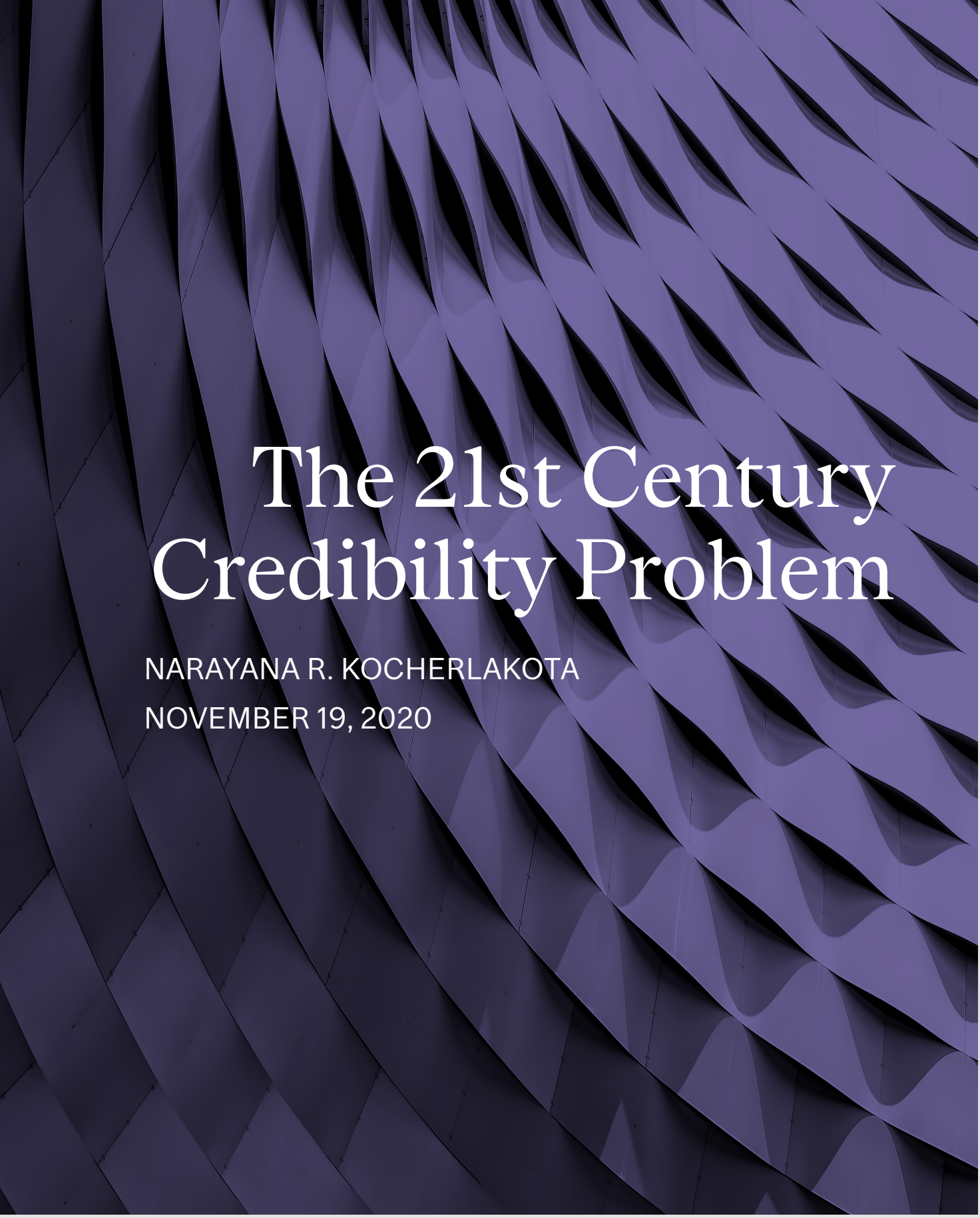

The 21st Century Credibility Problem

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This paper was written for and presented at *Choosing the Right Target: Real Options for the Bank of Canada's Mandate Renewal*, a conference held by the Max Bell School of Public Policy, September 22–25, 2020

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Choosing the Right Target: Real Options for the Bank of Canada's Mandate Renewal

A conference organized by Christopher Ragan and Stephen Gordon

With the Bank of Canada's mandate up for renewal in 2021, McGill University's Max Bell School of Public Policy held a four-day online conference from September 22-25, 2020. The conference was attended by over 100 policy professionals, students, academics, and monetary policy experts who had the chance to think about, exchange, and question what monetary policy in the post-pandemic era should look like. Recordings of the conference sessions can be accessed at:

https://www.mcgill.ca/maxbellschool/choosingtherighttarget

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1. Main message[1]

In this paper, I argue that both theory and evidence from this century imply that central bank credibility is asymmetric. Central banks can, through the use of active interest rate policy, eliminate outcomes with above-target inflation. But central banks cannot preclude persistent sub-target inflation, with associated materially adverse real outcomes. A key bottom line is that central banks should adopt ceilings, rather than targets, as their goals.

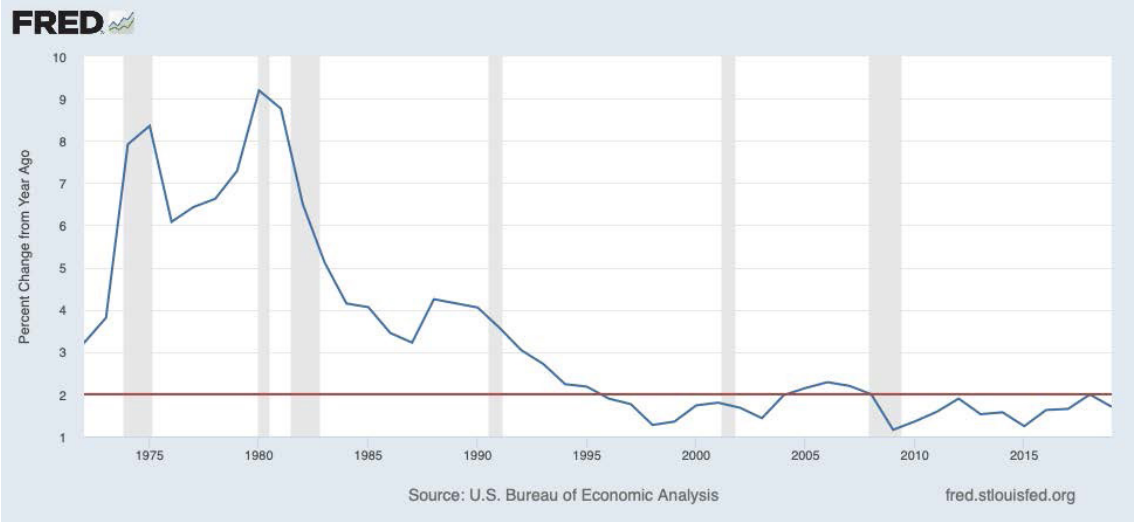
2. Results of a monetary policy experiment

In the early 1970s, the post-World War II Bretton Woods regime (the last version of the gold standard) ended. Thereafter, the advanced economies entered into a remarkable policy experiment, as their currencies have been unbacked by any metal or other commodity. There had been short bursts of this kind (for example, the US during the Civil War) in the historical record. But as I write, the post-Bretton Woods monetary framework has lasted for nearly a full half-century.

What have been the results of this experiment? In Figure 1, I plot post-Bretton Woods US inflation through the end of 2019. (As is often done, I use core inflation, which strips away food and energy components, in an attempt to capture underlying inflation that is free from transitory influences.) As those of who lived through the 1970s well remember, core inflation rose sharply to near ten per cent at the end of the decade. This kind of unduly high inflation is, at a loose level, what one might expect once a country has decoupled its money from any backing.

1 University of Rochester and NBER. This text is a summary of my keynote address at the "Choosing the Right Target" web conference in September 2020, sponsored by the Max Bell School of Public Policy at McGill University. The talk can be seen here. I thank the participants for their questions and comments.

Figure 1: Annual core inflation from 1972-2019 in US

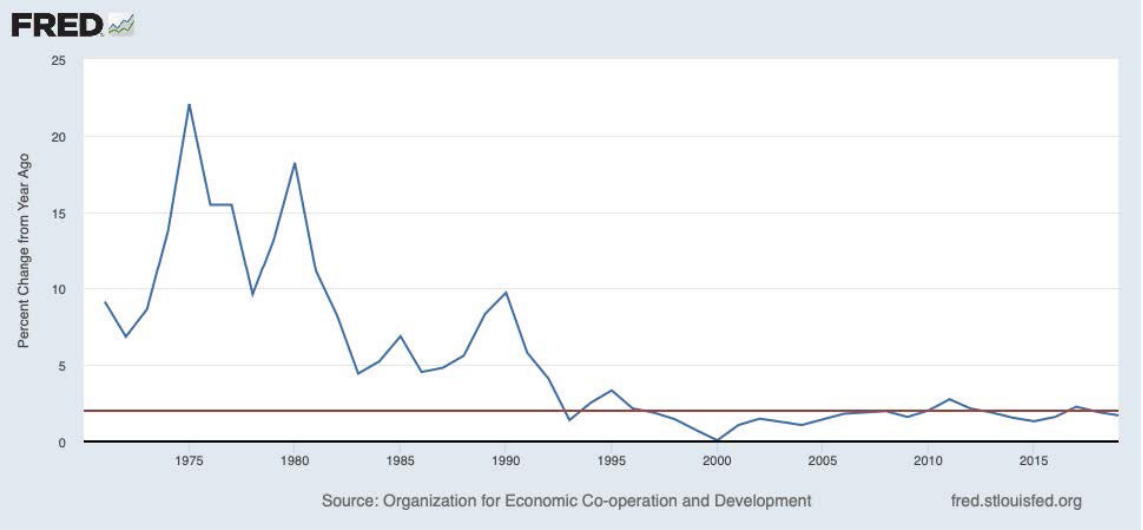


Source: U.S. Bureau of Economic Analysis, Personal consumption expenditures excluding food and energy (chain-type price index) [DPCCRG3A086NBEA], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/DPCCRG3A086NBEA, November 18, 2020.

But now fast forward to the last twenty-five years - the second half of the post-Bretton Woods monetary policy experiment. During this time frame, inflation has consistently run below the Federal Reserve's desired level of two per cent. To be clear: The degree of the shortfall is less than a percentage point and so is much smaller than the magnitude of the overshoot in the 1970s. Nonetheless, it is striking that in this (completely unbacked) monetary system, inflation has been too *low* rather than too *high*.

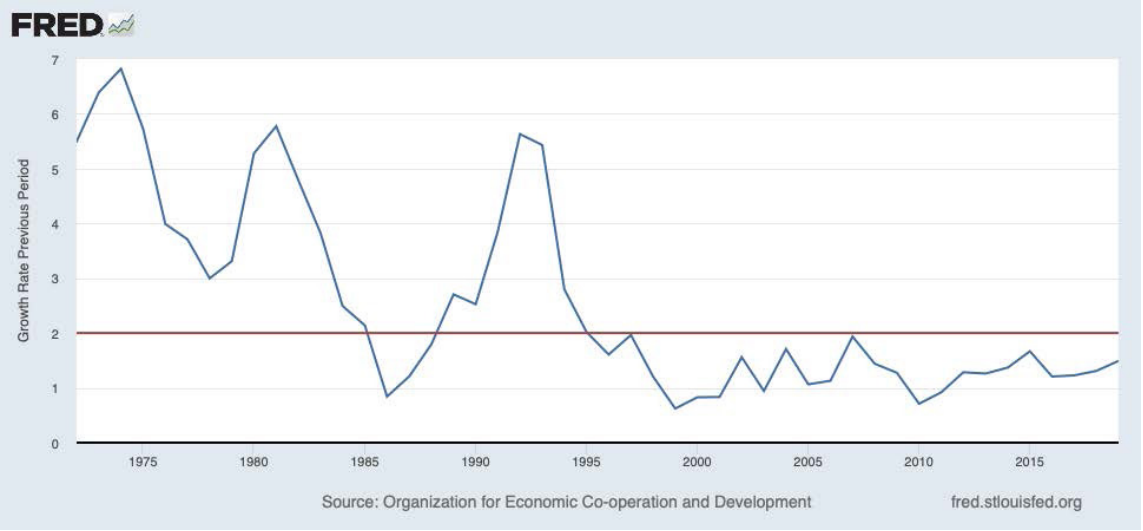
Figures 2 and 3 illustrate that this same basic pattern has played out in the UK and Germany, respectively. (The figures switch to core Consumer Price Index inflation, because that's what the relevant central banks target.) Again, inflation overshot desirable levels in the 1970s, as we might expect in an unbacked system. In contrast, inflation has largely undershot desirable levels in the last quarter-century (although, again, the magnitude of the latter shortfall is much smaller than the earlier overrun).

Figure 2: Annual core inflation from 1972-2019 in UK



Source: Organization for Economic Co-operation and Development, Consumer Price Index: All Items Excluding Food and Energy for United Kingdom [GBRCPICORAINMEI], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GBRCPICORAINMEI, November 19, 2020.

Figure 3: Annual core inflation from 1972-2019 in Germany

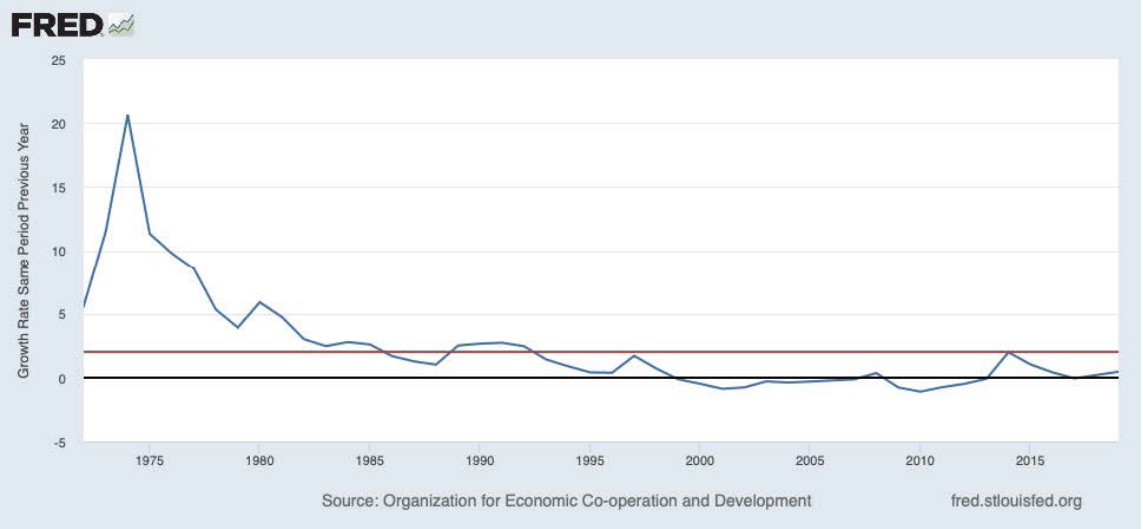


Source: Organization for Economic Co-operation and Development, Consumer Price Index: OECD Groups: All Items Non-Food and Non-Energy for Germany [CPGRLE01DEA657N], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPGRLE01DEA657N, November 19, 2020.

Figure 4 depicts the Japanese inflation experience since the end of Bretton Woods. Japan, too, struggled with unduly high inflation in the 1970s. In the last quarter-century, inflation has been close to zero. It is certainly arguable that, during

much of this period, the Bank of Japan was aiming for near-zero inflation. However, at least since 2013 (under Governor Kuroda), the Bank of Japan has eased monetary policy dramatically in an attempt to achieve two per cent inflation. But, by and large, it has failed to do so.

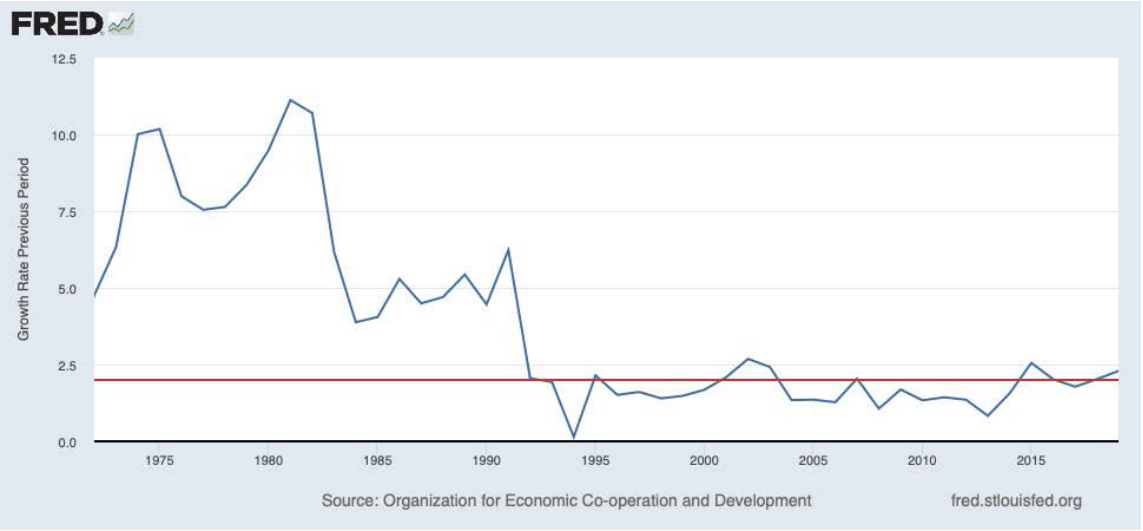
Figure 4: Core inflation from 1972-2019 in Japan



Source: Organization for Economic Co-operation and Development, Consumer Price Index: OECD Groups: All Items Non-Food and Non-Energy for Japan [CPGRLE01JPA659N], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPGRLE01JPA659N, November 19, 2020.

Given the setting and topic of this conference, I would be remiss if I didn't include a reference to post-Bretton Woods Canadian inflation, which is depicted in Figure 5. We see the same basic pattern: Inflation was undesirably high in the 1970s, and has been (slightly) below target in the past quarter century. Unlike in the other countries, the inflation underrun does disappear at the very end of the sample period. (And it is worth noting that, in Canada, headline inflation has been materially higher than core inflation through much of the current century.)

Figure 5: Annual core inflation from 1972-2019 in Canada

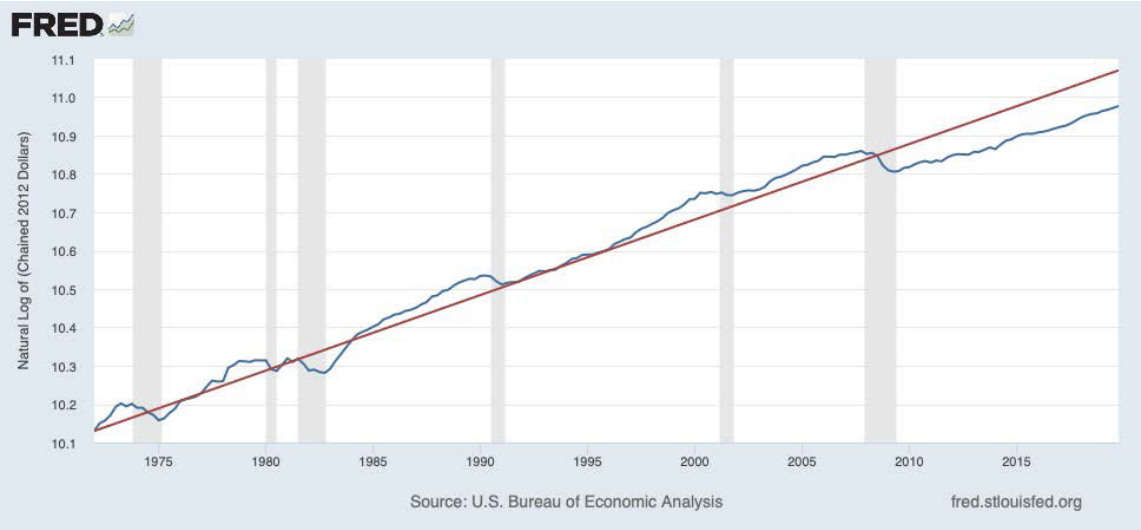


Source: Organization for Economic Co-operation and Development, Consumer Price Index: OECD Groups: All Items Non-Food and Non-Energy for Canada [CPGRLE01CAA657N], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPGRLE01CAA657N, November 19, 2020.

To sum up: in the immediate wake of the collapse of Bretton-Woods, the advanced economies experienced unduly high inflation, which is exactly what many might have expected to be the consequence of removing a monetary anchor. But since the turn of the century, we have seen an inflation surprise: it has been too low relative to the levels seen as desirable by central banks.

The relevant inflation shortfalls may seem small. But they are (at least) associated with materially adverse real outcomes. For example, Figure 6 exhibits the post-Bretton Woods time path of (logged) US per capita real Gross Domestic Product (GDP), relative to a trend line that grows at 2% per year. As of 1995 (essentially halfway through the post-Bretton Woods period), per capita real GDP lies on this trend line. However, as of 2019, per capita real GDP is well below the trend line. In this sense, inflation and output have been low in the second half of the post-Bretton Woods period.

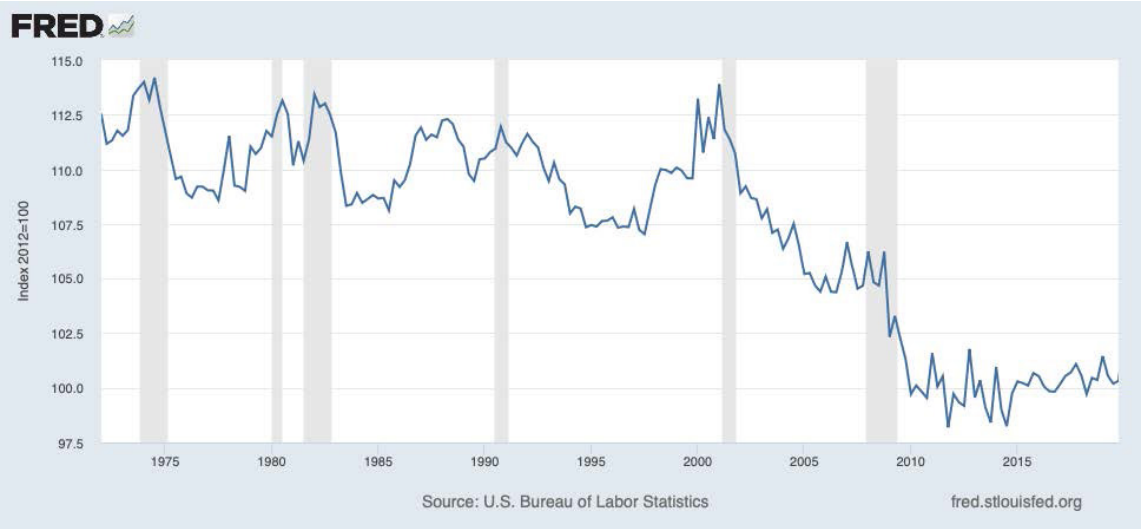
Figure 6: US per capita real GDP (in logs) from 1972-2019, relative to two per cent trend



Source: U.S. Bureau of Economic Analysis, Real gross domestic product per capita [A939RX0Q048SBEA], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/A939RX0Q048SBEA, November 19, 2020.

Figure 7 depicts the post-BW time path of labor share in the US. Here, we see that, like inflation, labor share has fallen sharply in the second quarter-century of the sample.

Figure 7: US Labor Share (Nonfarm Business) From 1972 to 2019



Source: U.S. Bureau of Labor Statistics, Nonfarm Business Sector: Labor Share [PRS85006173], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PRS85006173, November 19, 2020.

There are, of course, abundant literatures about this growth slowdown and the decline in labor share. But, in general, these papers make little or no connection between these real phenomena and low inflation.[2] In contrast, my view is that low output, low labor share, and low inflation are all by-products of protracted low aggregate demand, and that protracted low aggregate demand cannot be alleviated through interest rate policy. The following section describes the theoretical justification for this perspective.

3. Theory

This section describes a theory to rationalize the broad-brush description of the 21st century that I offered above. My high-level description is intended to be accessible to a broad audience. The full technical details are in Kocherlakota (2020).

3.1 Introduction

It is generally assumed by macroeconomists that, over the long run, economic activity must return to a level that is pinned down by technological factors. This presumption ensures that, eventually, supply creates its own demand, and so there is no room for persistent aggregate demand effects.

In contrast, the essence of the theory in this paper (and in Kocherlakota (2020)) is that long-run outcomes or expectations are not pinned down. As a result, economies experience low current inflation/output because households anticipate output/inflation to be low in the future. Those future expectations prove to be self-fulfilling because, once the future arrives, people again expect low inflation and output. Put another way, low long-run aggregate demand expectations flow backward through time (through households' demand for consumption versus bonds) to give rise to low current demand (and inflation/output).

2 Benigno and Fornaro (2018) is an important exception.

The model has two main implications. The first is related to prior results in the New Keynesian literature and explains why, in the wake of the 1970s, we have not seen elevated inflation in the advanced economies. Suppose the central bank uses what's often called an active monetary policy rule, so that it raises interest rates by more than one-for-one in response to above-target realizations of inflation. In the model, that active monetary policy rule eliminates any expectationally-driven outcomes in which inflation and output are above target.

The second implication is novel. No matter what monetary policy rule is used by the central bank, there is a host of (possibly random) expectationally-driven outcomes in which:

- inflation is always below target;
- output and labor share are below desirable levels.

The mechanism behind these results hinges on the possibility of costly firm exit. Under an active monetary policy rule, any above-target inflation rate can only be rationalized if households expect still higher inflation and output in the future. But this argument applies in turn to the higher future inflation/output. It follows that above-target inflation rate implies that households expect output to grow without bound. But such a growth path gives rise to unbounded growth in average costs, which is inconsistent with the ability of firms to exit production by paying a finite cost (no matter how large).

In contrast, neither the possibility of costly firm entry nor costly firm exit imposes a positive *lower* bound on output or inflation. As we shall see, arbitrarily low output is necessarily associated with arbitrarily low real wages. So, profit shares are high when output is low. But those high profit *shares* provide little incentive to enter, since *overall* profits are low when demand and production are low. Without this lower bound, monetary policy has no traction to keep aggregate demand from falling below desirable levels.

3.2 Some details

In this subsection, I sketch the elements of the underlying theory. As noted above, the full technical details are in Kocherlakota (2020).

3.2.1 Standard elements

To simplify the exposition, there are no shocks to fundamentals (so that all randomness emerges from endogenous expectational effects). Labor productivity is fixed at one (so that x units of labor translate into x units of output). Household preferences are such the average cost $AC(Y)$ of producing Y units of output grows without bound as Y grows.

The *natural* real rate of interest is fixed at r_{nat}. This assumption has two implications. First, if the real rate of interest is larger than r_{nat}, households choose sufficiently large asset holdings so that their consumption is growing (at least with some probability). In contrast, if the real rate of interest rate is lower than r_{nat}, then households choose sufficiently small asset holdings so that their consumption is falling (at least with some probability).

The central bank has a fixed interest rate rule $\widehat{R}$. The rule maps current inflation π and current real output Y into the *nominal* interest rate R. Here, the nominal interest rate refers to the (short-term riskless) rate of return from the current period to next period.

3.2.2 Non-standard element 1: A flexible Phillips curve

Suppose we lived in a world without nominal rigidities of any kind (when all price-setting and wage-setting is at least implicitly in terms of real commodities). Then, output is fully determined by preferences and technology. The Phillips curve (as described in Friedman (1968)) is vertical, as that level of output is consistent with any inflation rate.

In this model, I instead assume that inflation π and output Y are linked by an increasing function PC (which stands for Phillips curve):

(1) $$\pi = PC(Y)$$

I show in Kocherlakota (2020) how this relationship can be micro-founded through bounded rationality by price-setting firms (or simply through firms' believing that other firms aren't rational). If the deviation from rationality is slight, then the function PC will have a large slope: small changes in output are associated with large changes in inflation. If the deviation from rationality is large, then the function PC will have a small slope (as appears to be true in recent data).

The standard approach to motivating a non-vertical Phillips curve is to assume that firms face costs in adjusting their prices. The micro-foundations (described in Kocherlakota (2020)) for (1) may include, but don't need to include, these kinds of adjustment costs. As well, it is straightforward to extend the analysis to allow for lags in the Phillips curve (as seems to be empirically plausible).

3.2.3 Entry and exit costs

It is standard in modern monetary economics to assume that there is neither entry nor exit into production. Implicitly, the cost of entry and the cost of exit are both assumed to be infinite. In my theory, I assume instead that:

- incumbent firms can choose not to produce in a given period by paying an exit cost k_{EXIT};
- potential entrant firms can choose to enter in a given period by paying an entry cost k_{ENTER}.

The exit possibility imposes an upper bound on output. Recall that the average cost of production rises without bound as output rises. Hence, a firm would choose to pay the fixed cost k_{EXIT} rather than having to produce a very large amount. Specifically, the possibility of exit implies that:

$$Y_t \leq Y_{UB}$$

where:

$$(Y_{UB} - AC(Y_{UB})Y_{UB}) = -k_{EXIT}$$

This analysis raises a natural question: does the possibility of entry impose a lower bound on output? The answer to this question is no. When output is low, $AC(Y)$ is low, and so labor share is low. However, total profits:

$$(Y - AC(Y)Y)$$

are also low when output is low. Potential entrants actually have less incentive to enter when output is low.

To sum up: the possibility of entry and exit creates asymmetric bounds on output. Output cannot exceed Y_{UB}. But there is no corresponding lower bound on output.

3.3 Results

I start from the premise that the central bank wants to achieve a constant inflation rate π^* and a constant output level Y^* that are consistent with each other in the sense that they lie on the Phillips curve:

$$\pi^* = PC(Y^*)$$

Since output is constant in this desired outcome, the real interest rate must equal the natural real rate of interest rnat. Hence, to achieve its desired outcome, the central bank must use a rule $\widehat{R}$ that satisfies:

(2) $$\widehat{R}(\pi^*, Y^*) - \pi^* = r_{nat}$$

Here and elsewhere, I use the standard first-order linear approximation to what is an exact equality in logs. And, indeed, it is straightforward to show that if a central bank does use a rule of this kind, there is an outcome in which output is always Y^* and inflation is always π^*.

But does such a monetary policy rule admit other possible outcomes that are not as desirable? The next two subsections answer this question by taking a stand on how the interest rate rule depends on (π, Y) for values other than (π^*, Y^*).

3.3.1 Entry and exit costs

We saw in Section 2 that central banks in the advanced economies appear to have learned how to eliminate outcomes in which inflation is undesirably high. The key to being able to do so (as described, for example, in Clarida, Gali, and Gertler (2000)) is the use of what are typically termed active monetary policy rules. To be precise, we say that the monetary policy rule $\widehat{R}$ is active if it satisfies the requirement that:

$$\widehat{R}(PC(Y), Y) - PC(Y)$$

is strictly increasing for $Y \geq Y^*$. This means that if inflation (PC(Y)) goes up by one percentage point, then the central bank raises the nominal interest rate by more than one percentage point.

Kocherlakota (2020) demonstrates that **under an active monetary policy rule, it is impossible for inflation to ever be above target** (recalling, of course, that there are no shocks to fundamentals). The intuition for this result is as follows. Suppose inflation $PC(Y_t)$ at some date t were ever above target π^*. Then, Y_t is above Y^*, and so:

$$\widehat{R}(PC(Y_t), Y_t) - PC(Y_t) > \widehat{R}(PC(Y^*), Y^*) - PC(Y^*) = r_{nat}$$

Since the real interest rate is larger than r_{nat}, there is some chance that future output Y_{t+1} exceeds current Y_t. We can keep applying this argument at *(t+1), (t+2)*, and so on. But the constant growth in output eventually means that output would have to exceed Y_{UB} (with positive probability) - and that's impossible.[3]

Here, the possibility of firm exit is playing a critical role. If inflation is above target, it is because that output and inflation are jointly spirally upward. But such a spiral would eventually push average costs so high that firms would want to exit.

3.3.2 Lowflation outcomes

In the previous subsection, we saw how a central bank can eliminate above-target inflation outcomes by using an active rule. Now suppose the central bank uses *any* rule $R\hat{}$ that satisfies (2). The rule can be active or not. And it can be bounded from below or not. **Such a rule always admits a large class of (possibly random) lowflation outcomes** in which at all dates and with probability one:

$$Y_t < Y^* \text{ and } \pi_t = PC(Y_t) < \pi^*$$

Intuitively, current output (at date *t*) is determined by the current level of demand. That can be below target as long as there is a sufficient probability of future output (date *(t+1)*) being below target. But that's possible as long as there is a sufficient probability of output at date *(t + 2)* being below target - and so on into the future. The key here, of course, is that there is no element in the model that keeps output from being arbitrarily small (that mirrors how potential exit keeps output from being arbitrarily large).

3 This intuitive argument is not exact. The term $\hat{R}(\varpi,Y) - \varpi$ is actually the pseudo-real interest rate (because we are subtracting current inflation, rather than expected inflation). And we need the implied growth in output to be bounded away from zero. The formal argument in Kocherlakota (2020) addresses both of these issues.

The properties of these lowflation outcomes correspond to what we saw in the data in Section 1. Inflation and output are always below target. The nominal interest rate is also always below target. :

$$\widehat{R}(\pi,Y) < \widehat{R}(\pi^*,Y^*) = r_{nat} + \pi^*$$

As well, profit (labor) share:

$$(1 - AC(Y)) > (1 - AC(Y^*))$$

is always undesirably high (low).

3.3.3 Summary

The theory explains how central banks learned a 20th century lesson and now face a 21st century problem.

In the 20th century, central banks learned how to eliminate exceptionally driven above-target inflation. It is impossible for inflation to ever be above target if the interest rate rule is active for such inflation rates. The key to this approach working is the upper bound on output imposed by the possibility of exit.

In the 21st century, central banks cannot eliminate lowflation outcomes in which inflation, output, the nominal interest rate, and labor share are all below undesirably low. These outcomes are generated by low current demand that is induced in turn by self-fulfilling beliefs about future low demand.

4. Lessons for the Bank of Canada

The above results give rise to two main lessons for central banks.

The first lesson concerns the efficacy of tools. Forward guidance (including any form of level targeting) doesn't help eliminate lowflation equilibria. The point of

such communication is to describe how the central bank will act if inflation is above target. But it has no bite if the public believes that inflation will always be below target.

The second lesson is about the formulation of central bank goals. In its August 2020 statement on longer run goals, the US Federal Reserve states that, "The inflation rate over the longer run is primarily determined by monetary policy, and hence the Committee has the ability to specify a longer-run goal for inflation." But the evidence from the past quarter century and the theory in Kocherlakota (2020) both imply that this claim is false. As the Bank of Canada deliberates over its new mandate, it should keep in mind that, over the longer run, the theory and evidence both suggest that central banks can only deliver on ceilings, not targets.

The above lessons leave open the question of whether it is possible for governments use fiscal policy (perhaps in conjunction with monetary policy) to keep inflation and output from running persistently below target. But the prior section does imply that no less-than-permanent fiscal intervention is sufficient to do so, because no such action can be guaranteed to elevate expectations about very-long-run demand.

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Narayana Kocherlakota received a PhD in economics from The University of Chicago in 1987. Since that time, he has held academic appointments at a number of institutions, including Stanford University, Northwestern University, The University of Iowa, and the University of Minnesota. He was the President and CEO of the Federal Reserve Bank of Minneapolis from 2009-2015. As part of his responsibilities in that position, he served on the Federal Open Market Committee (FOMC), the monetary policymaking arm of the Federal Reserve System.

His past research includes theoretical and empirical contributions to many fields in economics, including the economics of money and payments, business cycles, financial economics, public finance, and dynamic games/contracts. His current research is on monetary policy.

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