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The 2021–22 Surge in Inflation

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Abstract

The rise in inflation in 2021–22 sparked a growing literature and debate over the causes of the surge as well as the near- and medium-term path for inflation. This review offers three key messages. First, the exceptional nature of shocks resulting from the COVID-19 pandemic and geopolitical events drove the surge in inflation and the initial underestimation by many central banks of the extent of inflationary pressures. Second, the pandemic may have accelerated structural changes in goods and labour markets, which are likely to put pressure on goods prices and wages in the medium and long term. Third, the resulting shifts in relative prices for goods, services and labour are unlikely to be large enough to threaten a return of inflation to target but may require somewhat higher interest rates than those in the decade before the pandemic.

Bank topics: Inflation and prices; Inflation targets; Monetary policy
JEL codes: E31, E52, E58

Résumé

La hausse de l'inflation en 2021 et 2022 a donné lieu à de plus en plus de publications et de débats sur les causes de cette flambée, de même qu'au sujet de la trajectoire de l'inflation à court et moyen terme. Notre examen présente trois messages clés. D'abord, la nature exceptionnelle des chocs occasionnés par la pandémie de COVID-19 ainsi que les bouleversements géopolitiques ont stimulé la montée de l'inflation, et expliquent que les banques centrales aient initialement sous-estimé l'ampleur des pressions inflationnistes. Ensuite, il est possible que la pandémie ait accéléré les changements structurels des marchés des biens et du travail, ce qui pourrait exercer des pressions sur les prix des biens et les salaires à moyen et long terme. Enfin, les variations subséquentes des prix relatifs des biens, des services et de la main-d'œuvre sont peu susceptibles d'être assez importantes pour menacer le retour de l'inflation à la cible, mais pourraient nécessiter des taux d'intérêt un peu supérieurs à ceux qui avaient cours pendant la décennie précédant la pandémie.

Sujets : Inflation et prix; Cibles en matière d'inflation; Politique monétaire
Codes JEL : E31, E52, E58

Introduction

The 2021–22 surge in inflation in Canada and across many advanced and emerging economies was the most pronounced since the 1970s.[1] In Canada, year-over-year consumer price index (CPI) inflation crossed the 3% upper bound of the inflation-control target range in April 2021 and continued to rise to peak at 8.1% in June 2022. In late 2022, inflation in Canada and other countries remained too high. For example, in September 2022, US year-over-year CPI (excluding food and energy) was at 6.6%, the highest since August 1982. Similarly, core inflation measures for Canada in September 2022 ranged from 4.7% to 6.0%, while October 2022 CPI inflation was at 6.9%. Long-term market-based measures of inflation expectations were also above normal levels, mostly reflecting investor uncertainty about future inflation (Adrian 2022).

This rise in inflation has sparked a growing literature and debate over the causes of the surge as well as the near- and medium-term path for inflation. In this review, we briefly summarize the evolution of inflation and central banks' inflation projections over the COVID-19 pandemic. We then discuss the literature's contribution to the debate on the likely path of inflation and its return toward the target. In particular, we discuss the key concerns for a longer-than-expected normalization period and higher-than-expected inflation levels over the long term.

Our review offers three key messages:

- The exceptional nature of shocks resulting from the pandemic and geopolitical events drove the surge in inflation and the initial underestimation by many central banks of the extent of inflationary pressures.
- The pandemic may have accelerated structural changes in goods and labour markets, which are likely to put pressure on goods prices and wages in the medium and long term.
- The resulting shifts in relative prices of goods and services and in the costs for labour are unlikely to be large enough to threaten a return to the inflation target. But they may require somewhat higher interest rates than those in the decade before the pandemic.

The paper proceeds as follows. We first discuss why the initial inflation surge was so remarkably fast and so surprisingly high. The factors that pushed inflation up are mostly cyclical and were largely triggered by the pandemic. We discuss how these factors will evolve and influence inflation going forward. We then turn to structural inflationary factors—some directly related to the pandemic and others predating it—and focus on how they influence the long-term inflation level. We conclude by discussing options for monetary policy and avenues for future research.

Why did inflation rise so high and so quickly?

The pandemic has been an extraordinary event. It unleashed a variety of inflationary forces, ranging from the well-known and expected to those less understood and unexpected. In

[1] Among the G7 countries, year-over-year CPI inflation in August 2022 was 7.0% in Canada, 5.9% in France, 7.9% in Germany, 8.4% in Italy, 3% in Japan, 8.7% in the United Kingdom and 8.3% in the United States.

particular, three features of the economic crisis caused by the pandemic may explain the unique challenge that many central banks did not sufficiently recognize.

First, the pandemic created a confluence of factors that evolved and interacted over time. For example, adverse supply factors (such as global supply chain disruptions) and demand factors (stemming from stimulative monetary and expansive fiscal policies) had an impact on inflation that accumulated over the pandemic. This impact was difficult to predict as the pandemic and the policy response to it evolved. The relative importance and persistence of these forces turned out to be much larger than anticipated and played a key role in driving the global surge in inflation (De Soyres, Santacreu Young 2021; Ferrante, Graves and Iacoviello 2022).

Second, the disruption in economic activity was uneven across sectors. Some goods-producing sectors (such as foods, durables, imported goods) and housing experienced a faster and steeper rise in inflation. For most goods, this inflation surge was attributed to:

- the shift in demand from hard-to-distance services to durables (Tauber and Van Zandweghe 2021; MacGee, Pugh and See 2022);
- the higher cost of inputs (for example, semiconductors in cars and electronics, Dunn and Leibovici 2021);
- the higher cost of shipments and delivery (Alessandria et al. 2022); and
- the higher cost of finding new suppliers (Kopytov et al. 2021).

Since this reallocation of demand toward goods-producing sectors took place in many countries at the same time, its impact on inflationary pressure in Canada may have been underestimated. This initial surge then spread to other goods sectors and to services.

Third, the disruptions caused by the pandemic were also uneven over time and highly uncertain (Dahlhaus et al. 2022). In most countries, after the initial wave of infections and deaths in the spring of 2020, the two subsequent waves came in winter, in 2020–21 and 2021–22. Through most of 2022, China repeatedly brought back lockdowns in its struggle to meet its "zero-COVID" policy. These waves of infections and repeated lockdowns prolonged and exacerbated supply chain disruptions.

In addition to pandemic-related forces, the onset of the war in Ukraine in February 2022 disrupted energy and food markets, sending global fuel, natural gas and some food prices soaring (Fornaro and Romei 2022; Caldara et al. 2022). Food and fuel prices not only contribute directly to CPI inflation but also amplify and propagate it by making input prices more expensive (Pasten, Schoenle and Weber 2020) and by alarming usually inattentive consumers to rising prices (Coibion and Gorodnichenko 2015).

Why did inflation forecasts miss the surge in inflation?

The acceleration of inflation sharply contrasted with its insensitivity to shocks and policy stimuli for more than a decade before the pandemic (Kryvtsov and MacGee 2020). The uneven and uncertain impacts of the pandemic played a role—as did the unexpected surge in energy and commodity prices following the Russian invasion of Ukraine. These forces contributed to the underestimation of future inflation by the Bank of Canada and other advanced-economy central banks from early 2021 to mid-2022.

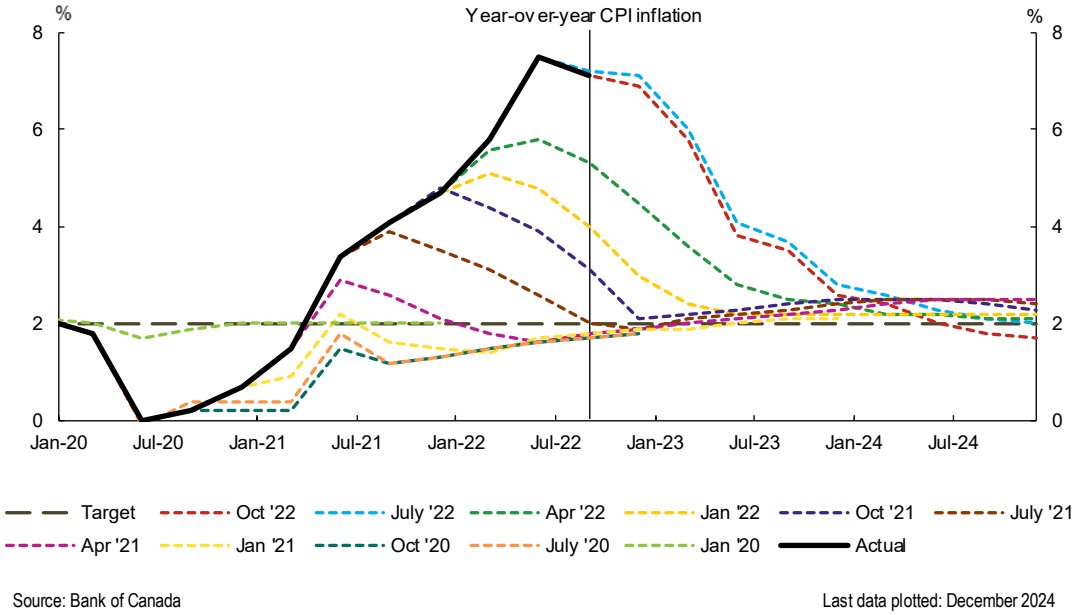
The initial projections in 2020 for inflation after the pandemic were consistent with the initial fall in inflation during the middle quarters of 2020 (**Chart 1**). In response to the extraordinary

uncertainty in early 2020 about how the pandemic would evolve, the Bank of Canada replaced the base-case projection with a range of plausible scenarios for inflation in its April 2020 *Monetary Policy Report*. Although these scenarios varied in the depth of the decline in inflation below the 2% target and in the timing of when inflation would recover to above 2% (see Chart 12 in the April 2020 *Monetary Policy Report*), none of the scenarios envisioned a rapid rise in inflation outside of the target range of 1%–3%.

After inflation decreased to –0.4% in May 2020 during a short economic decline in the wake of the first wave of the pandemic, it began to rise as the first lockdown was lifted. While the inflation projections in 2020 and early 2021 indicated a rise in inflation, the rise from 0.7% to 3.1% in Canada between the first half of 2020 and the first half of 2021 took place sooner and faster than forecast. The dominant view at the time for this unexpectedly rapid rise in inflation in Canada—and around the world—was that supply chain disruptions were the key driver (Dynan 2022; di Giovanni et al. 2022).

In the second half of 2021 and early 2022, the stronger-than-anticipated pace, breadth and persistence of inflation across goods and services contributed to upward revisions to the inflation projections at the Bank of Canada (**Chart 1**) as well as other central banks. For example, in its July 2022 *Monetary Policy Report*, the Bank of Canada revised up its previous CPI inflation forecasts by 2 percentage points in 2022, by 1.8 percentage points in 2023 and by 0.2 percentage points in 2024. Encouragingly, the October 2022 projection saw the first downward revision in the inflation projection since the pandemic hit in 2020. This followed inflation over the second half of 2022 measuring slightly below the July 2022 projection.

Chart 1: Evolution of Bank of Canada inflation projections



Source: Bank of Canada

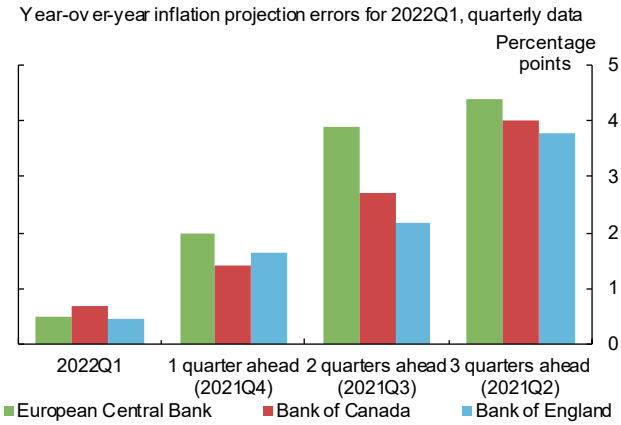
Last data plotted: December 2024

Chart 2 (reproduced from the July 2022 *Monetary Policy Report*) illustrates that this underestimation of inflationary pressures over 2021 and the first half of 2022 was not unique to the Bank of Canada. The Bank of England and European Central Bank had also underpredicted inflation since the second quarter of 2021. The largest factor contributing to these forecast errors was the inflationary effects of global supply shortages and rising

commodity prices, which together accounted for nearly four percentage points in the one-year-ahead forecast error of CPI inflation for the second quarter of 2022.

For most of the post-Second World War period in advanced economies, there is no inflation episode similar to the sudden surge that followed the pandemic (Schmitt-Grohé and Uribe 2022). Even the inflation in the 1970s took about a decade to develop. Central bank models informed by historical data therefore predicted gradual "linear" inflation dynamics around its average. Not surprisingly, these models did poorly in informing central bankers about the upside inflation risks during the pandemic (Forbes, Gagnon and Collins 2022; Harding, Lindé and Trabandt 2022).

Chart 2: Underpredictions of inflationary pressures



Note: This chart appears as Chart A-1 in the Bank of Canada's July 2022 *Monetary Policy Report*. The horizontal axis refers to the quarters when the forecasts were made for 2022Q1 inflation. Projection errors are the difference between the actual observed value and the projection value.
Sources: European Central Bank, Bank of England, Statistics Canada, Bank of Canada and Bank of Canada calculations

Several plausible mechanisms of nonlinear inflation behaviour may have contributed to the recent surge in inflation in advanced economies. These mechanisms originated, to a varying degree, from the pandemic crisis, and therefore, they were not well reflected in historical data. This made it more difficult for policy-makers to understand the nonlinear nature of the inflation surge.

Cavallo and Kryvtsov (2022) show that early in the pandemic, retailers were reluctant to raise goods prices and preferred to tolerate product shortages amid rising costs. But starting in mid-2021, retailers began raising prices more aggressively, helping them reduce the incidence of temporary product shortages to near pre-pandemic levels. But shortages of product lines that retailers discontinued when the pandemic started were still elevated in some countries and sectors in 2022. This included food and consumer electronics in the United States and household durables and furnishings in Canada. The combination of low inventories and high demand could make industry capacity constraints more binding and worsen firms' outlooks on future costs (Boehm and Pandalai-Nayar 2022). In response, firms abandoned cost-saving pricing strategies (for example, inventory management or temporary price discounts) in favour of raising prices. The Bank of Canada's Business Outlook Survey for the fourth quarter of 2021 provided early evidence of the change in the ability of businesses to pass along cost increases.

As inflation moved higher in 2021, it did not take long for inflation expectations to also begin to rise (Cascaldi-Garcia, Loria and López-Salido 2022). This sensitivity of inflation expectations

when inflation is high contrasts with their *in*sensitivity during the long stretch of below-average inflation after the Great Recession in 2008–09. This asymmetry can be attributed to firms and households paying more attention to their experiences with inflation when it is high (Cavallo, Cruces and Perez-Truglia 2017; Candia, Coibion and Gorodnichenko 2022). Albagli, Grigoli and Luttini (2022) demonstrate that firms' inflation expectations are influenced by price changes along their supply chain.

Persistence of cyclical factors over the projection horizon

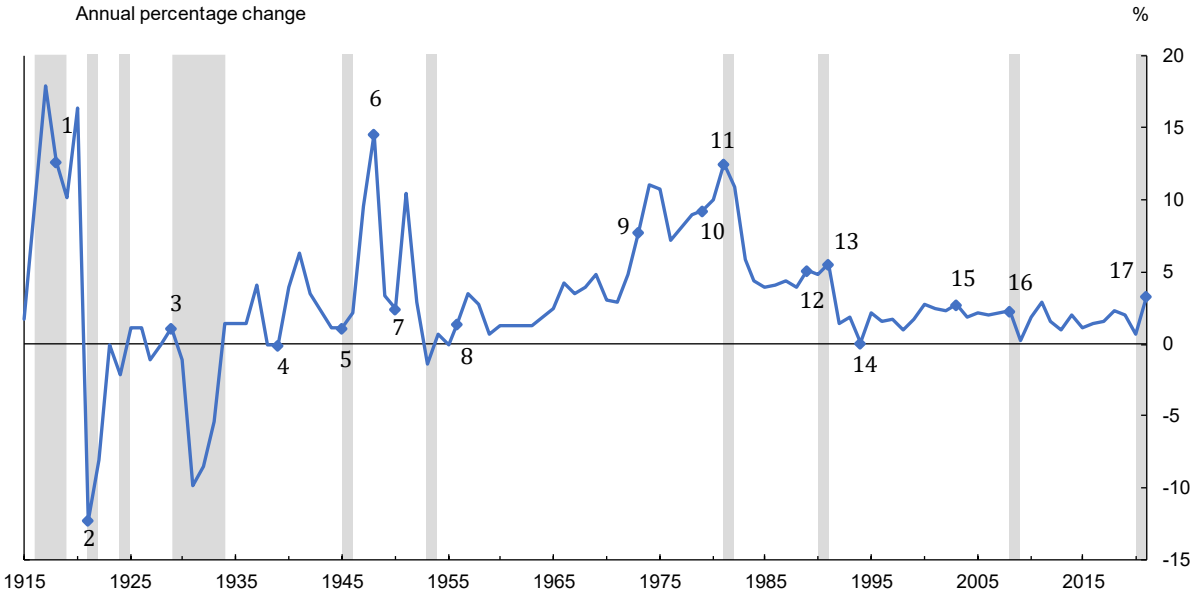
According to the Bank of Canada's October 2022 *Monetary Policy Report*, inflation in Canada is projected to return to the 1%–3% target range by the end of 2023 and reach the 2% target by the end of 2024. Underpinning this projection is the assumption that the cyclical factors that precipitated inflation over 2021–22 will dissipate in 2022–23. For example, supply-side disruptions gradually ease, aggressive monetary policy cools strong demand, and commodity prices stabilize. An additional assumption is that inflation expectations remain anchored. The risks associated with these forces will determine not only the path of inflation normalization but also its toll on the economy. As the cyclical forces dissipate, risks remain that they will persist longer than expected and delay inflation's return to normal.

Historical data provide two useful perspectives.

Schmitt-Grohé and Uribe (2022) examine US inflation, output and interest rate data between 1900 and 2021. While there is no post-Korean War precedent for the surge in inflation during the COVID-19 pandemic, similar episodes took place during the 1900–54 period. For example, in 1918, over the course of the Spanish flu pandemic and the last year of the First World War, inflation reached 17% (up from 1% in 1915) and then fell to -11% over the next three years. Schmitt-Grohé and Uribe estimate that when the 1900–54 period is considered in the analysis, the permanent component of inflation during 2019–21 increases by only 0.5 percentage points, out of the total 2.8-percentage-point increase. They conclude that from a historical perspective the recent burst in inflation is not permanent.

Canadian inflation history shows a similar pattern (**Chart 3**). The highest annual increase in Canadian CPI in recorded history was 17.9% in 1917, with the CPI increasing by more than 48% over the course of the First World War (Charest and White 2015).

Chart 3: Canadian consumer price index over time



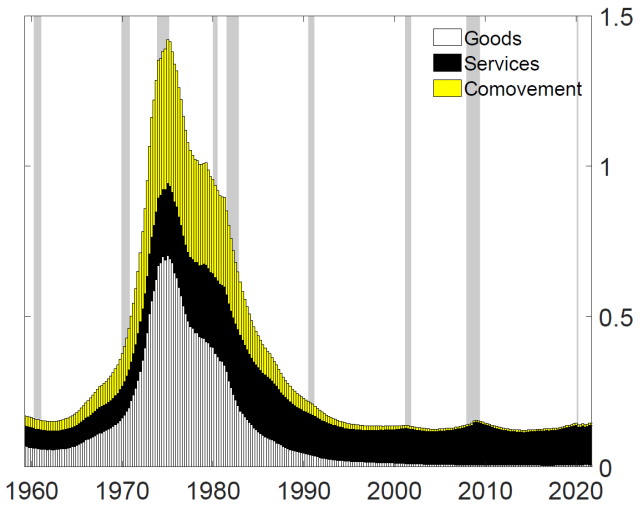
1. First World War ends	6. Post-war boom	11. 1981–82 recession	15. Iraq War
2. Post-war recession	7. Korean War starts	12. Canada–US Free Trade	16. 2008–09 Great Recession
3. Great Depression starts	8. Suez Crisis	Agreement	17. COVID
4. Second World War starts	9. International oil embargo	13. Inflation targeting	
5. Second World War ends	10. Iran–Iraq War	14. NAFTA	

Note: This chart is reproduced from Figure 1 in Charest and White (2015). The grey bars mark the years with negative annual growth in gross domestic product. NAFTA is the North American Free Trade Agreement.
Source: Statistics Canada

Eo, Uzeda and Wong (2022) provide complementary historical insight by highlighting movements of *relative* prices. They estimate underlying trend inflation in the United States using the co-movement of inflation across goods and services sectors. They estimate that, since the 1990s, trend inflation has been mainly determined by inflation in the services sector and its separation from inflation in the goods sector (**Chart 4**). Their findings also hold for Canada and Australia and are not driven by energy prices. Because the rise in inflation in 2020–21 was primarily driven by goods prices, Eo, Uzeda and Wong conclude that underlying trend inflation had been stable. Schmitt-Grohé and Uribe (2022) reach a similar conclusion using a completely different approach.[2]

[2] Eo, Uzeda and Wong (2022) interpret trend inflation as a measure that provides a signal of future inflation by removing transient noise embedded in headline inflation. This interpretation follows studies such as Stock and Watson (2007, 2016), who view trend inflation as an alternative estimate of core inflation. In a similar vein, Khan, Morel and Sabourin (2013) explore price co-movement across different sectors to construct a measure of common (or core) CPI inflation for Canada. However, other researchers define trend inflation as a latent indicator of the monetary authority time-varying inflation target (e.g., Kozicki and Tinsley 2001 and Ireland 2007).

Chart 4: Sectoral contribution to trend inflation volatility



Note: Trend inflation is in units of annualized quarter-over-quarter inflation. The shaded areas denote National Bureau of Economic Research recession dates. See Equation 12 in Eo, Uzeda and Wong (2022) for details on the construction of sectoral contributions.
Source: Eo, Uzeda and Wong (2022)

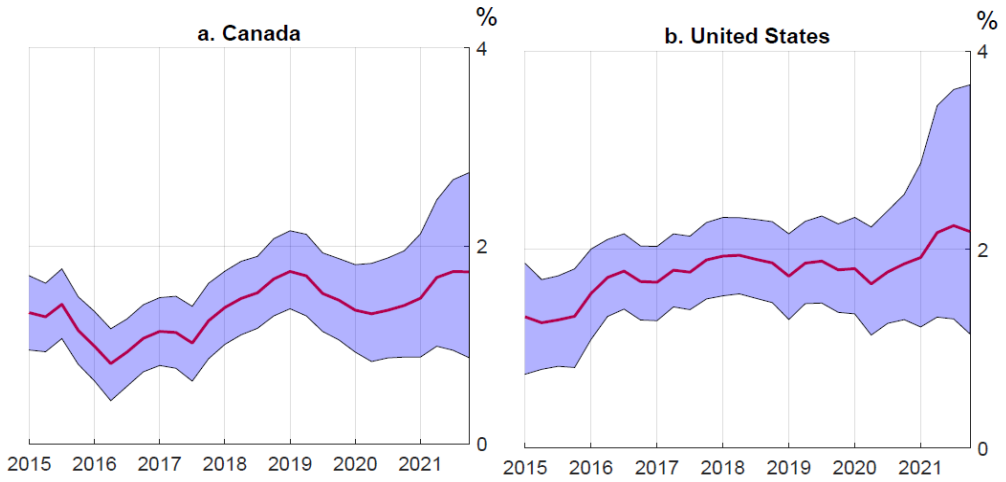
These studies using long-term data suggest that the recent inflation episode is associated with a sizable temporary component associated with factors influencing goods markets. Indeed, supply pressures have normalized gradually. By October 2022, Drewry's composite World Container Index had decreased by almost 70% from its peak one year before, while the Global Supply Chain Pressure Index from the Federal Reserve Bank of New York decreased for five consecutive months after reaching its peak in December 2021. Easing supply chain pressures can also be seen in CPI inflation of durable and non-durable goods, which has declined since the first half of 2022 in both Canada and the United States. In contrast, the war in Ukraine is likely to last well into 2023, and China continues to struggle with the spread of COVID-19 infections. Both developments indicate upside risks to the costs of imports, especially for foods and general merchandize.

In turn, aggressive monetary policy tightening seems to have dampened activity in sectors sensitive to interest rates. For example, mortgage rates above 6% in the United States have contributed to slowing growth in house prices, which declined by 1.5% from June to August according to the S&P CoreLogic Case-Shiller US National Index. Gorea, Kryvtsov and Kudlyak (2022) show that house prices respond to unexpected changes in monetary policy rates, especially future rates, within two to three weeks. Similarly, the Federal Reserve Bank of Chicago's National Financial Conditions Index has shown an upward trajectory since early 2022, closely tracking the Fed's recent interest rate hikes. The optimistic view is that if the costs of supplying goods and commodity prices continue to normalize, if labour markets remain resilient, and if interest rates continue to keep aggregate demand in check, a soft landing is likely (Reifschneider and Wilcox 2022).

Eo, Uzeda, and Wong's results, however, point to an important risk associated with the permanent component of inflation in the services sector. The authors estimate that the uncertainty around trend inflation is larger than usual and skewed to the upside (**Chart 5**). Indeed, Bunn et al. (2022) find that the dispersion of realized inflation across firms and

industries has changed significantly since 2021 with increased upside risk. Since most services are labour-intensive, such a risk is directly associated with imbalances in the labour market.[3] For example, Stock and Watson (2020) document strong co-movement between several subcomponents of services inflation (for example, shelter, food and accommodation services) and different measures of labour-market tightness.

Chart 5: Estimated aggregate trend inflation



Note: Trend inflation is in units of annualized quarter-over-quarter inflation based on the PCE (personal consumption expenditures price index) deflator. The shaded area denotes the 67% interval associated with estimation uncertainty.
Source: Eo, Uzeda and Wong (2022)

The labour market tightness in most advanced economies in 2022 was at least partly a consequence of the disruptions during the pandemic. Some of the workers who left the labour force in 2020 did not return or returned only on a part-time basis, while others moved to work in a different sector (Domash and Summers 2022a, 2022b; Faberman, Mueller and Şahin 2022). For example, in late 2021 and throughout 2022, most major airlines struggled to keep up with the return of travellers due to a shortage of pilots, flight controllers and gate agents. These workers left their jobs or retired early when the industry stalled during the pandemic (Kotoky, Whitley and Philip 2022). Limits on immigration also stifled the supply of foreign workers, especially in food and transportation (Perri and Zaiour 2022).

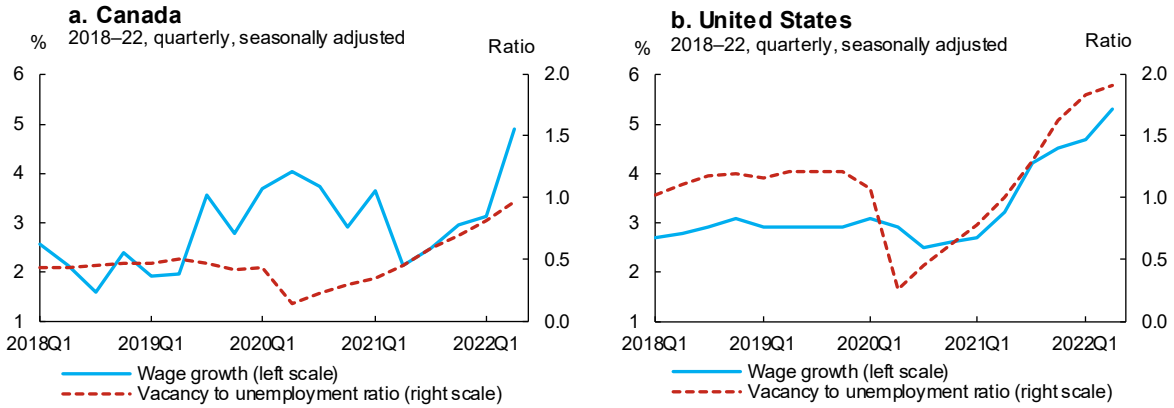
According to most labour market indicators, labour markets have been tight since at least the end of 2021 (Duval et al. 2022).[4] In Canada, the ratio of job vacancies to unemployed workers was near 1.5 in the second quarter of 2022, more than three times as high as its pre-pandemic levels (**Chart 6**). In some industries, labour-market tightening has been even more pronounced. For instance, accommodation and food services saw the job vacancy rate

[3] Bolhuis, Cramer and Summers (2022) point to an upside inflation risk related to inflation in shelter (rent and utility services), which is a capital-intensive services sector. In Canada, as of September 2022, year-over-year shelter CPI inflation sat at 6.0%, which was approximately 3 percentage points above its pre-pandemic level in December 2019 (2.8%). Nonetheless, upward pressures in shelter inflation have appeared to ease. In October 2022, it was more than a full percentage point below its peak (7.5%) in May 2022.

[4] While the general trends are similar for Canada and the United States, there have been some quantitative differences in the labour market recovery. For a broader view on Canadian labour-market indicators see, for example, Ens et al. (2021), Ens et al. (2022), Macklem (2022) and the Bank of Canada labour-market dashboard on its website.

peaking at 13% in May 2022.[5] US vacancy rates and quit rates were also at near-record highs of 6.8% and 2.9%, respectively (Domash and Summers 2022a). Crump et al. (2022) estimate that while the US natural rate of unemployment rose to 5.9% by the end of 2021, the downward secular trend in unemployment continued, reaching 4.2%. They estimate the gap between these series will exert strong pressure on wage growth, adding at least 0.5 percentage points to inflation by the end of 2023, even if inflation expectations remain anchored. Ball, Leigh and Mishra (2022) argue that an inflation reversal to pre-pandemic levels in the United States is unlikely in the near term under the Federal Reserve's current projected path for the unemployment rate, at just above 4%.

Chart 6: Wage growth and ratio of job vacancies to unemployment



Note: The US Bureau of Labor Statistics gives the series directly as seasonally adjusted quarterly data. To match this, data were taken from Statistics Canada Table 14-10-0213-01, aggregated to quarterly data by taking the average of the fixed-weight earnings index across each quarter and used to calculate year-over-year growth.
Sources: Canadian Federation of Independent Business, Statistics Canada and US Bureau of Labor Statistics

Labour market tightness often leads to increased wage pressures, thereby reinforcing inflationary pressures, especially in labour-intensive sectors (Furman 2022). In Canada, wage growth accelerated by 1.4 percentage points in the second quarter of 2022. Nevertheless, other labour market indicators suggest that some mechanisms could mitigate wage pressures. For instance, Blanchflower, Bryson and Spurling (2022) argue that many employed workers would prefer to work more hours, and so the risks of higher wage growth are overstated. Ilzetzki (2022) offers a useful example of the reverse, showing the link between a tight labour market and inflation in Japan. Japan's labour market was mostly insulated from the effects of the pandemic, seeing only a small increase in unemployment, which reached 3.2% at its peak. As of July 2022, Japan's year-over-year inflation rate was a mere 2.6%.

Among the cyclical risk factors, the potential de-anchoring of inflation expectations is the most serious. Ominous signs appeared around mid-2022 when surveys of consumers and firms showed that 1- and 2-year-ahead inflation expectations were climbing upward. Despite the rise in measures of short-term inflation expectations, long-term measures continued to remain anchored (see the Bank of Canada's Canadian Survey of Consumer Expectations for the second quarter of 2022 and Armantier et al. 2021). That said, a prolonged period of high inflation—especially without a credible policy response—could increase the risk of de-anchoring. For instance, using survey data for New Zealand and the United States, Kumar et

[5] This measure is the number of vacancies in accommodation and food services divided by the sum of total employed and job vacancies. For details, see Statistics Canada's Job Vacancy and Wage Survey.

al. (2015) find that long-term inflation forecasts can be sensitive to movements in short-term inflation forecasts. Similarly, Corsello, Neri and Tagliabracci (2021) find that, since 2013, long-term inflation expectations in the euro area have become more sensitive to short-term inflation surprises.

Admittedly, these studies are based on a period when inflation was persistently low (i.e., the post-Great Recession period). Nevertheless, these findings provide some warning signs of the risks of de-anchoring expectations. Furthermore, focusing only on average inflation expectations may understate inflation risks because changes in the distribution of households' or firms' expectations are more informative (Reis 2022). To this point, in the Bank of Canada's Business Outlook Survey, the share of firm managers that expected annual CPI inflation to be above 3% over the next two years increased from 35% in the second quarter of 2021 to 78% in the second quarter of 2022.

De-anchored expectations amplify the risks that inflation normalization will take longer than expected or even that inflation will become entrenched and unresponsive to monetary policy tightening (Beaudry 2022; Kozicki 2022). Using data for 55 countries since the 1990s, Blanco, Ottonello and Ranosova (2022) document that long-term inflation expectations, measured by the 5-year average of 5-year-forward forecasts, rise by 0.3 percentage points during a typical inflation surge and remain elevated for 3 to 4 years during subsequent disinflation. Higher inflation expectations set the stage for greater changes in market wages and prices, causing higher inflation. In turn, higher inflation results in yet higher inflation expectations, repeating the self-reinforcing inflationary cycle.

Perhaps the worst implication of de-anchored inflation expectations is that they indicate the public is no longer certain about the central bank's ability to deliver on its promise to keep inflation in check. In these circumstances, inflation will be less responsive to interest rates, requiring even higher interest rates and a greater likelihood of a prolonged recession (Erceg and Levin 2003).

How will structural factors influence inflation normalization?

Beyond the cyclical factors, the pandemic may have accelerated or precipitated long-term changes in goods and labour markets.

Trade disruption during the pandemic may mark the beginning of a reversal of trade globalization. This reflects both concerns that the efficiency of global supply chains during trade globalization may have come at the cost of reduced resilience (Carstens 2022) and increased geopolitical risks. These concerns have been heightened by numerous disturbances impacting key global suppliers—such as China (general merchandise), Russia (oil and gas), Ukraine (grain) and Taiwan (semiconductors). These disturbances created waves of shortages and higher costs affecting buyers across the world. Some loss of efficiency and an increase in costs are expected as domestic and global suppliers and retailers adjust to increase their resilience to such disturbances by shifting away from just-in-time inventories, moving from foreign to domestic supply networks, consolidating product lines and improving transportation infrastructure (Kopytov et al. 2021). While costs to increase resilience in supply chains are likely to remain elevated for the next few years, they should not lead directly to persistent upward pressure on inflation in the long term.

A reduction in globalization that sees significant reshoring of production could lead to a higher level of trend inflation in goods if it shifts the production of goods away from locations with lower (trend) production costs. Over the 30 years from 1990 to 2019, goods inflation in Canada averaged roughly 1 percentage point below services inflation (**Table 1**), with the average level of goods inflation remaining well below the 2% target. In contrast, services price inflation averaged above 2%.[6] This pattern reversed during the pandemic, with goods inflation averaging nearly 1.5 percentage points above services inflation.

Table 1: Average goods and services inflation in Canada since 1962

	Year-over-year CPI inflation, by decade, in %		
	Overall CPI	*Goods*	*Services*
Jan 1962–Dec 1969	2.87	2.36	3.83
Jan 1970–Dec 1979	7.39	7.38	7.58
Jan 1980–Dec 1989	6.51	6.33	6.71
Jan 1990–Dec 1999	2.20	1.74	2.72
Jan 2000–Dec 2009	2.12	1.48	2.73
Jan 2010–Dec 2019	1.74	1.33	2.10
Jan 2020–Oct 2022	3.47	4.26	2.75

Source: Statistics Canada, Table: 18-10-0004-01 (formerly CANSIM 326-0020)

The declining price of goods relative to services reflects both trends in technology and expenditure shares. It also reflects the development of global supply chains with the relocation of production to lower-cost locations in emerging-market economies. The lack of consensus around the relative importance of these forces makes it challenging to quantitatively assess the impact of a reversal in globalization on the trend level of goods price inflation.[7] However, if globalization were to reverse to trends seen in the 1960s, reshoring could stabilize goods inflation at levels comparable to those witnessed at that time, that is, a full percentage point above its post-1990 average.[8] In this scenario, services inflation would need to average slightly *below* 2% for inflation to average 2%.

Whether this scenario would pose a challenge for monetary policy over the coming years is not clear. Since the adoption of inflation targeting in 1991, inflation in Canada has averaged near the 2% target with different combinations of goods and services inflation. This is consistent with standard economic intuition that various long-term trends in the relative prices of goods and services are consistent with overall inflation of 2%. However, shifts in the trends in the relative prices of goods and services could have medium-term implications for the stance of monetary policy. Borio (2021) argues that the low rates of goods price inflation in advanced economies as a result of globalization over the decade before the pandemic was

[6] One factor behind this long-term shift in relative prices is ongoing structural transformation, which sees higher productivity growth in goods than in services production or a shift in demand toward more labour-intensive services (e.g., see Herrendorf, Rogerson and Valentinyi 2014). A second oft-cited factor is the increasing importance of developing economies in exporting consumer goods (e.g., see Francis 2007). Gagnon, Sabourin and Lavoie (2004) provide a review of trends of relative prices up to the early 2000s.

[7] Gilchrist and Zakrajšek (2020) find that rising trade intensity in the United States lowered the responsiveness of US inflation to measures of economic slack.

[8] Goods inflation today has a less direct impact on CPI inflation than it had in the 1960s due to shifts in the CPI basket weights. These shifts were the result of a decline in the share of goods in consumption, reflecting shifts in relative prices and changes in households' spending habits (Van Neuss 2019).

a factor in central banks holding policy rates at low levels in pursuit of their inflation targets. This view suggests that a reversal of globalization may require monetary policy to target higher short-term interest rates, closer to the levels observed before the Great Recession.

The coming decades will also see continued shifts in labour markets around the world. The working-age population has started to shrink in some advanced economies. In China, it is projected to fall by about one-fifth over the next three decades (Goodhart and Pradhan 2020; Fairless 2022). These demographic forces may prolong current imbalances that have resulted in tight labour markets, such as post-pandemic labour market mismatch and the shift toward time spent not working. If the pandemic-induced shift of preferences away from time working persists, this will further tighten labour markets, adding pressures on wage growth (Domash and Summers 2022a). In contrast, Barrero et al. (2022) argue that as employees enjoy the benefit (or amenity value) from shifting to remote work, the pressure on employers to raise wages will ease. They estimate the amenity-value effect will remove 2 percentage points from wage growth over 2022–23. In addition, increased access to remote work could encourage higher levels of labour force participation in Canadian regions or sectors with traditionally low participation rates.

Another potential force adding to inflationary pressures is the extraordinary rise in public and sovereign debt during the pandemic. Bianchi and Melosi (2022) argue that when a fiscal imbalance is aggravated by the fiscal authority's loss of credibility, inflation will drift away from the central bank's inflation target. Cochrane (2022) argues that unless aggressive interest rate hikes are coordinated with fiscal tightening, lower inflation rates will not last. These papers highlight the risk that a prolonged period of tight monetary policy could be necessary to offset inflationary pressures.

Finally, the slowest but perhaps the most persistent trend is associated with the ongoing transition from fossil fuels to green energy (Schnabel 2022a). The transition requires an immense reallocation of investments, which raises costs due to higher demand for new investments and lack of investment supply into fossil fuel production. These cost pressures are exacerbated by the long time required to build green energy infrastructure, further boosting prices for fossil fuels. This shift to relatively higher energy prices will also contribute to challenges for monetary policy to keep inflation on target over the long term.

Overall, the pandemic has accelerated structural changes in goods and labour markets that are likely to put pressure on goods prices and wages in the medium and long term. The resulting shifts in relative prices for goods and services and in costs for labour are unlikely to be large enough to threaten a return to the inflation target. But they may require central banks to return to higher interest rates, perhaps like those observed during the 2000–06 period.

Lessons for monetary policy

The failure of central banks to prevent the recent burst in inflation has renewed debate over two rules of thumb that often guide central bank policy choices: looking through temporary disturbances and interest rate smoothing (Schembri 2017).

When the economy experiences an adverse shock, the optimal policy response is to keep the interest rate unchanged if the shock is temporary and expectations are forward-looking. Beaudry, Carter and Lahiri (2022) argue that when inflation expectations are not fully rational, it is no longer optimal to look through an adverse supply shock. Rather, central banks should aggressively tighten interest rates when inflation crosses a certain threshold.

An alternative view is that monetary policy should be loosened to reduce the fallout from an adverse supply shock (Guerrieri et al. 2022) or demand reallocation shock (Ferrante, Graves and Iacoviello 2022). Guerrieri et al. (2022) explain the asymmetric effect across sectors during the pandemic. The contracting sectors experienced a large increase in unemployment and no wage or price decline, whereas in expanding sectors the output gap widened and inflation increased. In these circumstances, it is desirable for monetary policy to heat the economy to reinforce the reallocation of resources from contracting to expanding sectors. When appropriate, the central bank can also reallocate resources over time. Caballero and Simsek (forthcoming) argue that in response to a temporary supply contraction, the central bank needs to balance negative output gaps in the wake of the shock with positive output gaps later during the recovery. If aggregate demand has significant inertia, it is optimal for the central bank to introduce a temporary interest rate cut early, creating momentum in demand that supports the subsequent recovery. They point out that the risk of waiting too long to raise the interest rate back risks overheating the economy above the optimal level.

Finally, the current economic context warrants a reassessment of central banks' approach to risk management (Schnabel 2022b; Jordan 2022). Current central bank analysis seems to focus on projections of the desired path of key economic variables. Such an approach may be appropriate when these variables are close to their normal levels, for example, when inflation is within the inflation-control target range. But when the economy is unbalanced, considerations of risks, especially those that amplify the imbalances, must be brought to the fore. Had central banks in early 2021 considered the risks that would lead to nearly double-digit inflation within a year, they could have been better informed and may have acted differently. However, even if central banks succeed in bringing inflation rates down by aggressively hiking interest rates, it is far from certain that deflationary risks would no longer exist.

To support an expanded approach to risk management, central banks should also revise their communication strategies to help manage expectations in a more uncertain world and maintain public trust in the central bank's ability to control inflation (Blinder et al. 2022).[9]

Concluding remarks and avenues for future work

At the end of 2022, inflation in Canada and around the world was high and had been elevated for some time. As a result, central banks faced a dilemma—on one hand, inflation stabilization becomes pressing, but on the other hand, pursuing such stabilization too aggressively could steer the economy into a recession. To shed light on the matter, we characterize the distinct stages of the recent inflation surge and discuss how the inflation normalization might play out going forward. Our analysis focuses on both cyclical and structural factors underlying the ongoing inflationary episode. We also suggest some lessons to be learned in terms of revising long-standing monetary policy doctrines, namely the notion of looking through temporary adverse shocks and interest rate smoothing. In conclusion, we propose some avenues to extend central banks' analytical frameworks along several dimensions.

[9] The Bank of Canada continues to take additional steps in this direction by pledging to introduce a summary of monetary policy deliberations in February 2023. As Kozicki (2022) notes, the Bank of Canada has "[…] taken many actions over the past 30-some years to help Canadians better understand our decisions and the kinds of issues that preoccupy us."

First, central banks can sharpen inflation forecasts by leveraging models and methods that can handle finer degrees of data granularity. For example, Stock and Watson (2016) show that fitting an econometric model to 17 subcomponents of the US PCE deflator delivers medium- and long-term inflation forecasts that are superior to modelling aggregate inflation directly. Such a result echoes findings from theoretical studies on forecasting aggregate variables using disaggregated information (Lütkepohl 2006; Hendry and Hubrich 2011).

Second, central bank models need the mechanisms of state-dependent, asymmetric and accelerated inflation dynamics, such as nonlinear Phillips curves (Harding, Lindé and Trabandt 2022) and time-varying volatility (Vavra 2014). Furthermore, central bank models should include features that dampen the over-sensitivity of inflation and output to current and future interest rates, which is inherent in many dynamic stochastic general equilibrium models (Del Negro, Giannoni and Patterson 2012; and McKay, Nakamura and Steinsson 2016).

Third, policy-makers should account for explicit risk channels for inflation in their models, for example, wage-price inflationary spirals. They also need to enrich their understanding of time-varying uncertainty (Clark, McCracken and Mertens 2020; Fernández-Villaverde and Guerrón-Quintana 2020) and incorporate robust control in their analytical frameworks (Hansen and Sargent 2003, 2011).

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