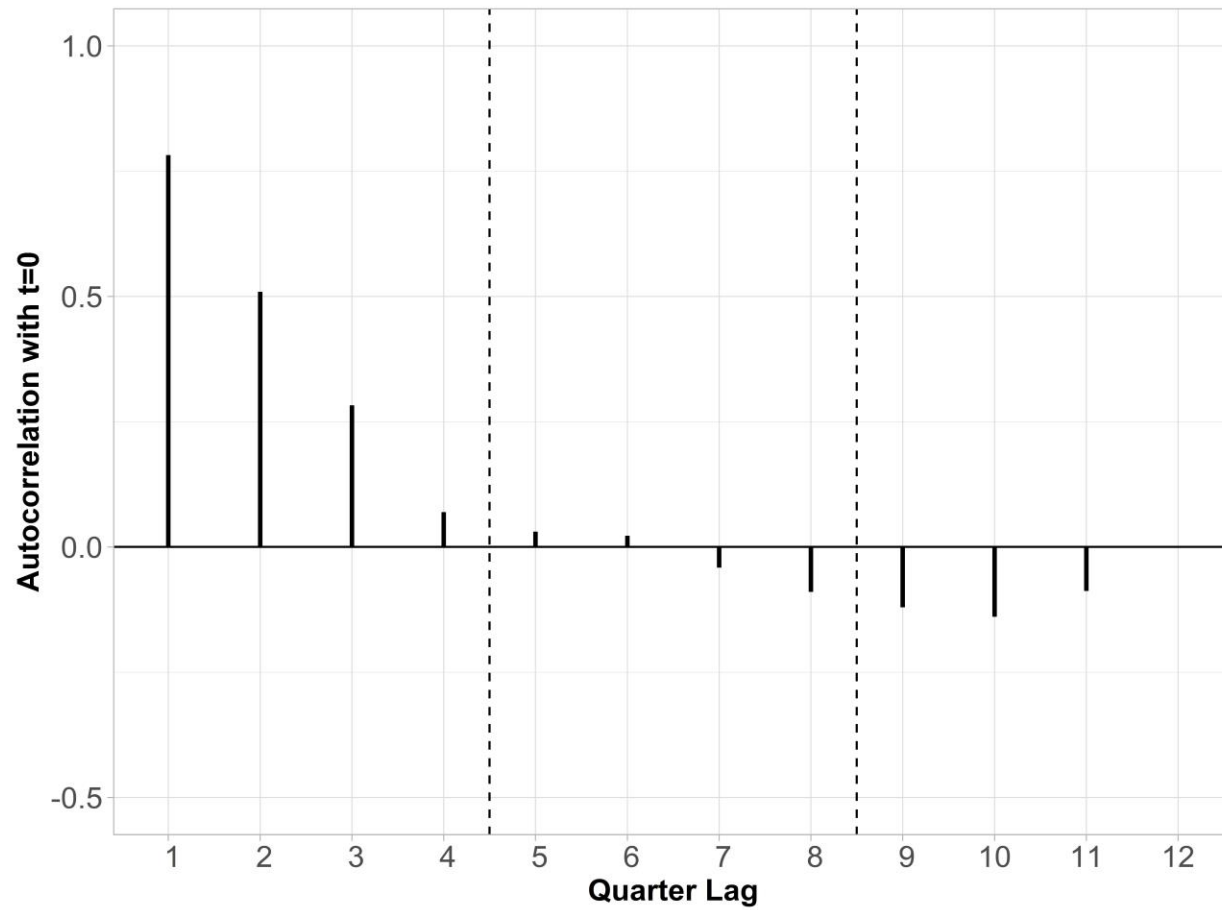
Q4 2021: π around 4%
Q1-Q2 2022: $\pi < 3.6\%$
Q3-Q4 2022: $\pi > 2.5\%$

Q4 2021: π around 4%
Q1-Q2 2022: $\pi < 3.6\%$
Q3-Q4 2022: $\pi < 2.5\%$

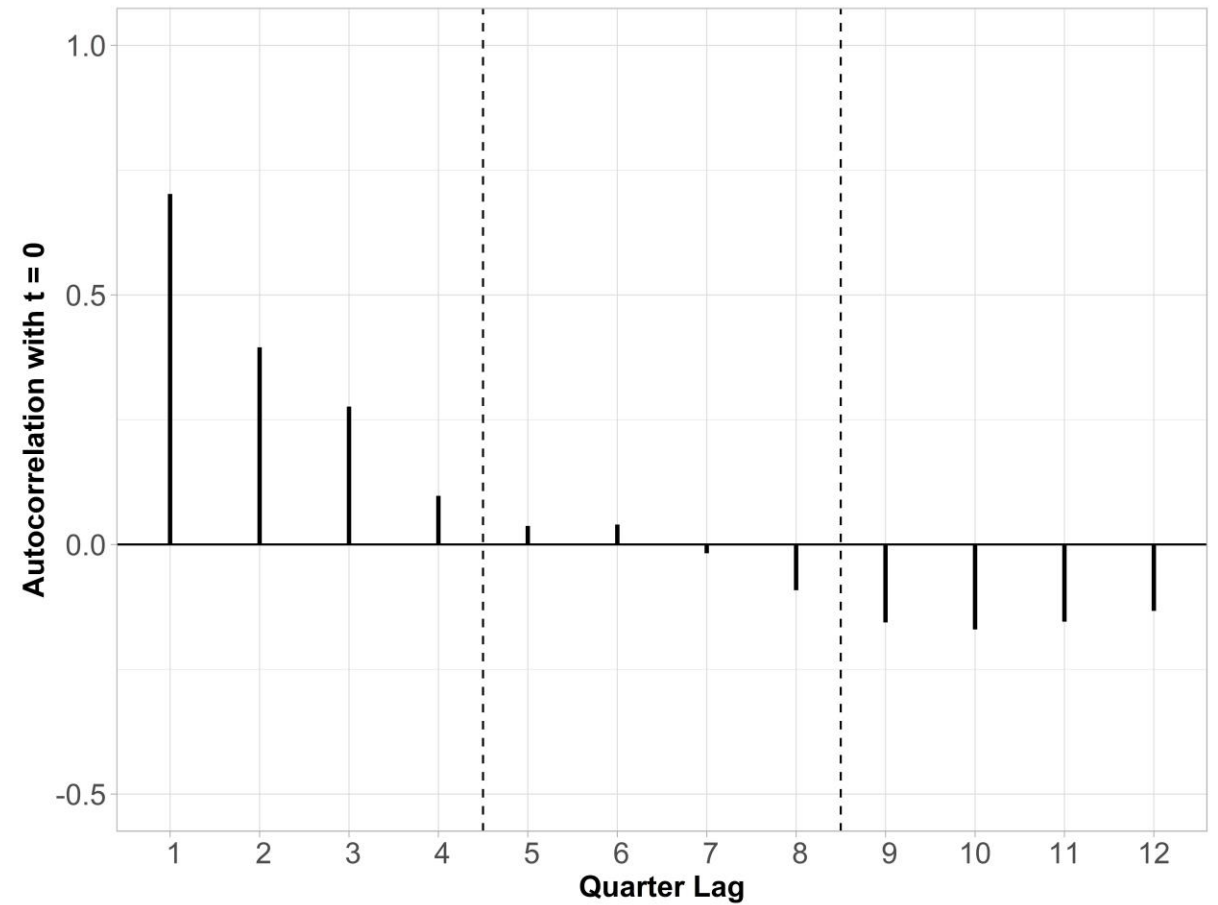
Appendices

Appendix A - Persistence of inflation in the US and in Canada

Canada: Persistence of Inflation (2000-2021)



US: Persistence of Inflation (2000-2021)



Appendix B - Policy Recommendation Conditional Paths

Q4 2021

If π around 4% :

- Maintain 0.25% policy rate
- Continue with halting of QE, transitioning into reinvestment phase

Q1-Q2 2022

If $\pi < 3.6\%$:

- Maintain 0.25% policy rate
- No change in asset purchase behavior

Q3-Q4 2022

If $\pi < 2.5\%$ and GDP has exceeded pre-COVID levels:

- Increase policy rate by 25 bp
- No change in asset purchase behavior

If $\pi > 2.5\%$:

- Increase policy rate by 50 bp

If $\pi > 3.6\%$:

- Increase policy rate by 25 bp

If $\pi > 2.5\%$:

- Increase policy rate by 50 bp

If $\pi > 3.6\%$:

- Increase policy rate by 50 bp

If $\pi > 2.5\%$:

- Increase policy rate by 50 bp

If $\pi \gg 4\%$:

- Maintain 0.25% policy rate
- Continue with halting of QE, with no advancements in reinvestment phase

Predicted Path

Q3 2021

Worst-Case Path