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Into the Unknown: Reflections on Risk, Uncertainty and Monetary Policy Decision-making

In the uncertain global environment, the Bank of Canada and other central banks should add to their toolkits with “bottom up” agent-based models, in which simple behaviours add up to real-world complexity, and strengthen their communications strategies with narratives to help economic agents understand the world confronting them.

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THE STUDY IN BRIEF

The contention of this *Commentary*, using the 2008-2009 Global Financial Crisis (GFC) and related monetary policy decision-making as a case point, is a simple one: that closer attention should be paid to the distinction between risk and uncertainty. As defined by economist Frank Knight of the University of Chicago, risk applies to situations where the outcome of a given situation is not known, but where we can measure probabilities with some degree of confidence. Uncertainty, in contrast, applies to situations where we cannot know all the information we need in order to estimate the probabilities in the first place.

It has been standard practice that central banks take into account perceived risks for the economic outlook in their conduct of policy. The *Commentary* starts with a review of the ways the central banks have traditionally dealt with the distinction between risk and uncertainty using models of optimizing (i.e., rational) behaviour. The *Commentary* then discusses Agent-Based Models (ABMs), one example of a non-optimizing behavioural model, in which simple behaviours can combine from the ‘bottom up’ to recreate the more complex behaviours seen in the real world (Turrell 2016). Employing these models could expand the central bank’s toolkit for dealing with risk and uncertainty.

The discussion then turns to the importance of communications and why central banks should reposition their communications strategies to better address the distinction between risk and uncertainty. The case is made that expanding their communications strategy to include narratives is a potentially powerful approach for acknowledging there is no pretense on their part that they know what the future holds. By narrative, we mean the ability to integrate information in a way that both acknowledges the infinite uncertainties facing us and tells a story to assist economic agents to understand the world confronting them.

For the best policy decisions, a single judgment about the economic outlook is needed, where risks are considered balanced. However, uncertainties may mean that a single judgment is difficult, or near impossible. In today’s world, it seems that economic (and geopolitical) uncertainties have become an almost constant feature of the policy landscape.

A growing concern about the true nature and extent of these uncertainties facing policymakers is becoming more commonplace, and for good reason.

Three examples are considered, all reflective of the uncertain global economic environment facing Canada. The first is Brexit; the second is the implications for Canada of US-China trade tensions; and the third is climate change.

The message of this *Commentary* is that it is better to acknowledge than ignore these uncertainties as part of a central bank’s modeling and communications strategy.

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“If economic history teaches us anything, it is to be mindful of our own limitations in a world of infinite uncertainties.”¹

Monetary policy actions take time to work their way through the economy. Because of these transmission lags, monetary policy must be forward looking. This, in turn, requires some ability on the part of monetary authorities to predict the future.

While the models, computational capabilities and information sets now used by major central banks to project the future have become much more sophisticated, the events leading up to, during and, after the fallout of the 2008 to 2009 Global Financial Crisis (GFC) have made it clear that our ability to project economic activity – both domestic and global – is considerably less than previously assumed.

It has been standard practice that central banks take into account perceived risks in the economic outlook in their conduct of policy. In addressing such risks, economists have typically used a number of analytical approaches.² As defined by the University of Chicago’s Frank Knight (1921), risk applies to situations where the outcome of a given situation is not known, but where we can with some degree of confidence measure the probabilities

or odds of an event happening. Uncertainty, in contrast, applies to situations where we cannot know all the information we need in order to estimate the probabilities in the first place. In other words, Knightian, or radical, uncertainty is a lack of any quantifiable knowledge about some possible occurrence.³

For some economists, however, this distinction lacks a reality check in that economies are so complex that making projections is always about dealing with uncertainties. That is to say, it is only reasonable to think of any economic outlook as characterized by uncertainty since many risks exist and can be embraced within a larger uncertainty. The tendency, therefore, has been to use risk and uncertainty interchangeably.⁴

While this view may represent a practical perspective, the GFC to a significant extent stemmed from a failure by policymakers (and the private sector) to comprehend fully the risks to the economy, let alone quantify them. In October 2005, Ben Bernanke (then Chairman of the White House Council of Economic Advisers) stated – and

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- 1 Rogoff (2018).
- 2 Even if there weren’t lags in the transmission of monetary policy, risk and uncertainty would still pose a challenge to policymakers.
- 3 Keynes was the other great exponent of uncertainty’s importance, believing that a distinction must be made between risk and uncertainty (1921, 1936). For Keynes, uncertainty about the future – for example, about private-sector decisions – is one reason why economies do not automatically tend to full employment. It is this recognition that gives rise to Keynes’s belief in a prominent government role in economic stabilization.
- 4 For example, Kozicki and Vardy (2017) use risk and uncertainty interchangeably, reserving the use of Knightian uncertainty to “characterize unknowns that are closer to the ‘impossible-to-calculate’ metric.”

was not alone in this faulty judgment – that while “house prices have risen by nearly 25 percent over the past two years ... these price increases largely reflect strong economic fundamentals.”

The contention of this *Commentary*, using the GFC and related monetary policy decision-making as a case point, is a simple one: that closer attention should be paid to Knight’s distinction between risk and uncertainty.

We start with a review of the ways that central banks have traditionally dealt with the distinction between risk and uncertainty, using models of optimizing behaviour. Alternative models of non-optimizing behaviour are then discussed in terms of how they could expand the central bank’s toolkit for dealing with risk and uncertainty. In practical terms, what this means is that in today’s complex world, policymakers need a suite, or range, of models that complement one another to enable them to draw out the insights required in the conduct of policy.⁵ This is not a new thought, but attention to non-optimizing models, particularly those built up on the basis of behavioural economics, might enhance the central bank toolkit in addressing what the economics profession means by true uncertainty.

Second, the *Commentary* discusses the importance of communications and why central banks should reposition their communications strategies to better address the distinction between risk and uncertainty. In addressing this distinction, central banks should consider alternative ways of conveying that the future is unpredictable.

This *Commentary* argues that expanding their communications strategy to include narratives is a potentially powerful approach for acknowledging there is no pretense on their part that they know what the future holds. By narrative, we mean the ability to integrate information in a way that both acknowledges the infinite uncertainties facing us and tells a story to assist economic agents to understand the world confronting them. A potentially important outcome of this use of narratives is that all stakeholders will take more responsibility for their own decision-making.⁶

MODEL STRATEGIES FOR DEALING WITH RISKS AND UNCERTAINTY

Strategies for dealing with risks and uncertainty vary significantly. Here we look at two aspects from a modelling perspective: (i) models of optimizing (rational) behaviour and (ii) models of non-optimizing behaviour.

(i) Models of Optimizing Behaviour

Macroeconomic models are, by nature and necessity, simplified representations of the economy. For a number of years, many central banks have relied on dynamic stochastic general equilibrium (DSGE) models,⁷ built with an explicit focus on micro-based optimizing behaviour. In their early configuration, DSGE models assumed rational expectations, used a representative agent and imposed intertemporal

5 To quote Keynes, “Economics is a science of thinking of models joined to the art of choosing models which are relevant to the contemporary world” (Moggridge 1973).

6 For central banks, a long-lasting concern has been that agents, especially those in financial markets, will take what are typically conditional statements as a commitment on their part to act in a particular way. Rather, the banks want agents to understand their communication, but then to act on their own beliefs and analysis thereby contributing to two-way markets with both buyers and sellers.

7 For non-economists: Dynamic = the economy is allowed to evolve over time; Stochastic = the economy is affected by the occurrence of random shocks; in other words, affected by unpredictable changes; and General Equilibrium = all economic variables in the model are allowed to evolve, and end up in a state where the shock has died out and none of the variables have an incentive to deviate from their current levels.

budget constraints, effectively eliminating the possibility of default and the need for financial intermediation (Christiano, Eichenbaum, and Trabandt 2018). However, these models neglected the complications, or financial frictions, that arise from information asymmetry between lenders and borrowers, from limited enforcement of contracts and from other real world aspects that make money useful.

This characterization applied to the Bank of Canada's open-economy DSGE model, known as Terms of Trade Economic Model (ToTEM), (Murchison and Rennison 2006) when it was introduced in late 2005. As a DSGE model, ToTEM provided a useful discipline for policy analysis, as it pre-empted the use of policy choices inconsistent with the Bank's inflation target. However, the discipline imposed by its simplifying assumptions led to predictions of more continuous behaviour than witnessed in the real world of financial markets. Thus, the model was ill-suited to capture episodes of financial stress such as the sudden tightening of market discipline and lending standards after a period of lax lending witnessed during the GFC's peak.

To overcome these shortcomings, subsequent versions of ToTEM incorporated a number of changes. ToTEM II, introduced in 2011, incorporated multiple interest rates, sector-specific demand specifications for consumption, housing and inventory investment, a role for financial wealth in household consumption, and rule-of-thumb price

and wage setters. In 2017, further enhancements were made with the incorporation of household debt into ToTEM III.⁸

A key element of central bank risk management has been the use of these types of models to produce alternative scenarios from their base-case projections.⁹ In presenting a base-case projection, central banks speak of a situation in which the risks are balanced. That is to say, better and worse outcomes (in both cases relative to the base-case projection) are equally likely. Alternative scenarios can then be generated in order to assess different assumptions and risks from those incorporated into the base case. The Bank of Canada, for example, includes a risk assessment as part of its inflation outlook in each of its quarterly *Monetary Policy Reports*.

Central banks take other practical steps in gauging risks to their economic projections. Based on projection errors and stochastic (random event) simulations, they present confidence intervals, or fan charts, of key variables such as inflation and the output gap. As well, other sources of information, such as monetary aggregates, financial variables and regional input (e.g., the US Federal Reserve's Beige Book and the Bank of Canada's regional surveys) are used to assess and apply judgments when incorporating risks in their economic outlooks.

The economic literature and, more generally, a typical central bank playbook highlights several sources of uncertainty. The standard list includes:

- shock uncertainty – models make prediction

8 These ToTEM innovations recognize that financial markets do not operate in a frictionless environment and that such frictions can lead to enhanced propagation of economic shocks with the financial system itself being a source of such shocks.

9 In addition to the work on DSGE models, Bank of Canada staff members have developed alternative models, ranging from single equations relating GDP to various interest-rate spreads, credit and money growth to small models of the financial accelerator and to the development of LENS (Gervais and Gosselin 2014), a large empirical and semi-structural model that is based more on what the data show with a less rigorous set of theoretical constraints than found in ToTEM III. Recently, central bank staff members have also begun to look at AI techniques to help in their economic projections.

errors, where the associated uncertainty is referred to as shock uncertainty;

- parameter uncertainty – while similar to shock uncertainty, in that model parameters should be regarded as random variables, parameters interact with the model's endogenous (internal) variables, whereas shocks are additive;
- data uncertainty – virtually all data used in economic models are subject to revision, and most models use variables (e.g., the output gap) that are not directly measurable; and
- model uncertainty – models may be built using paradigms that do not reflect economic reality, ignore relevant economic relationships, or use simplifying assumptions that make the model tractable but less representative of the real world.

A basic strategy for dealing with these types of uncertainties is to take them into account when designing policy rules (Cateau and Murchison 2010; Levin et al. 2006). As summarized by Cateau and Murchison, “There are two basic approaches to designing a robust rule:

- deriving optimized coefficients that account for specific uncertainties – that is, determine how strongly the policy instrument should respond to each variable in the rule, taking into account the features about which we are uncertain; and
- determining a functional form for the rule that is less susceptible to yielding a poor performance, given specific uncertainties.”

Overall, policymakers acknowledge that it is crucial to take these types of uncertainties into account in designing policy rules to ensure that their performance is satisfactory, irrespective of the conditions (or state) of the economy (Jenkins

and Longworth 2002, Wilkins 2017, Mendes, Murchison, and Wilkins 2017).

However, the fact remains that uncertainties defined this way are much closer to risk assessment¹⁰ (“known unknowns,” if you like)¹¹ than to radical uncertainty as defined by Knight.

ii) Models of Non-Optimizing Behaviour

To summarize, in optimizing models (i.e., DSGE models) agents are fully rational, knowing what shocks have occurred, their persistence and how the shocks are propagated.

In contrast, agent-based models (ABMs) – one example of a non-optimizing model – have a number of interacting heterogeneous agents, each endowed with its own behavioural rule permitting interactions in unknown complex environments, with no direct restrictions on aggregate outcomes. As stated by Turrell (2016): “The strength of these models is that they show how even very simple behaviours can combine from the ‘bottom up’ to recreate the more complex behaviours observed in the real world ... This ‘bottom-up’ approach is in contrast to models which are ‘top down,’ and which presume how agents’ behaviours will combine together, sometimes by assuming that all agents are identical.”

Thus, ABMs offer, from a macroeconomic perspective, a possible range of policy scenarios quite different from a DSGE model, but at the same time complementary in the sense that they can be seen as capturing aspects of reality that DSGE models cannot.¹² As seen using an ABM

10 For example, the presence of quantifiable risks such as those in statistical noise or a parameters-confidence interval.

11 US Defense Secretary Donald Rumsfeld is famously quoted as saying at a February 2002 press briefing: “There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. These are things we don't know we don't know.”

12 There is an early, growing literature on exploring DSGE models where heterogeneous consumers face idiosyncratic shocks and binding borrowing constraints. (Christiano, Eichenbaum, and Trabandt 2018.)

approach, the GFC can be characterized by irrational behaviour, by markets that failed to clear and by conditions far from equilibrium.

ABMs provide an alternative analytical approach by accounting for agents' heterogeneous behaviour, capturing non-equilibrium conditions in markets, and modelling the network and institutional structure of the financial system. Haldane and Turrell (2018) provide a succinct summary: "Broadly defined, ABMs will add value when problems revolve around heterogeneity, complexity, non-linearity, emergence, heuristics, and detailed rules." Seen this way, the goal has not been to build a model from a mathematical formula or theory, but to build a model from the ground up by simulating the interactions of the model's component parts.¹³

These comparative advantages, however, have to be weighed against an important question of whether or not ABMs provide policy discipline without imposing rationality. With rule-of-thumb behaviour, there is the possibility they may not reflect basic economic laws. Indeed, such behaviour may be subject to sudden modification if the environment agents' experience, and their reaction to it, change.¹⁴ Mervyn King worries that ABM models, coming from behavioural economics (Akerlof and Shiller 2009, Kahneman 2011), require agents to act irrationally. King (2016) states that, "The problem with behavioural economics is that it does not confront the deep question of what it means to be rational when the assumptions of the traditional optimizing model fail to hold."

In contrast, Akerlof and Shiller believe that by assuming rational expectations, macroeconomics fails to recognize that agents can act on non-

economic motives, or so-called animal spirits, which are the main cause of economic fluctuations. In other words, when confronted with fundamental uncertainty about the future, agents make decisions that are intuitive rather than analytic. In the authors' view, "Failing to incorporate animal spirits into the model can blind us to the real sources of trouble."

A key question, therefore, is whether non-optimizing models such as ABMs provide an additional tool for central bank management of risks and uncertainty above and beyond that of optimizing-behaviour models. Radical uncertainty cannot (by definition) be captured in either optimizing or non-optimizing models because it is not subject to measurement. But ABMs, nonetheless, can deal with questions not readily addressed by conventional rational-expectations equilibrium analysis.

For their part, Ashraf, Gershman and Howitt (2012) use an ABM to investigate inflation costs for exactly that reason. The advantage they see is that an ABM can provide a "propagation mechanism through which inflation might impede the market processes that coordinate economic activity." Put differently, they say their use of an ABM shows "how inflation can worsen macroeconomic performance by disrupting the mechanism of exchange in a decentralized market economy."

Seen this way, ABMs, with their complexities arising from agents' behavioural interactions, appear to bring us closer to understanding the possible consequences of an uncertain environment where these interactions could result in irrational, unpredictable behaviour, including possible systemic breakdowns.

13 The Bank of England has been one of the most progressive users of ABMs. For example, it has developed ABMs for both the corporate bond and housing markets.

14 Put differently, these models are subject to the Lucas (1972) critique in that there is not as much adaptation with exogenous-behavioural rules as in a rational-expectations model.

COMMUNICATIONS AND NARRATIVES

Communications has become central to the work of central banks. Effective, timely communication contributes to the trust and confidence that economic agents have in their central bank's ability to promote economic and financial well-being.

i) Communications as a Monetary Policy Tool

In the conduct of monetary policy, communications have come to play a distinct and special role. Indeed, communications have helped conduct policy (Jenkins 2005). Properly carried out, communications can improve the effectiveness of policy and serve as a primary means of achieving transparency and accountability. Handled poorly, as we have seen in many situations, communications can have the opposite effect.¹⁵

The power of effective communications comes from an increased level of understanding among economic agents about the objectives of policy, the transmission mechanism (i.e., real-financial linkages), the outlook for the economy, and the risks surrounding that outlook.¹⁶ In the Bank of Canada's case, it is fair to say that its strategy for communicating monetary policy has evolved around an understanding of its inflation-targeting framework.

With such an understanding, communications can improve the effectiveness of policy through several channels:

- by generating broad support for policy (i.e., price stability as a “means to an end”);
- by anchoring expectations of consumers, producers, governments and financial market participants to the inflation target; and
- by promoting informed policy discussion.

Clearly, this approach to communications is based on a monetary-policy framework that relies on optimizing-behaviour models. Agents are rational and forward-looking, monetary policy rules are integral to achieving the policy objectives and equilibrium conditions prevail.¹⁷

The GFC directly challenged this approach to communications, either because of non-optimizing (irrational) behaviour on the part of economic agents or because of a break in the policy framework where, for example, the real-financial linkages of policy transmission change due to liquidity and/or capital shortages.¹⁸ Thus, while the GFC reinforced the importance of central bank communications because of a need to understand and be accountable, it also demonstrated why an effective communications strategy, developed for times when risks can be calibrated, might be counterproductive in times of heightened uncertainty. In this type of situation, such a

15 At a June 2013 news conference, Bernanke (2013) suggested that the Federal Reserve would likely start to slow (i.e., “taper”) the pace of asset purchases later in the year. Even though it was a conditional statement, markets reacted immediately with bond yields increasing dramatically. This became known as the “taper tantrum.”

16 While the focus of this *Commentary* is on risk and uncertainty from a policymaker's perspective, clarity about the monetary-policy framework – policy objectives, transmission mechanisms, policy tools and transparency – can help address risk and uncertainty as seen by the public.

17 Communicating risks in this context would be as discussed earlier: base-case projections would balance risks; confidence intervals would be estimated; alternative scenarios and information would be presented; use of robust rules would be explained; and central bank officials would discuss openly what they see as the main risks to the outlook. See Kozicki and Vardy (2017).

18 See Bergevin, Duguay and Jenkins (2011).

communications strategy is likely to be unable to explain “what is going on” in response to the unpredictable having happened.¹⁹

This quickly moves us beyond a central bank’s communications strategy based on models of optimizing-behaviour and into how central banks can best address uncertainty when they lack quantifiable knowledge of the risks of some possible occurrences.

ii) The Potential for Narratives

Nobelist Robert Shiller, in his 2017 American Economic Association Presidential Lecture, “Narrative Economics,” argues that economics should include serious quantitative study of changing narratives. By narrative economics he means the study of the spread and dynamics of popular narratives in understanding and explaining economic fluctuations. While acknowledging the difficulties in applying scientific rigor, he presents evidence that the Great Depression of the 1930s, the GFC of 2008 to 2009, and even the contentious political-economic situation today “are considered as the results of the popular narratives of their respective times.”

The foundation for Shiller’s work on narratives is in behavioural economics,²⁰ including the work of Kahneman and Tversky (2000) who argue that individuals form their expectations based on similarity of stories, and not on probabilities. Shiller argues that the relationship between narratives and economic outcomes is complex and can vary over time. Moreover, there is the serious issue of inferring causality: are narratives associated with

behaviour simply because they are reporting on the behaviour, or can narratives produce changes in behaviour.

Here we need to circle back to King’s criticism of behavioural economics: that it requires agents to act irrationally. King rejects this idea, arguing that individuals are not compelled to act irrationally (or by impulse) but that neither is there a single optimizing solution for each problem. As King (2016) puts it, “When we cannot write down a mathematical model with numerical probabilities, we can nevertheless think and talk about the future in qualitative terms.” For him (King 2017): “A narrative is an entirely rational way to approach the challenge of radical uncertainty. It is a story that integrates the most important pieces of information in order to make a decision.”

Clearly, King’s view of the use of narratives differs from Shiller’s. For King, agents use narratives in response to macroeconomic events to make “one-off decisions” when faced with radical uncertainty. For Shiller, a narrative is a story that is told to influence the views and emotions of others. In his view, financial market excesses, for example, are driven by stories that people tell and which are neither necessarily rational nor stable over time.

There is no simple way of reconciling these differences and this *Commentary* does not favour one or the other. Indeed, the economics profession has historically struggled to make sense of how people handle true uncertainty.

The question is whether narratives can bridge optimizing and non-optimizing behaviour in a world of radical uncertainty. Put differently, in a world of uncertainty where the future is

19 In addition to explaining what was happening and why, especially at the peak of the GFC, the Bank of Canada also undertook to lay out its thinking on the potential use of quantitative easing, credit easing, forward guidance and innovative ways of providing market liquidity within a policy framework that individuals and markets could understand (Bank of Canada 2009.).

20 Similarly, as with the development of ABMs discussed earlier.

unpredictable and risks difficult to calibrate, can central banks use narratives to convey the degree and nature of uncertainty (even possibly reduce the degree of uncertainty) and, thereby, condition behaviour in the event of the unpredictable happening.

King's use of narratives in support of one-off decisions is one way to deal with radical uncertainty confronting rational agents immediately following an entirely unanticipated event. Yet, irrational (intuitive) behaviour, or animal spirits, in a world of radical uncertainty cannot be dismissed as the source of such an unanticipated event. Moreover, in both cases – the former involving an unanticipated event and the latter about some future possible occurrence – we are talking about situations where there is a lack of sufficient knowledge to quantify risks.

Viewed this way, narratives could become an important additional tool in a central bank's communications strategy. The idea would complement a central bank's overall strategy when risks can be calculated with a clear distinction between those circumstances with identifiable risks and those of radical uncertainty.

CONCLUSION

This *Commentary's* focus is on the distinction between risk and radical, or Knightian, uncertainty in the formulation and implementation of monetary policy.

For the best policy decisions, one needs a single judgment about the economic outlook, where risks are considered balanced.²¹ However, uncertainties may mean that a single judgment is difficult, or near impossible. In today's world, it seems that economic

(and geopolitical) uncertainties have become an almost constant feature of the policy landscape. We have, to name just a few, trade war uncertainties and associated uncertainties about the future of the global trading system, uncertainties about a changing world order, uncertainties about global governance and the rules of the game, uncertainties related to technological disruptions, and climate change uncertainties. Each is of a singular nature to which one cannot easily assign a risk-probability distribution.

Consider the following three examples, all reflective of the uncertain global economic environment facing Canada.

The first is Brexit. Since the 2016 referendum, the uncertainties about the ultimate outcome, and the economic consequences of any one outcome, have lacked sufficient clarity so that quantifying the risks with any degree of confidence has been near impossible. That is not to say that various scenarios cannot be analyzed.²² Rather, basing policy on any one scenario is difficult. In such a situation, it is far better for the central bank to be up front about the extent of uncertainty, share a narrative that acknowledges these uncertainties and relays a story to assist economic agents to understand what they are confronting. And in doing so, enable all stakeholders (i.e., citizens, financial and non-financial corporations, small enterprises, and governments and their institutions) to take more responsibility for their own decision-making.

A second example would be the implications for Canada of US-China trade tensions. The Trump administration has been extremely volatile on the nature and extent of a possible escalation of a trade war with China, with China countering with

21 Again, speaking of a situation in which the risks are balanced is consistent with Knight's distinction between risk and uncertainty.

22 The Bank of England has produced such an analysis with a clear eye to the need to be objective, given the political divides on Brexit. Admittedly, it has been a difficult fine line, but still one requiring thoughtful analysis.

numerous possible actions. Here again is a situation where we do not have sufficient information in order to calculate probabilities and base a policy on them.

A third example is climate change. Central banks have become more vocal in discussing the risks of climate change for financial institutions and for the stability of the system, overall.²³ From an economic perspective, however, the risks to the economy (short or long term) of inaction, or action, are difficult to quantify. Still, a central bank can engage in an objective discussion through various narratives to help people better understand the possible economic consequences.

A growing concern about the true nature and extent of uncertainty facing policymakers is becoming more commonplace, and for good reason. The US Federal Reserve, for example, is undertaking a review of its approach to communications with such a concern clearly in mind. At a recent conference on its policy strategies and practices, including communications, Chairman Jerome Powell said, “The most important policy message may be how the central bank will respond to the unexpected...”²⁴

The Bank of Canada also seems dialed in to this reality. In a recent speech, Governor Poloz (2018) said, “These days, there is a litany of things we just do not know.” And he added, “We consider it misleading to pretend that uncertainty does not exist.” More recently, he cited (2019) “a significant increase in uncertainty around the future of the global trading system,” adding that, “The global economy has been dealing with heightened uncertainty over trade policy for an extended period now.” These are serious and deep concerns about the global trading system being subject to a prolonged period of radical uncertainty.²⁵

The message of this *Commentary* is that it is better to acknowledge than ignore these uncertainties as part of a central bank’s modelling and communications strategy – that is, there is no pretense that we know with any precision what the future holds. The challenge is in integrating acknowledgement of these uncertainties, while recognizing the need for judgment in taking policy decisions based on risks that are calculable.

23 The Bank of Canada has announced that it has joined the “Central Banks’ and Supervisors Network for Greening the Financial System,” which was established in 2017 and includes more than 30 members (Bank of Canada 2019).

24 See Powell (2019).

25 Another example of how the Bank of Canada has dealt with Knightian uncertainty is discussed by Kozicki and Vardy (2017). Citing the September 11, 2001, terrorist attacks on US soil, they discuss how economic projections that are subject to Knightian uncertainty can be “conditioned on an assumption.” In this case, the post-attack assumptions were not included in the Bank’s November 2001 Monetary Policy Report on balance of risks.

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