Crossed Wires: Does Fiscal and Monetary Policy Coordination Matter?

When monetary and fiscal policy are in conflict in periods of high inflation, with the Bank raising interest rates while the government increases new spending, the risk of an ever-growing debt burden and even higher inflation increases. However, our research shows that because people are mostly backward looking, the central bank should not stop the necessary hikes to tame inflation.

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Daniel Schwanen
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The Study In Brief

The onset of the pandemic saw a high degree of coordination between our monetary and fiscal authorities. The Bank of Canada lowered its overnight rate to its effective lower bound and engaged in quantitative easing, governments pumped in stimulus and support programs, and the Office of the Superintendent of Financial Institutions (OSFI) lowered its domestic stability buffer to add extra lending space for Canada's largest financial institutions. Despite a short and sharp drop in economic growth in the first half of 2020, these coordinated policies were broadly a success.

However, since April 2021, inflation in Canada has far exceeded the top end of the Bank of Canada's inflation target range (1-3 percent). The Bank, which was slow off mark, is now sharply tightening monetary policy, and the federal government has shrunk the deficit through higher tax revenue from higher inflation. But it has also added new spending to the mix.

In this paper, our goal is to understand how these fiscal and monetary authority interactions – be they in coordination or in conflict – at different points in the cycle (e.g., recession/recovery), affect macroeconomic expectations, and, as a result, macroeconomic outcomes. While our findings are relevant in Canada's current context, critically, they apply more generally as well.

Economic theory suggests that under coordination, because rational households and businesses anticipate that the monetary and fiscal authorities will work together, the recession is less severe, and the recovery is stronger, happening at a quicker pace. Under conflict, theory suggests that governments continue to accumulate debt, which fuels inflation, while the central bank raises rates to lower inflation, causing the servicing cost of debt to rise. This debt burden will dampen the economic recovery and has the potential to cause a double-dip recession.

To test this economic model of policy conflict and coordination, we designed a lab experiment where participants, consisting of undergraduate students from diverse disciplines, interacted in a *simulation economy* and were asked to make predictions about future macroeconomic outcomes.

The primary policy conclusion from our experimental findings is that people do not exhibit sufficiently forward looking behaviour for expectations of future policy conflict to matter. People respond to the recent state of the economy and not on how fiscal and monetary authorities will react at some future moment in time. In other words, participants use some form of historical information to formulate their expectations, with the large majority of them using historical trends to forecast inflation and the output gap (between actual and potential output).

These findings have implications for both governments and the Bank of Canada. Ideally, with the Bank firmly in a tightening cycle to get inflation under control, governments would contribute to this fight by not adding new spending. This would help achieve those necessary results. However, should this not be the path fiscal authorities choose, while conflict might make things harder, our results suggest that the optimal path for the Bank of Canada is to continue its tightening cycle to get inflation back under control in order to re-anchor inflation expectations.

Central banks and governments can, and often do, act in coordination with one another to achieve common macroeconomic objectives.

An example of such coordination occurred at the start of the pandemic crisis, when monetary and fiscal authorities across multiple jurisdictions aligned their policy tools in an attempt to stabilize economies facing unprecedented lockdowns. Here in Canada, the Governor of the Bank of Canada, the Minister of Finance, and the Superintendent of Financial Institutions announced a series of coordinated measures in March 2020, in order to prevent an economic crisis from turning into a full-blown financial crisis. Despite a short and sharp drop in economic growth in the first half of 2020, these coordinated policies were broadly a success.

However, a combination of continued fiscal stimulus, unforeseen supply-side issues, e.g., the war in Ukraine, and monetary policy that was slow to tighten, have forced the central bank to turn its attention to fighting inflation, the likes of which we haven't seen since the early 1980s. The Bank has responded by hiking the overnight rate 325 basis points since March 2022. Fiscal policy has been more mixed in its response, on the one hand shrinking the projected budget deficit – buoyed by higher tax revenue as a result of high inflation – and, on the other, using this windfall to add $11.3 billion in new spending.[1]

If the mix of fiscal and monetary policy persists beyond what can be plausibly explainable, there is a risk that the public may come to doubt the credibility of the government's fiscal framework and its commitment to long-run debt sustainability. Fiscal policy would then be fundamentally incompatible with the Bank of Canada's inflation targeting mandate.

In this paper, we consider how expectations about this type of conflict affect outcomes for economic growth and inflation. Economic theory (see, for example, Bianchi and Melosi 2019) predicts that central banks and governments can achieve desired outcomes if their fiscal and monetary policies are coordinated rather than in conflict. These conclusions stem, to a large extent, from the assumption that people/agents in the economy form forward-looking, rational expectations. We use an experimental lab setting to test these assumptions and predictions.

The primary policy conclusion from our experimental findings is that people do not exhibit sufficiently forward-looking behaviour for expectations of future policy conflict to matter.[2] We observe that people respond to the recent state of the economy and not on how fiscal and monetary authorities will react at some future moment in time. It might be tempting to conclude that expected future policy coordination is not important, but we would frame it differently. What

1   https://www.reuters.com/markets/canada-cuts-202223-deficit-forecasts-pledges-targeted-new-spending-2022-11-03/
2   While we don't elicit participants' confidence in their forecasts or the policy decisions of the government or central bank, we do explicitly convey to participants the policy actions that will take place. In other words, participants have no uncertainty about actions. Even in the absence of policy uncertainty, participants are insufficiently forward-looking.

Key Concept Explainer

Fiscal and Monetary Policy, Togetherness is Best: Theory has it that government fiscal policy and the Bank of Canada's monetary policy work best in coordination. In periods of high inflation, the government reduces, or holds the line, on spending to lessen demand in the economy, while the Bank raises interest rates through its main policy tool, the overnight rate, to do the same. In recessionary times they can work in tandem to stimulate economic recovery through increased spending (the government) or lower interest rates and quantitative easing (the Bank).

When the two policies conflict in inflationary times, theory suggests that governments continue to accumulate debt, which fuels inflation, while the central bank raises rates to lower inflation, causing the servicing cost of debt to rise. This debt burden will dampen the economic recovery and has the potential to cause a double-dip recession.

We tested these theories of coordination and conflict in a lab experiment with undergraduate students from diverse disciplines. Given simulated economic conditions, they were asked to predict economic outcomes. The results were surprising. They suggest that people update their expectations about future inflation based on current and previous trends, regardless of coordination or conflict between monetary and fiscal authorities. As a result, regardless of what government does, the optimal path for the Bank of Canada is to continue its tightening cycle to get inflation back under control in order to re-anchor inflation expectations.

is most important for policymakers is not allowing a recession to become too severe or inflation expectations to become unanchored; i.e., going from a state where households/businesses expect low inflation to having very little idea of where it is headed.

In other words, acting quickly and decisively, and seeing results, is critical for economic stability. This finding is generalizable, both in the current context, and looking ahead to future periods of economic uncertainty.

MOTIVATION

The onset of the pandemic saw a high degree of coordination between our monetary and fiscal authorities. Facing an unprecedented economic lockdown and recession, the Bank of Canada lowered the overnight rate by 50 basis points to 1.25 percent on March 4. That was an extremely rare break from the pattern over the last two decades of 25 basis point moves. On March 11, the federal government jumped in with a $1 billion spending package. However, both sides, along with the Office of the Superintendent of Financial Institutions (OSFI), realized quickly that this support would be insufficient. On March 13, the Bank announced a surprise inter-meeting[3] drop of the overnight rate – another 50 basis points, and a Bankers' Acceptance Purchase Facility to support small and medium-sized enterprises (SMEs). The federal government added a $10 billion credit

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3 The Bank meets eight times a year, at predetermined dates, and announces the new target for the overnight rate. By inter-meeting we mean a new target rate announced in between those predetermined dates.

facility, again to help SMEs, and OSFI lowered the domestic stability buffer, a Canada-specific capital requirement of our systemically important financial institutions, by 125 basis points, with a commitment to leave it at the new lower level for at least the next 18 months. OSFI estimated this would add an extra $300 billion in lending space for Canada's largest financial institutions.

This was just the beginning of measures by the Bank of Canada and federal government. The Bank would begin its first foray into quantitative easing (unlike the Federal Reserve, the Bank did not use quantitative easing during the 2008 global financial crisis). In addition, it moved beyond sovereign debt (federal government treasury bills and bonds) and purchased provincial government and private-sector debt. The result: assets on the Bank of Canada's books grew from $120 billion in March of 2020 to a peak of $575 billion in early 2021.

At least as it pertains to the first part of the crisis, these programs demonstrated the importance of acting quickly and decisively in a coordinated fashion (see, for example, Ambler and Kronick 2020). Liquidity access improved immensely after worrying spikes in spreads and borrowing costs for even the safest asset, i.e., Government of Canada debt. Further, in many instances, these programs had a much lower uptake than expected, e.g., provincial debt programs, which was an indication of the importance of the Bank simply announcing that it stood ready to make these purchases. And, lastly, their use declined fairly quickly. For example, the Bankers' Acceptance Purchase Facility had no demand by the end of July 2020.

At the same time that the Bank was pumping liquidity into the system to prevent an economic crisis turning into a financial one, the federal government was adding to its fiscal support, primarily through the Canada Emergency Response Benefit (CERB) and the Canada Emergency Wage Subsidy (CEWS). The former was geared at those workers who were directly impacted by the pandemic lockdowns, and paid $500 a week to those eligible. The latter evolved over time in terms of who was eligible and how a business qualified, but in principle, the concept was the same: employers that lost a certain percentage of their revenue qualified for a wage subsidy.

The Canadian economy, after the two largest monthly declines in GDP on record in March and April of 2020, began a rebound in May that has continued ever since, though with bumps along the way.[4]

However, since April 2021, inflation in Canada has far exceeded the top end of the Bank of Canada's inflation target range (1-3 percent), which reflects the Bank being slow off the mark in tightening monetary policy, alongside continued fiscal stimulus. As the Bank tightens monetary policy - to the tune of 325 basis points since March, fiscal policy has been mixed, on the one hand having its shortfall shrink as a result of higher tax revenue from higher inflation, while on the other hand spending some of that windfall on new government spending.

In this paper, our goal is to understand how these fiscal and monetary authority interactions – be they coordination and/or conflict – at different

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4   We note there are a number of inherent coordination features between monetary and fiscal authorities in Canada. First, inflation targets are the joint property of the Minister of Finance and the Bank of Canada. Second, the *Bank of Canada Act* requires regular meetings between the Governor of the Bank of Canada and the Minister of Finance to discuss policies, and also requires the Bank to act as the Government's agent in the debt market. Third, they sit together on different committees including, for example, the Heads of Regulatory Agency Committee, chaired by the Governor. Lastly, certain elements in the monetary policy transmission process, e.g. the mortgage market, are heavily regulated by Finance.

points in the cycle (e.g., recession/recovery), affect macroeconomic expectations, and, as a result, macroeconomic outcomes.[5] While our findings are relevant in Canada's current context, critically, they apply more generally as well.

Predictions under Rational Expectations

We focus our study on a scenario where an economy is in the middle of a recession with the expectation that it is headed for an economic recovery with excess demand. At such a point, there are essentially four paths forward:

- A monetary-led coordinated scenario – where the central bank, once in excess demand, actively works to bring inflation back to target by raising the interest rate, and where the government commits to stabilizing the debt-to-GDP ratio so as not to further stimulate demand, which would place further upward pressure on prices;

- A fiscally led coordinated path – where the government does not stabilize the debt-to-GDP ratio, or, at least, continues to further stimulate economic growth, and where the central bank takes a "passive" stance on inflation, resulting in inflation remaining above target and thus helping with the higher debt load;

- A conflict scenario with fiscally led resolution – where the government initially pursues an expansionary fiscal policy despite the economic recovery moving into excess demand, while the central bank pursues a more aggressive contractionary monetary policy to tame price increases, and ultimately the government "wins" with the central bank taking a more passive stance to inflation; and

- A conflict with monetary-led resolution – where, again, the government initially pursues an expansionary fiscal policy in the economic recovery while the central bank pursues a more aggressive contractionary monetary policy, but this time the central bank "wins" and the government is forced to rein in its spending.[6]

The anticipation of policy conflict after a recession is predicted to generate deeper and more severe recessions during the economic downturn (Bianchi and Melosi 2019). If governments continue to accumulate debt, which fuels inflation, while the central bank raises rates to lower inflation, the servicing cost of debt will rise. This debt burden will dampen the economic recovery and has the potential to cause a double-dip recession. If people are sufficiently forward looking in the midst of a recession, they will form more pessimistic expectations as they anticipate the consequences of policy conflict. During an economic recovery,

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5   The literature on the linkages between monetary and fiscal policy is lengthy. Using standard macroeconomic models (see, for example, Woodford (2003) and Gali (2015)), in a typical recession, the combination of conventional monetary policy and fiscal automatic stabilizers produces positive business cycle outcomes (smoother economic shocks). However, atypically large negative economic shocks that force the overnight rate to its effective lower bound lead central banks to turn to more unconventional monetary policy, such as forward guidance and/or quantitative easing. While successful in stabilizing the economy and financial markets, the central bank's ability to further stimulate the economy and get inflation back to target on its own are more limited, as we saw after the financial crisis. Such a scenario requires even stronger coordination between monetary policy and fiscal policy (see, for example, Corsetti et al. (2019)). Additional government spending will stimulate demand, putting upward pressure on marginal costs, which puts upward pressure on prices, bringing inflation back to target. Of course, this can be taken too far, as we have seen of late in terms of above-target inflation in most of the developed world.

6   Setting the conflict as temporary is necessary in order to generate a stable equilibrium. Without defining the end of the conflict period, inflation, output, and debt set out on an explosive path. Our experiments test whether this stability through defining an end to the conflict holds in practice.

households and businesses, aware of the policy conflict, expect even higher inflation, leading to actual higher inflation, which negatively affects central bank credibility.

Under the coordinated scenarios, because rational agents anticipate that the monetary and fiscal authorities will work together, the recession is less severe, and the recovery is stronger, happening at a quicker pace. Fiscally led coordinated scenarios typically lead to stronger recoveries (as measured by output) with the additional boost from government spending, but at the expense of inflation above target.

In these economic models, coordination is key for dealing with business cycle fluctuations. Crucially, the typical economic models that make these predictions depend on the assumption that people are forward looking; that is, they anticipate the actions of the central bank and the government in the future, and update their inflation expectations accordingly in the present. We ask whether this is true: are people as forward looking as models assume? If they are not – or, at least, not as much as we think – we ask if it is most important for authorities, whether fiscal or monetary, to act quickly, and to get inflation (and other important macroeconomic variables) under control as fast as possible regardless of what the other is doing.

Experimental Design

To test this economic model of policy conflict and coordination, we designed a lab experiment where participants, consisting of undergraduate students from diverse disciplines, interacted in a *simulation economy* and were asked to make predictions about future macroeconomic outcomes, including inflation. Lab experiments are becoming more and more common in macroeconomics as the underlying assumptions of many economic models have been called into question. Box 1 describes how a macroeconomy can be implemented in the lab using Learning-to-Forecast Experiments (LtFEs),

first developed by Marimon and Sunder (1994) and extended for macroeconomic questions by Adam (2007). By using a simplified model economy, we can see how people form beliefs and make decisions based on the information they are presented with, and whether they behave in the same way that economic theory would expect them to.

Participants were tasked with playing the role of professional forecasters and would be incentivized to make forecasts about inflation and output in a simulated LtFE economy. Appendix A provides quantitative details of the experimental economy. In our economy, participants' forecasts and exogenous (external) shocks to aggregate demand feed into the economy's data-generating process (DGP) and drive aggregate dynamics.

During the instruction phase, we provided participants with complete information about the structure of the economy, including detailed information about the government debt level, the tax rate, and the interest rate to inform their decisions. They were informed that they would interact in an economy for 30 rounds, which would consist of two or three phases of unspecified length. In Phase 1 (which lasted 10 rounds), the economy was in a recessionary, low-demand state, and both the government and the central bank would be engaging in expansionary fiscal and monetary policy in order to stimulate demand. In the remaining phases, the economy would return to the high-demand state. Depending on the treatment, the monetary and fiscal authorities entered the recovery phase(s) either coordinating their policy decisions or in conflict. For the remaining 20 rounds, phases 2 (11-20 in conflict or to 30 in coordination) and 3 (21-30 only in conflict), as the economy returned to a high-demand state, participants would find themselves in one of the four scenarios we described above: either a monetary-led coordinated recovery; fiscally led coordinated recovery; a conflict recovery with a fiscally led resolution; or a conflict recovery with a monetary-led solution.

Box 1: Experimental Economics Applied to Macroeconomics

Laboratory experiments have been used for decades in economics to study the predictions of theory and their underlying assumptions. More recently, lab experiments have been applied to macroeconomic models where assumptions of agents' behaviour are critical to the resulting policy prescriptions. Experiments can be particularly useful to obtain data when there are relatively few real-world examples to study and it is difficult to identify the causal effects of, say, policy on the economy.

In a macroeconomics experiment, the researchers build a virtual economy for participants to interact in. The role that participants take depends on the research question and the type of behaviour of interest. For instance, firm price-setting questions would have participants play the role of firms; dynamic optimization questions might have participants play the role of consumers. The researchers systematically vary features of the economy to make causal inferences.

Experimental frameworks. There are many ways to design a laboratory macroeconomy. In this study, we use learning-to-forecast experiments (LtFEs) to understand how individual and aggregate expectations respond to policy coordination. LtFEs are an apparatus to study forecasting behaviour both at the individual and aggregate level. They are very useful for studying how expectations respond to shocks, structural features of the economy, policy, and communication. Data from LtFEs can provide valuable insight into how to more realistically model expectations under different scenarios (see Hommes (2021) for an extensive survey of the literature). Because the participants' task is limited to forecasting, LtFEs are not useful in studying questions related to optimization such as intertemporal planning, investment and price-setting. These other questions are better suited for consumption-smoothing experiments (Carbone and Hey 2004, Brown et al. 2009, Meissner 2016) and production economy experiments (Lei and Noussair 2002, Fenig et al. 2018, Noussair et al. 2021).

Who are the participants? Undergraduate students from a wide range of disciplines. Undergraduates are typically recruited as they have lower opportunity costs for their time and they can learn the rules and procedures of an experimental game quickly.

What is their task? To submit accurate forecasts about macroeconomic variables such as inflation and output gaps between an economy's potential and actual output.

How are participants incentivized? In LtFEs, the more accurate each of their forecasts are, the more points they will earn. At the end of the experiment, their total points are converted into cash at a pre-specified exchange rate.

How does the economy evolve? In LtFEs, there is an underlying data-generating process (DGP) that drives the macroeconomic dynamics (see Appendix A). For macroeconomic research questions, it is typically assumed that the economy follows the dynamics of a simple, linearized (straight line approximation around a given point) New Keynesian model where the

Box 1: Continued

real side of the economy (the output gap), inflation, and the nominal interest rate are pre-specified. The experimental economy's DGP is pre-calibrated to match parameters commonly used in the macroeconomics literature and is typically derived under the assumption that agents forecast in a model-consistent, forward-looking manner.[a] Each period in the experimental economy is calibrated to be one quarter. The economy evolves each period according to a set of exogenous shocks and, importantly, aggregate expectations. Aggregate expectations are sourced from participants' forecasts of the subsequent period's inflation and output. Importantly, this framework assumes that underlying this economy are households and firms who would form forecasts identically to the participants. That is, participants' forecasts have, to some degree, a self-fulfilling effect on the aggregate economy.

a   It may be the case that participants do not form rational expectations, in which case the pre-specified DGP may be incorrect. This inconsistency can be tackled by using a more complex underlying DGP (see Kryvtsov-Petersen 2021 and Mauersberger 2021).

In the (coordinated) monetary policy Led (MP Led) treatment, we informed participants that:

> "When consumer demand eventually recovers, output and inflation will begin to rise. The government and central bank will follow a coordinated strategy to simultaneously reduce debt and inflation. The government will reduce its spending and collect more taxes to reduce its debt level, i.e., run fiscal surpluses. The central bank will begin to raise the interest rate more than one-for-one with inflation."

During the economic recovery, participants were told that taxes and the interest rate will be calculated as follows:

$$Tax_t = 0.966\ Tax_{t-1} + 0.009\ Output_t + 0.002\ Debt\ Level_{t-1}$$

$$Interest\ Rate_t = 0.657\ Interest\ Rate_{t-1} + 1.2\ (Inflation_t - 0) + 0.09\ (Output_t - 0)^7$$

Increasing the amount of tax collected will reduce the government's debt level. Raising the interest rate will make it more expensive for households and firms to borrow, thereby reducing demand and indirectly reducing inflation. Higher interest rates also cause the government's debt level to rise. This will, in turn, lead to higher taxes as the government aims to stabilize its debt level.

In the (coordinated) fiscal policy led (FP Led) treatment, we informed participants that:

> "When consumer demand eventually recovers, output and inflation will begin to rise. The government and central bank will continue to follow a coordinated strategy to keep the economy growing. The government will reduce its spending but will continue to ignore its debt level when deciding how much to collect in taxes. The central bank will continue to respond weakly to any changes in inflation."

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7   The subtraction of '0', here and in other equations, indicates a deviation of inflation and output from their respective steady state, which we set to zero in our experimental model.

As above, we informed participants on how the path for taxes and the interest rate would be calculated:

$$Tax_t = 0.65 \ Tax_{t-1} + 0.098 \ Output_t$$

$$Interest \ Rate_t = 0.657 \ Interest \ Rate_{t-1} + 0.236 \ (Inflation_t - 0) + 0.091 \ (Output_t - 0)$$

As output and inflation improve, the government will spend less. This, together with growing inflation and relatively low interest rates, will help the government to reduce its debt level.

In the two conflict treatments, participants were informed that:

> "When consumer demand eventually recovers, output and inflation will begin to rise. The government and central bank will face a conflict in how to approach the recovery. The government will reduce its spending but will continue to ignore its debt level when deciding how much to collect in taxes. The central bank, on the other hand, will begin to raise the interest rate more than one-for-one with inflation."

Taxes and the interest rate were calculated as follows:

$$Tax_t = 0.65 \ Tax_{t-1} + 0.098 \ Output_t$$

$$Interest \ Rate_t = 2 \ (Inflation_t - 0) + 0.265 \ (Output_t - 0)$$

By increasing the interest rate, the central bank aims to reduce inflation. The combination of lower inflation and higher borrowing costs, exacerbates the government's debt level.

In the conflict then monetary policy led (ConflictMP) treatment, participants were told that eventually the conflict would end and the government would begin taxing more to manage its debt level.

Participants were informed that once the conflict ended, taxes collected by the government would be given by:

$$Tax_t = 0.966 \ Tax_{t-1} + 0.009 \ Output_t + 0.002 \ Debt \ Level_{t-1}$$

Participants were also told that the central bank would continue to aggressively adjust its interest rate to keep inflation and output gap close to target, and interest rates would follow the following path:

$$Interest \ Rate_t = 0.657 \ Interest \ Rate_{t-1} + 1.2 \ (Inflation_t - 0) + 0.091 \ (Output_t - 0)$$

In the conflict then fiscal policy led (ConflictFP) treatment, participants were told that eventually the conflict would end and the central bank would lessen its response to inflation. The government would continue to ignore its debt level when deciding how much to collect in taxes. The only change once the conflict ended was to the central bank's interest rate response to inflation:

$$Interest \ Rate_t = 0.657 \ Interest \ Rate_{t-1} + 0.236 \ (Inflation_t - 0) + 0.091 \ (Output_t - 0)$$

Relatively lower interest rates, together with higher inflation, will help the government to reduce its debt level.

We provided participants with complete information about the economy's structure, including a full quantitative model that clarified the relative importance of different variables in driving inflation and the output gap (see Appendix A). Importantly, they had complete information about the economy's structure, the monetary and fiscal authorities' policy rules, and that the economy would go through two or three phases. Participants did not know when the economy would move from the low to the high state, nor did they know when the conflict would end (in the conflict treatments). The experimental economy is directly modeled on the theoretical framework of Binachi and Melosi (2019). While monetary policy directly influences aggregate demand, fiscal policy – namely, the government's debt level – can only impact the economy through its effect on expectations.

Under the assumption that the public is forward looking, the conflict scenarios are predicted to produce short-run economic instability as the

government's debt grows rapidly in response to the central bank's aggressive response to inflation.

Appendix B has the parameter values used for each treatment.

Lab Results

In this section, we ask whether our experiments confirm the following conclusions from standard economic theory:

- the recessions are deeper and more severe under policy conflict;
- the recovery is stronger and happens more quickly under policy coordination;
- recoveries are stronger in coordination – whether it be right after the low demand state or after conflict – under fiscally led scenarios, but at the expense of having inflation above target.

Figures 1 and 2 show the results in both theory and in the lab under both the monetary (coordinated and conflict) and fiscal (coordinated and conflict) scenarios, respectively. The lines for the experiment (black-dashed lines for coordination and gold-dashed lines for conflict) represent median values across treatments. The gray-dashed (coordinated) and black solid (conflict) line are the results from running the Bianchi and Melosi (2019) model using the parameters in Appendix B.

What is most important in interpreting these graphs is not the quantities themselves, but the directions relative to standard economic theory and the differences when comparing different scenarios.

Prediction 1: Initial Recessions are Deeper in Policy Conflict Situations

Finding 1: Lab results predict recessions are NOT deeper in policy conflict situations.

Our first testable hypothesis is that the initial recessions are deeper in policy conflict situations than they are in coordination situations both in the monetary-led and fiscally led scenarios.

We do not find support for this hypothesis. Specifically, the median results during the recession (phase 1) when we compare coordination versus conflict in each of the monetary and fiscally led scenarios are almost indistinguishable (Figures 1 and 2). Future policy mix makes little difference during the recession phase.

Putting numbers to this finding, in the monetary policy scenarios, the average output gap trough is -945 basis points when there is coordination and -934 basis points in conflict (Figure 3). Similarly, in the fiscal policy scenarios, the average output gaps are -903 basis points under coordination and -933 basis points in conflict. Comparing the two types of scenarios, we find that coordination and conflict scenarios experience comparable troughs during the recession phase of the experiment.[8] This irrelevance of policy type (coordination versus conflict) is due to subjects failing to incorporate the impending conflict – and the monetary-policy induced contraction – into their expectations.

Prediction 2: Recovery is Stronger and Faster with Policy Coordination

Finding 2: Lab results suggest recovery is strongest and fastest under monetary-led policy coordination

Our second testable hypothesis was that the output gap rebound when the economy returned to normal was greater with coordination – regardless of being fiscal versus monetary-led – as was the speed with which the recovery occurred.

Our experiments provide mixed support for these predictions. On the one hand, the peak of

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8   To test the significance of the differences we did a two-sided Wilcoxon rank sum test, which gave a p-value of 1.00), meaning we cannot reject the null of no difference.
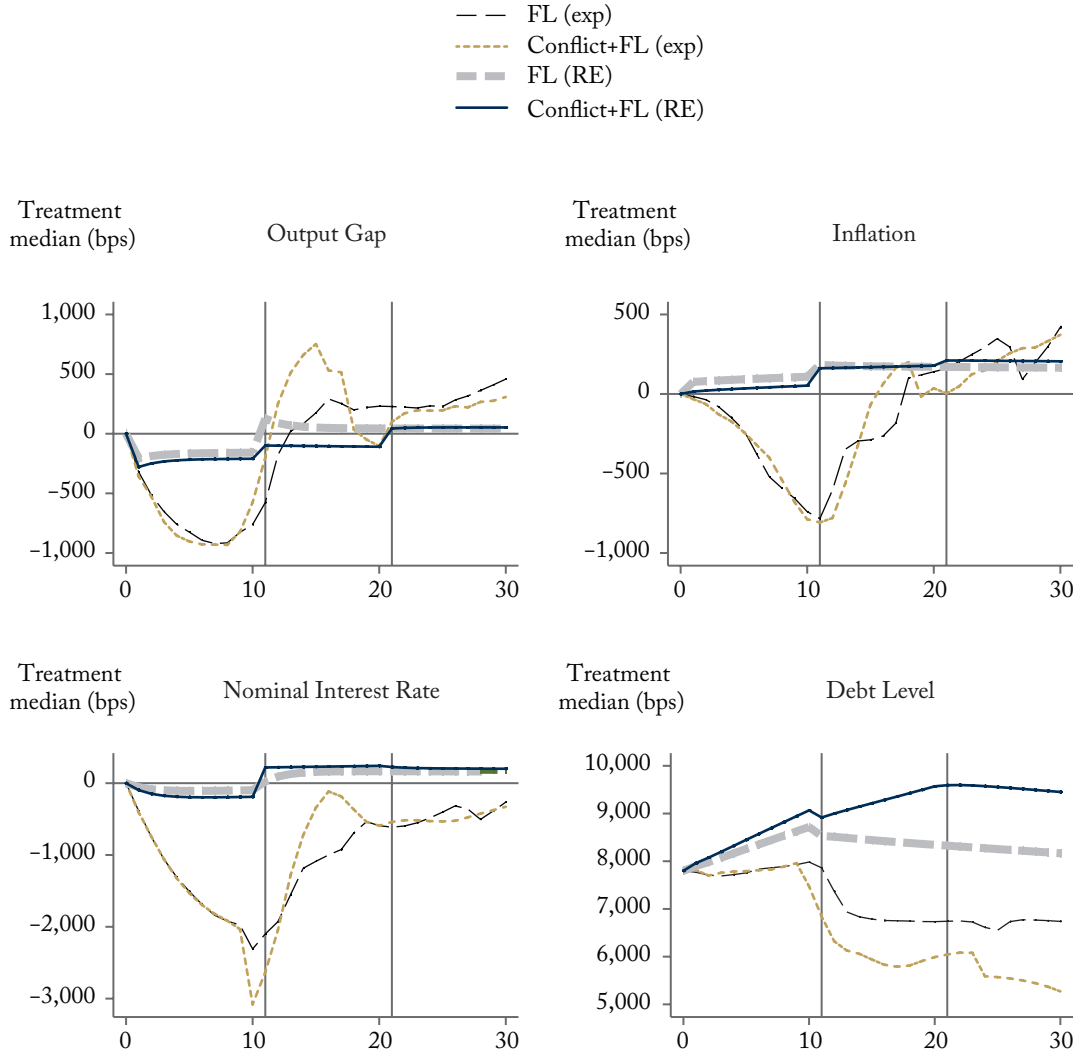
Figure 1: Monetary-Led Scenarios (in basis points)
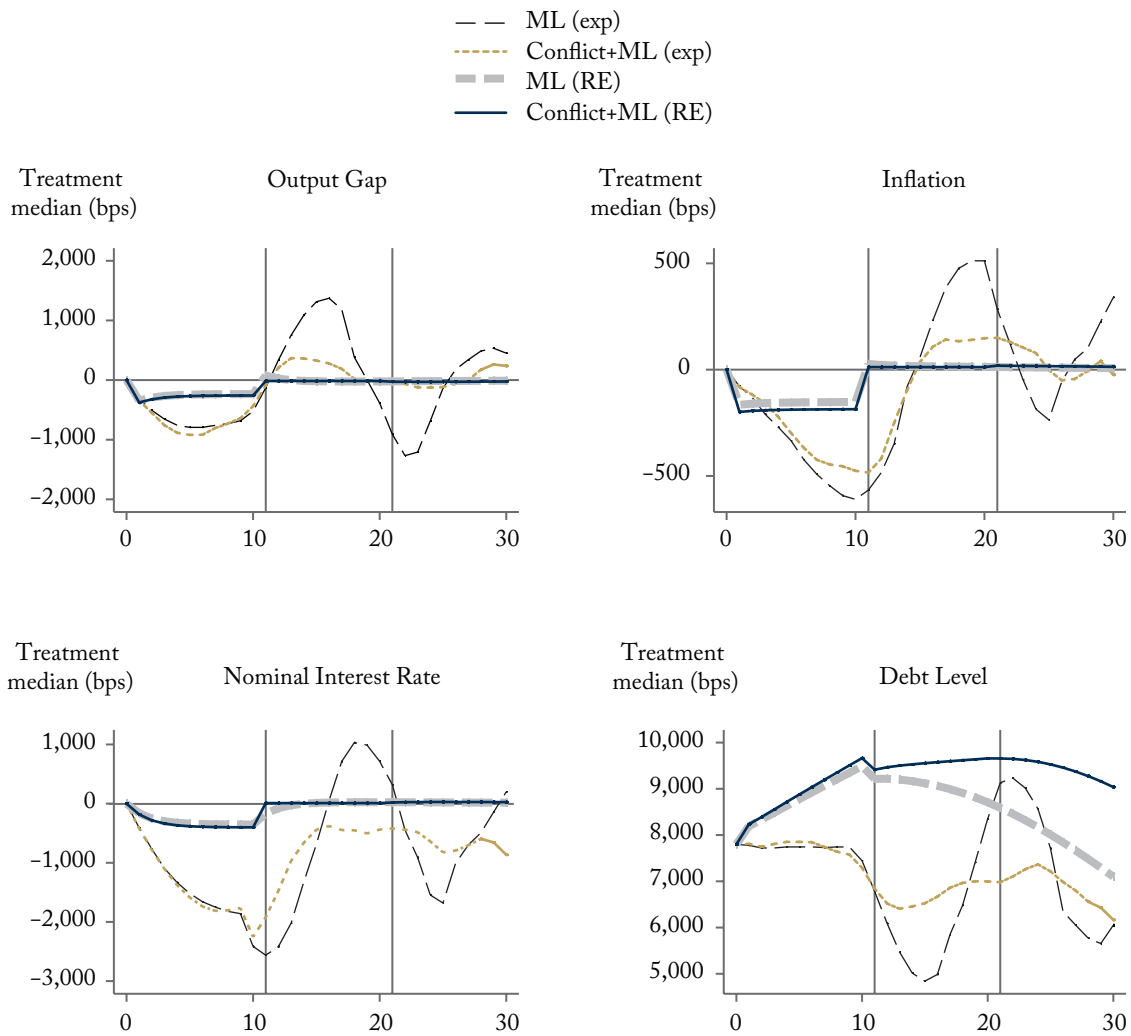
Note: The black-dashed line ("ML (exp)") is the median value across sessions at each point in time in the monetary-led coordinated scenario in the experiments, while the grey-dashed line ("ML (RE)") is the result from Bianchi and Melosi's rational expectations model. Similarly, the gold-dashed ("Conflict+ML (exp)") is the median value across sessions at each point in time in the monetary-led coordination scenario in the experiments, while the solid black ("Conflict+ML (RE)") is the conflict followed by monetary-led coordination from the rational expectations model. Output gap, inflation, and interest rate are set to represent basis point deviations from steady state and so are initialized at zero. Debt level (debt to GDP ratio), borrowing from Bianchi and Melosi (2019), is set at an initial level of 77 percent (or 7700 basis points).

Source: Authors' calculations.

Figure 2: Fiscally Led Scenarios (in basis points)

Note: The black-dashed line ("FL (exp)") is the median value across sessions at each point in time in the fiscally led coordinated scenario in the experiments, while the grey-dashed line ("FL (RE)") is the result from Bianchi and Melosi's rational expectations model. Similarly, the gold-dashed ("Conflict+FL (exp)") is the median value across sessions at each point in time in the fiscally led conflict scenario in the experiments, while the solid black ("Conflict+FL (RE)") is the conflict followed by fiscally led coordination from the rational expectations model. Output gap, inflation, and interest rate are set to represent basis point deviations from steady state and so are initialized at zero. Debt level (debt to GDP ratio), borrowing from Bianchi and Melosi (2019), is set at an initial level of 77 percent (or 7700 basis points).
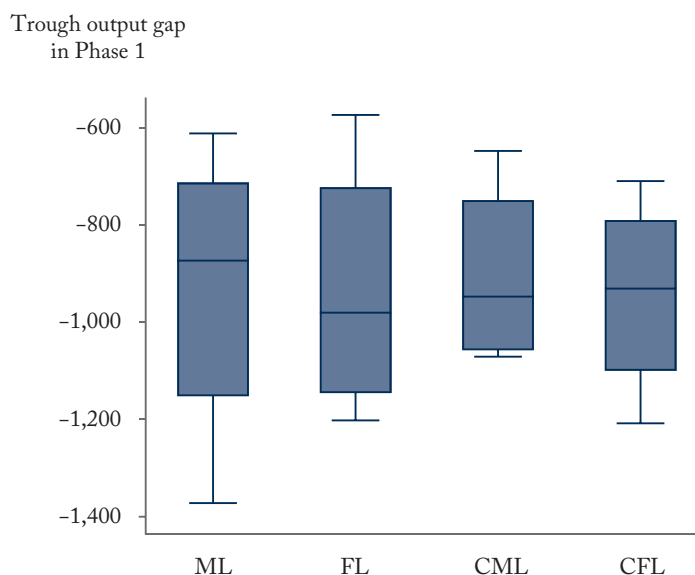
Source: Authors' calculations.

Figure 3: Distribution of Recession Output Gap Troughs (in basis points)

Note: ML = Coordinated monetary-led scenario, FL = Coordinated fiscally led scenario, CML = Conflict monetary-led scenario, and CFL = Conflict fiscally led scenario. Horizontal line within each box is the median.

Source: Authors' calculations.

the recovery is stronger in coordination scenarios. Figure 4 panel (a) shows the distribution of the peaks of the output gaps in phase 2.[9] The average peak recovery in phase 2 is significantly higher in coordination (1,871 basis points in monetary-led and 693 basis points in fiscally led) than in conflict (432 basis points in monetary-led and 574 basis points in fiscally led).[10] In both coordination and conflict, the differences between monetary and fiscal policy-led recoveries are statistically significant at the 10 percent level.[11]

The results are also mixed when using an alternative measure of the size of the recovery – the total output gap – in phase 2. Panel (b) shows the distribution of the total output gaps across sessions for each treatment. On this metric, while the average total output gap is largest in the coordinated monetary-led scenario (7,392 basis points), it is followed not by fiscally led coordinated scenario but by the fiscally led conflict scenario (2,347 basis points).[12] The differences between the coordination and conflict policy scenarios on the

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9   The peaks in each session do not occur at the same time. Consequently, the time series peaks in Figures 1 and 2 do not necessarily match those found in Figure 4.

10   Two-sided Wilcoxon rank sum test yields a p-value of 0.0742.

11   Two-sided Wilcoxon rank sum test yields a p-value of 0.1003 in coordination and 0.0679 in conflict.

12   After that the largest output gap is fiscally led coordinated (2,071 bps), and monetary-led conflict (1,724 bps).

Figure 4: Distribution of Output Gap Results in Phase 2 (in basis points)
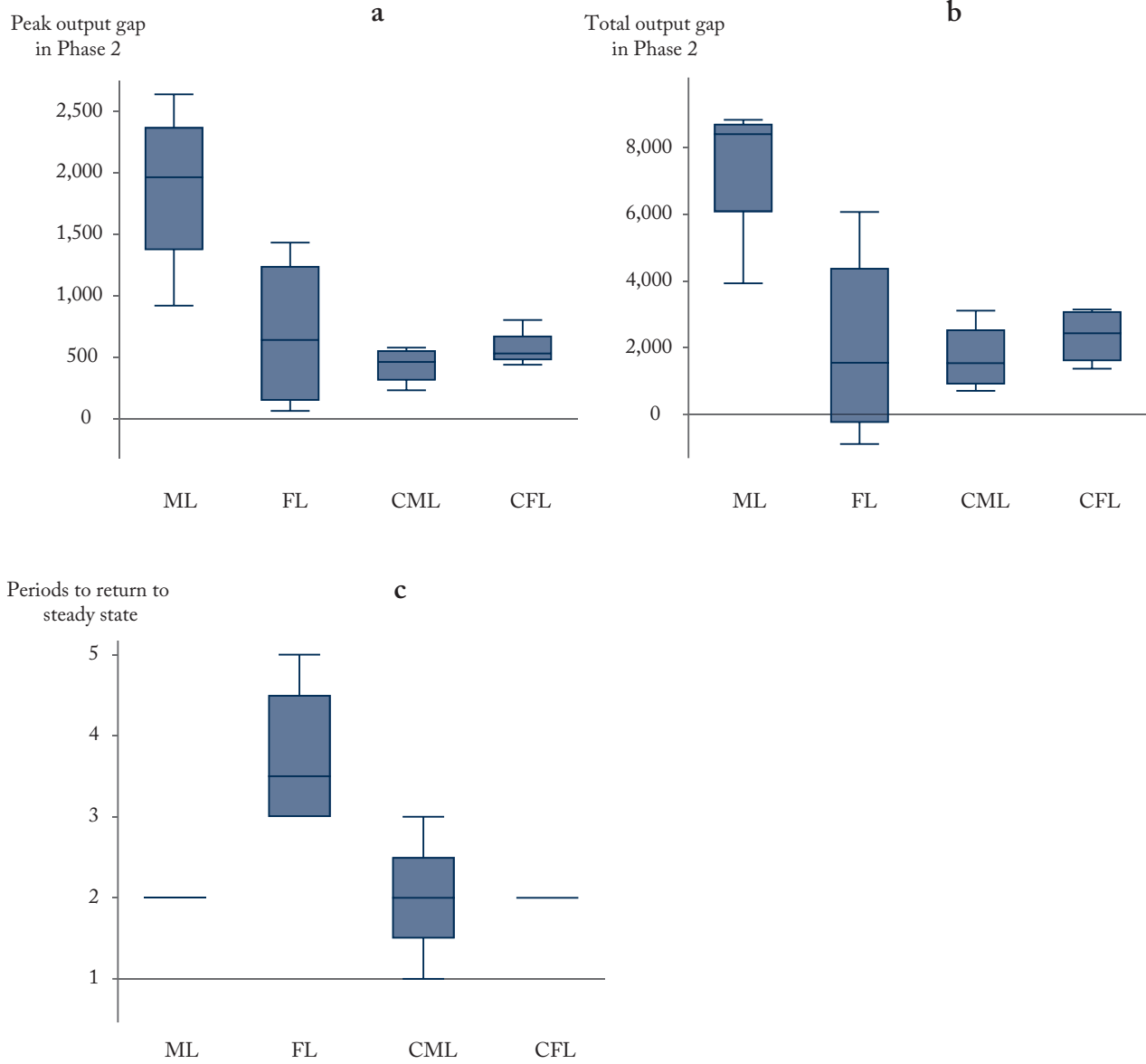
Note: ML = Coordinated monetary-led scenario, FL = Coordinated fiscally led scenario, CML = Conflict monetary-led scenario, and CFL = Conflict fiscally led scenario. Horizontal line within each box is the median.

Source: Authors' calculations.

whole are also not statistically significant.[13]

In terms of speed of recovery, panel (c) in Figure 4 presents the number of periods before the economy in a particular session returns back to the steady state. The average session in each of monetary-led coordination and both conflict scenarios takes two periods to return to its pre-recession state. The coordinated fiscally led scenario is more sluggish, however, taking an average of 3.75 periods. Taken together, these results suggest that recovery is not ubiquitously faster in coordinated scenarios.[14]

Prediction 3: During the Recovery – Regardless of Coordination/Conflict – Fiscally Led Scenarios Lead to Stronger Output Recoveries, but at the Expense of Inflation Well Above Target

Finding 3: Lab results indicate that economic recovery is strongest under monetary-led coordination with limited inflation. Fiscal leadership does not necessarily imply worse inflation.

Our last testable hypothesis is that the recovery in the policy coordination scenarios is stronger when the fiscal authority eventually leads, though gains under fiscally led scenarios come at the expense of inflation well above target. Under the monetary-led scenarios, inflation is essentially at target.

Our experiments provide little support for these predictions. When there is clear coordinated leadership immediately following the recession, the economic recovery in phase 2 is significantly stronger under monetary-led coordination than fiscally led coordination (as we saw above in Figure 4 panel a)).[15] The reason: the central bank is much more active in dropping the overnight interest rate. But this strong recovery is not accompanied with notably greater peak inflation.[16]

Following the conflict scenarios, phase 3 economic recovery and inflation are on average stronger under fiscally led than monetary-led scenarios. Peak output (inflation) under fiscally led is 1,698 bps (698 bps), while only 388 bps (111 bps) under monetary-led. However, both treatments exhibit notable variance across sessions in inflation and output, and, as a result, the differences across regimes on the whole are not statistically significant.[17]

Policy Implications

What does it mean that the lab results differ so markedly from what we expected based on economic theory? And, what does it mean in practice for Canada's monetary and fiscal policy.

To help us answer these questions, we use the experimental data from participants' forecasts to determine how they form their expectations. We categorize these mental shortcuts into types and assign a type to each participant that best fits their forecasting behaviour. Table C1 in Appendix C summarizes all the types (heuristics in economists' terms) we have considered in mathematical terms.

The simplest deviation from rational expectations is called cognitive discounting (Gabaix 2020), where households/businesses discount variables far

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13   Two-sided Wilcoxon rank sum test yields a p-value of 0.1722.
14   Two-sided Wilcoxon rank sum test yields a p-value of 0.0692.
15   Two-sided Wilcoxon rank sum test yields a p-value of 0.083.
16   Inflation is on average higher under monetary-led, at 175 bps compared with 51 bps under fiscally led, but the differences are not statistically significant. Two-sided Wilcoxon rank sum test yields a p-value of 0.2012.
17   Two-sided Wilcoxon rank sum test yields a p-value above 0.5 for both inflation and output gaps.

Figure 5: Percentage Distribution of Forecasting Types for Inflation Forecasts, by Treatment
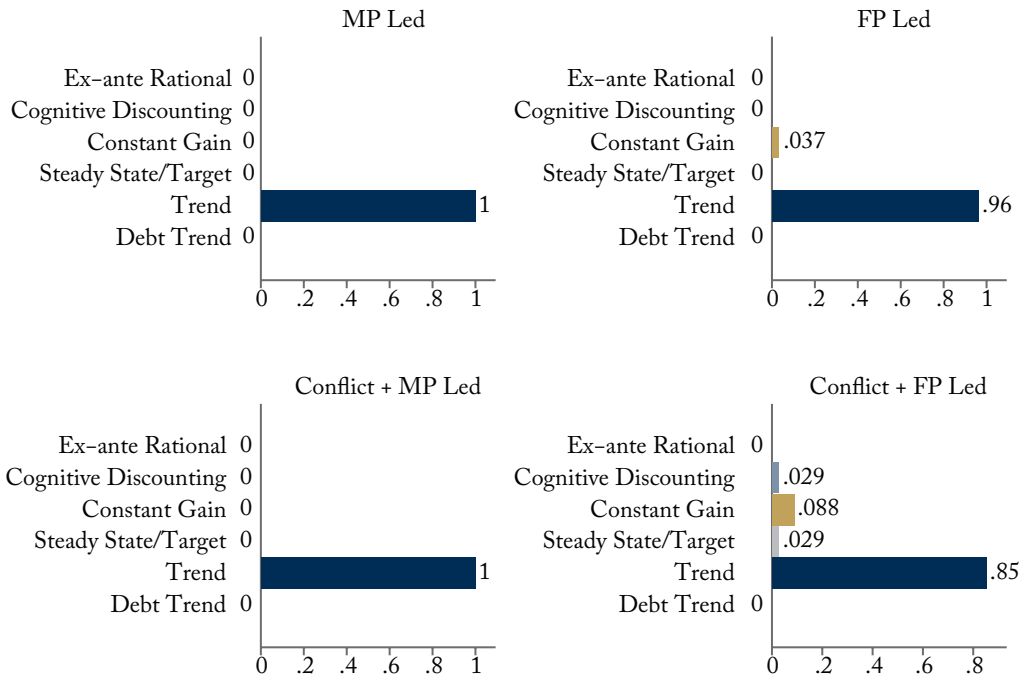
Note: Conflict + FP Led = Conflict fiscally led scenario, Conflict + MP Led = Conflict monetary-led scenario, FP Led = Coordinated fiscally led scenario, MP Led = Coordinated monetary-led scenario.

Source: Authors' calculations.

into the future to a larger degree than we expect.[18] We also look at the case in which participants' forecasts are based on a steady state/target.

We also consider backward-looking types in which the formation of expectations is history driven, e.g., constant-gain learning (see, for example, Evans and Honkapohja 2012 and Milani 2008).

Lastly, we look at two trend-chasing expectations:[19]

- expectations of next period's output/inflation is based on last period's output/inflation, though with the addition of a trend-chasing parameter that gives weight to how last period's output/inflation evolved from output/inflation the period before that; and

- another form of trend-chasing, one focused on government debt instead of output/inflation.

We determine the forecasting type for each participant that best fits their forecasting behavior during each phase of the experiment (Figure 5

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18 α<1 in Table C1
19 See, for example, Pfajfar and Zakelj, 2014, Cornand and M'Baye, 2018; Petersen, 2014, Assenza et al., 2013.

Figure 6: Percentage Distribution of Forecasting Types for Output Forecasts, by Treatment
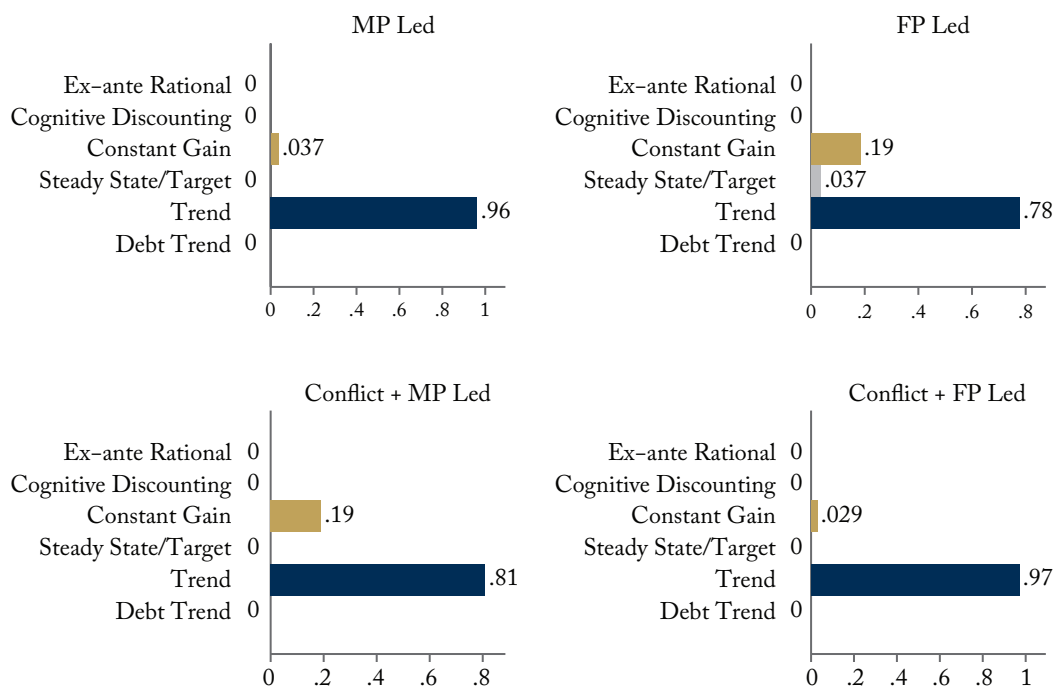
Note: Conflict + FP Led = Conflict fiscally led scenario, Conflict + MP Led = Conflict monetary-led scenario, FP Led = Coordinated fiscally led scenario, MP Led = Coordinated monetary-led scenario.

Source: Authors' calculations.

for inflation forecasts and Figure 6 for output forecasts).[20] The figures present the share of participants in each treatment classified by type.

We find that economic fundamentals and the government's debt do not weigh significantly in their forecasts. Rather, participants use some form of historical information to formulate their expectations. The large majority of them use historical trends to forecast inflation and the output gap. There is a wide range within each treatment in the degree of trend-extrapolation, but not across treatments. That is, the treatments themselves do not significantly change the way in which people forecast.

When people mostly extrapolate trends, updating their expectations based on what has happened in the past, it matters how the central bank and government individually set policy following an economic downturn. If people are likely to form backward looking expectations, it is important for

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20   To do so, we compute the mean absolute error of each participant's expectations for each of the decision-making types presented in Table C1. We assign each participant the type and its parameter value (if applicable) that produces the lowest mean absolute error.

the authorities to maintain economic stability. The conflict between policymakers means the central bank takes an even more aggressive stance on inflation. This works well to manage inflation and, in turn, inflation expectations. By being relatively relaxed about inflation in the monetary-led regime, we see that inflation can become more volatile and expectations can become significantly unanchored. The importance of aggressive monetary policy responses to manage inflation expectations has also been documented by Kryvtsov and Petersen (2015) and Pfajfar and Žakelj (2018).

Conclusions

Canadians are in the midst of inflation the likes of which we haven't seen in 40 years, and as prices continue to rise, inflation is becoming a salient issue for more and more people. Our lab results suggest that people update their expectations about future inflation based on current and previous trends, regardless of coordination or conflict between monetary and fiscal authorities.

There are implications for both governments and the Bank of Canada. Ideally, with the Bank firmly in a tightening cycle to get inflation under control, governments would contribute to this fight by not adding new spending. This would help achieve those necessary results. However, should this not be the path fiscal authorities choose, while conflict might make things harder, our results suggest that the optimal path for the Bank of Canada is to continue its tightening cycle to get inflation back under control in order to re-anchor inflation expectations.

The prevalence of backward-looking expectations also has important implications for the choice of monetary policy frameworks more generally. Many central banks, including the Bank of Canada, have recently entertained introducing make-up strategies into their frameworks (e.g., allowing for more inflation to compensate for recently low inflation and vice versa). These strategies create better anchored expectations if the public is forward looking and anticipates the make-up down the road. Our results demonstrate that such strategies may not work as intended.

APPENDIX A: MACROECONOMIC DYNAMICS

The structure of the experimental macroeconomy comes from a linearized version of the model developed in Bianchi and Melosi (2019). The macroeconomy can be described by the following system of equations:

$$x_t = E_t x_{t+1} - \frac{1}{\sigma}(R_t - E_t \pi_{t+1}) + \zeta_t^d \ (1)$$

$$\pi_t = \kappa \left(1 + \frac{\alpha}{1-\alpha}\right) x_t + \beta E_t \pi_{t+1} \ (2)$$

Equation 1 describes how the economy's output gap evolves in response to aggregate expectations of period $t+1$ output gap, $E_t x_{t+1}$, and the real interest rate, $R_t - E_t \pi_{t+1}$, where R_t is the central bank's policy rate and $E_t \pi_{t+1}$ refers to the aggregate expectation of period $t+1$ inflation. Equation 2 is the New Keynesian Phillips curve and describes inflation driven by aggregate expectations of inflation and the output gap. κ governs the pass-through of monetary policy and other factors that affect aggregate demand to inflation.

The policy rule of the central bank is given by:

$$R_t = \psi_y(1 - \rho_R)x_t + \psi_\pi(1 - \rho_R)\pi_t + \rho_R R_{t-1} \ (3)$$

Equation 3 describes the reaction function of the central bank, where ψ_π governs the response to deviations of inflation from target and ψ_y the response to deviations of output from target. The parameter ρ_R denotes the degree of persistence in the central bank's policy rate.

On the fiscal side, the government's tax rate evolves according to the following equation:

$$\tau_t = \delta_y(1 - \rho_\tau)x_t + \delta_b(1 - \rho_t)b_{t-1} + \rho_\tau \tau_{t\,t-1} \ (4)$$

where b_t, the government's real debt level, is given by

$$b_t = \frac{b_{t-1}}{\beta} - \frac{b^*}{\beta}(x_t - x_{t-1}) - \frac{b^*}{\beta}\pi_t - \tau_t + \frac{b^*}{\beta}R_t + e_t \ (5)$$

Equation 4 says that the central bank increases its taxes as the output gap and the level of past real debt, b_{t-1} grow larger. The parameter ρ_τ denotes the degree of persistence in the government's tax rate.

Equation 5 describes the evolution of real government debt. Real government debt increases as the output gap contracts, inflation is low, the government taxes less, and nominal interest rates rise.

The exogenous demand shock, ζ_t^d, follows a two-state Markov process. In the low state, $\zeta_t^d = -143$ bps. The probability that the economy remains in the low state in the next period is 0.94. In the high state, $\zeta_t^d = 43$ bps. The probability that the economy remains in the high state in the next period is 0.99.

We close the model by specifying the aggregate expectations that are key to driving aggregate dynamics. Aggregate expectations are elicited by our experimental participants. Each period t, participant i forms expectations about the next period's output gap, $E_{i,t} x_{t+1}$, and inflation, $E_{i,t} \pi_{t+1}$. The median forecast of each variable is used as the aggregate forecast and fed into the economy's data-generating process to determine the macroeconomic dynamics.

APPENDIX B: PARAMETER VALUES

We take the bulk of the parameter values directly from Bianchi and Melosi (2019), making minor adjustments we felt better suited the Canadian economy and the reaction function of the Bank of Canada (Table B1).

We note that the persistence parameter for the central bank, labelled ρ_r, is different under coordination and conflict. The intuition is that whether inflation causes an increase or decrease in real debt comes down to how aggressive the central bank reaction function with respect to inflation above target is – the more aggressive it is, the more likely real debt will increase. To generate the double dip recession under conflict in this model, debt servicing costs for the government must go up, which requires a secondary increase in interest rates from the higher inflation the government needs to pay down their increased debt load (the higher debt/higher inflation/higher interest rate spiral). To get these higher interest rates, we need the central bank to respond aggressively to inflation above target, which we get by removing any persistence in the Taylor rule.

Because we then need this persistence parameter to be positive in coordination, this also affects the parameters we need in the Taylor Rule equation to generate the greater than one-for-one reaction of interest rates to inflation under active monetary policy.

Payoffs

We incentivize participants to forecast accurately by awarding them points according to the following scoring rule:

$$F_{i,t} = 2^{-.5|E_{i,t-1}\{\pi_t\}-\pi_t|} + 2^{-.5|E_{i,t-1}\{x_t\}-x_t|}$$

At the end of each period *t*, subjects would receive points based on the forecast accuracy of their period *t-1* forecasts about period *t* inflation and output gap. For every 100 basis point error participants made for each of their two forecasts, their score would drop by one-half. Points were exchanged for Canadian dollars at an exchange rate of $1.25 per point.

Table B1: Parameter Values for Experimental Treatments

	Low demand state	High demand state (HD)			
	All treatments	HD-ML	HD-FL	HD-CML	HD-CFL
ζ_t^d	-143	43	43	43	43
κ	0.007232228	0.007232228	0.00723223	0.00723223	0.00723223
α	0.33	0.33	0.33	0.33	0.33
β	0.9985	0.9985	0.9985	0.9985	0.9985
ρ_{tr}	0.462027055	0.462027055	0.46202706	0.46202706	0.46202706
ϕ_y	0	0	0	0	0
b^*	1.118045487	1.118045487	1.11804549	1.11804549	1.11804549
δ_y	0.281411571	0.281411571	0.28141157	0.28141157	0.28141157
ρ_τ	0.650109862	0.966628833	0.65010986	0.65010986	0.65010986
δ_b	0	0.077837151	0	0	0
ψ_y	0.265458534	0.265458534	0.26545853	0.26545853	0.26545853
ρ_r	0.657556532	0.5715	0.65755653	0	0
ψ_π	0.690266852	3.5	0.69026685	2	2

Note: ML = Coordinated monetary-led scenario, FL = Coordinated fiscally led scenario, CML = Conflict monetary-led scenario, and CFL = Conflict fiscally led scenario.

Source: Authors' calculations.

APPENDIX C: FORECASTING TYPES

We note that for some types, such as Cognitive Discounting, Constant Gain, and Trend-Chasing, we consider a wide range of parameterizations. The cognitive discounting parameter α can take values in the range of $[0.1, 0.9]$. The constant gain parameter γ and trend-chasing parameter τ are in the range of $[0, 1.5]$. We consider values of these parameters from these ranges with an increment of 0.1.

Table C1: Models of Different Heuristics

Model	Heuristic Name	Model
M1	Ex–Ante Rational	$E_{i,t}\, x_{t+1} = f(r^n_{t-1}, \epsilon_t)$
		$E_{i,t}\, \pi_{t+1} = f(r^n_{t-1}, \epsilon_t)$
M2	Cognitive Discounting	$E_{i,t}\, x_{t+1} = \alpha f(r^n_{t-1}, \epsilon_t)$
		$E_{i,t}\, \pi_{t+1} = \alpha f(r^n_{t-1}, \epsilon_t)$
M3	Constant Gain	$E_{i,t}\, x_{t+1} = E_{i,t-1}x_t - \gamma(E_{i,t-2}\, x_{t-1} - x_{t-1})$
		$E_{i,t}\, \pi_{t+1} = E_{i,t-1}\pi_t - \gamma(E_{i,t-2}\, \pi_{t-1} - \pi_{t-1})$
M4	Steady State/Target	$E_{i,t}\, x_{t+1} = 0$
		$E_{i,t}\, \pi_{t+1} = 0$
M5	Trend Chasing	$E_{i,t}\, x_{t+1} = x_{t-1} + \tau(x_{t-1} - x_{t-2})$
		$E_{i,t}\, \pi_{t+1} = \pi_{t-1} + \tau(\pi_{t-1} - \pi_{t-2})$
M6	Debt Trend Chasing	$E_{i,t}\, x_{t+1} = x_{t-1} + \delta(b_{t-1} - b_{t-2})$
		$E_{i,t}\, \pi_{t+1} = \pi_{t-1} + \delta(b_{t-1} - b_{t-2})$

$\alpha \in [0.1, 0.9]$, γ, τ and $\delta \in [0, 1.5]$ in increments of 0.1.

Source: Authors' calculations.

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