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24-21 The Trinity of COVID Era Inflation in G7 Economies

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ABSTRACT

COVID era inflation was driven by a unique combination of three shocks: First, a plethora of pandemic-related shifts in demand patterns and disruptions to supply caused prices of consumer durable goods to skyrocket. Second, the Ukraine war caused the largest global commodity price surge in 40 years, which mainly affected prices of nondurable goods such as food and gasoline. Third, strong monetary and fiscal responses to the pandemic recession caused labor markets to tighten, pushing up prices of services. This paper estimates models of the components of consumer prices in each G7 economy in order to document the transmission of these shocks. The first two shocks had run their course by 2023, enabling overall inflation to decline sharply from its 2022 peak. But labor markets remained at least moderately tight in most G7 economies in 2024, and services inflation remained noticeably higher than its pre-pandemic level.

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Introduction

Inflation surged to a 40-year high across the advanced economies and in many emerging and developing economies in 2021-22. Central banks and private forecasters almost universally failed to predict this surge. Economists are now working to understand what caused the COVID era inflation and why it was so hard to foresee.

This paper addresses these questions through separate models of inflation for the three main components of consumption: durable goods, nondurable goods, and services. The focus is on the major advanced, or G-7, economies. The results highlight three important and independent drivers of inflation, hence our "trinity," each element of which is concentrated in a different component of inflation. In temporal order, these are (1) a plethora of pandemic-related demand and supply disruptions that mainly affected durable goods, (2) the global commodity price shock caused by Russia's invasion of Ukraine that mainly affected nondurable goods, and (3) tight labor markets that are a legacy of aggressive monetary and fiscal policy stimulus in the early years of the pandemic and that mainly (though not exclusively) affect services.

We find that the latter two shocks raise inflation through a standard model in which inflation responds to tight labor markets and rising commodity and import prices. We find some evidence for a nonlinear effect of unemployment on inflation, but this nonlinearity is not especially unconventional since it has a pedigree back to the seminal work of A.W. Phillips (1958).

The effects of the first group of pandemic-related shocks are not well explained by a standard model. The pandemic drove a shift in spending from services like restaurants and travel to durable goods like automobiles and furniture, especially in the United States, which gave rise to bottlenecks and exposed the difficulties producers face in responding to very large increases in demand. In addition, factory shutdowns and shipping snafus probably also contributed to high prices of durable goods. Perhaps most importantly, automakers canceled orders for semiconductors at the start of the pandemic, fearing a prolonged recession. In the event, the recession was short and demand for autos bounced back quickly, resulting in a massive supply shortfall in autos that pushed their prices way up.

To a large extent, the COVID era inflation reflects an unusual combination of shocks that is likely to occur very rarely. A conventional macroeconomic model of inflation can explain most of the surge in inflation. But sector-specific demand and supply shocks were large enough to have important aggregate effects that are not well-explained by a standard model. The COVID era inflation has some similarity with the inflation surge during the Korean War in 1950-51, which was also associated with a large increase in demand for durable goods and which receded quickly without any increase in unemployment (Gagnon and Rose forthcoming).

With commodity prices back in historical ranges, demand for durables waning, and semiconductors in plentiful supply, inflation has fallen dramatically for nondurable and durable goods. However, tight labor markets are keeping services inflation elevated in some economies, most notably the United States.[1]

Previous studies

There has been an explosion of research on causes of the COVID era inflation around the world. Results differ somewhat depending on the years and economies being examined. But the trinity of this paper receives broad support. For evidence on the effects of demand and supply chain disruptions related to COVID-19, see Brooks and Orszag (2023), Comin, Johnson, and Jones (2023), Koch and Noureldin (2023), and Firat and Hao (2023). For evidence on the effects of commodity price shocks, see Hansen, Toscani, and Zhou (2023), Firat and Hao (2023), and Ha et al. (2023). For evidence on the effects of fiscal policy and tight labor markets, see Koch and Noureldin (2023) and Jorda and Nechio (2023).

One interesting outcome is renewed interest in a possible nonlinear relationship between the unemployment rate or other labor market measures and inflation, sometimes referred to as a nonlinear Phillips curve (Benigno and Eggertsson, 2023; Gudmundson, Jackson, and Portillo, 2024). Focusing on the United States, Laurence Ball, Daniel Leigh, and Prachi Mishra (2022) propose replacing the unemployment rate in the Phillips curve with the ratio of job openings (or vacancies) to unemployed persons. By putting the unemployment rate in the denominator, this specification creates a modest nonlinearity in the relationship. The authors go further and include both the square and the cube of the vacancy-unemployment ratio, which they argue helps to explain core inflation by allowing even more curvature in the relationship.

In a subsequent paper, Leigh and Mishra join with Mai Chi Dao and Pierre-Olivier Gourinchas (2024) and model core inflation allowing for the square and cube of the vacancy-unemployment ratio in a broad sample of economies. A unique feature of Ball, Leigh, and Mishra (2022) and Dao et al. (2024) is that these studies split inflation into (1) core inflation defined as the weighted median of the underlying components of inflation and (2) the gap between headline and core inflation. Broadly speaking, the gap between headline and core is mainly driven by commodity price shocks and some of the pandemic-related demand and supply shocks, whereas core inflation mainly reflects labor market conditions with spillover from the gap shocks.

Perhaps the most widely cited work on COVID era inflation is the analysis of US inflation by Ben Bernanke and Olivier Blanchard (2023). In a subsequent paper, Bernanke and Blanchard (2024) summarize the results of a coordinated research project among central banks for 10 other advanced economies. These studies estimate small models of price inflation, wage inflation, short-run inflation expectations, and long-run inflation expectations. They generally find that inflation began with pandemic-related shortages of critical goods and a global commodity price shock caused by the Ukraine war. These shocks have receded and inflation has fallen. But labor markets have tightened or remain tight in

[1] For further analysis of the slow normalization of services inflation across economies, see Amatyakul, Igan, and Lombardi (2024).

most economies, contributing to a moderate continuing excess of inflation above its target in most economies.[2] As in Ball, Leigh, and Mishra, Bernanke and Blanchard and their collaborators use the vacancy-unemployment ratio in their wage Phillips curves but without further nonlinear transformation.

This paper shares the basic conclusions of both the Bernanke and Blanchard multi-country research project and the Ball, Leigh, and Mishra and Dao et al. papers on the main drivers of COVID era inflation. Unlike those studies, however, our breakdown of inflation by type of consumption enables us to trace the demand-shift and supply shocks through durable goods, the commodity price shock mainly through nondurable goods, and the labor market tightness mainly through services. In addition to the Bernanke-Blanchard supply shortage variable, we find that the shift in consumer demand to durable goods during the pandemic also plays a significant role in durable goods inflation in some economies.

Inflation in G-7 economies, 1995-2023[3]

Inflation soared to a 40-year high in 2021-22 in many economies around the world, including the major advanced, or G-7, economies. Inflation dropped noticeably in most G-7 economies during the course of 2023, but it had not reached pre-2021 levels as of early 2024.

The solid black lines in figure 1 display four-quarter rates of change of the price index for personal consumption expenditures (PCE) in each G-7 economy from 1995 through 2023. Many other studies focus on the consumer price index (CPI) or the Harmonized Index of Consumer Prices (HICP). All three measures of inflation rose sharply in 2021-22 and fell in 2023.

The colored bar segments display the contributions to inflation from three categories of spending: durable goods, nondurable goods, and services.[4] When all components contribute positively to inflation, the solid line is at the top of the stacked bars. When inflation is positive but some components are negative, the solid line is below the top of the bars. Three broad patterns are apparent in the data. First, services prices tend to be the largest contributor to inflation on average, except in Japan, as can be seen from the relatively large area shaded in pink. Second, highly volatile nondurables prices are the main drivers of changes in overall inflation, as ups and downs of overall inflation tend to coincide with ups and downs in the green areas. Third, durables prices are the smallest contributor

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[2] Japan is somewhat of an outlier with less of a surge in inflation and less impact on inflation from labor market tightness (Nakamura et al. 2024).

[3] The analysis in this section begins in 1995 because all G-7 economies had low explicit or implicit targeted rates of inflation after that point, enabling us to avoid modeling changes in monetary regime. The transition to low inflation happened earliest in Japan and latest in Italy.

[4] Non-US G-7 economies have a fourth category: semi-durable goods. We include semi-durables with durables because they tend to have higher labor and lower commodity inputs than nondurables. According to Statistics Canada, semi-durables include clothing, footwear, tableware, and household utensils. In the United States, clothing and footwear are considered nondurables and tableware and household utensils are considered durables. Thus, it is not possible to have categories that are identical across all G-7 economies.

to inflation on average and often have a negative contribution, reflecting outright declines in the prices of durable goods, shown in the dark blue areas. Nondurables prices were particularly important in the inflation surge of 2021-22. Durables prices also made their largest positive contribution to inflation since 1995 during the years 2021 and 2022.

Table 1 summarizes the inflation surge during and after the COVID-19 pandemic (2020-23) in comparison to the four-year period prior to the pandemic (2016-19). All of these economies undershot their 2 percent inflation targets in the four years prior to 2020. All but Japan overshot their targets in the four years that began in 2020; in some cases, inflation was more than twice its targeted level.

Goods prices (durable and nondurable) contributed between about half (France, United Kingdom) to more than three-quarters (Japan) of the cumulative increase in inflation in the years 2020-23 compared to the years 2016-19. This is particularly notable in light of the fact that half or less of consumer spending in these economies is on goods, whereas half or more is on services (the final three rows of table 1).

Figure 1 displays a common pattern over time in these economies. In 2020, goods inflation was zero or negative and services inflation very low. In 2021 and 2022, goods inflation surged while services inflation moved up steadily. In 2023, goods inflation dropped back sharply while services inflation remained constant or fell slightly. Japan shared in the common pattern, but with a much smaller rise and fall of inflation.

A modest difference across these economies is that inflation peaked earlier in Canada and the United States, by 2022Q2. In the other G-7 economies, inflation peaked at the end of 2022 or beginning of 2023. The next three sub-sections explore each of the elements of the COVID era inflation trinity in turn.

Durables demand and supply chain shocks

Durable goods are the smallest category of consumption and typically have flat or even falling prices because they enjoy the greatest improvements in productivity over time. Thus, their average contribution to inflation over 1995-2019 was negligible in all G-7 economies except Japan, where they made a negative contribution to overall inflation of 0.4 percentage point.

Durables prices surged in 2020-23, making a small but significant positive contribution to inflation for the first time in decades. (See figure 1.) A conventional model of inflation with unemployment and commodity prices is not able to explain the surge in durable goods prices. Two other factors appear to have been important.

First, consumer demand shifted from services to durable goods during the pandemic, as consumers avoided airplanes, restaurants, and hotels and instead spent on furniture, appliances, and vehicles. This shift was most pronounced and prolonged in the United States.

The surge in demand for durable goods pushed some industries to capacity limits and highlighted bottlenecks in production. Limitations in supply caused price increases that were much larger than would be expected from a similar shift in demand starting from a position of excess capacity. In other words, the price adjustment process is nonlinear. (Gagnon and Collins 2019; Forbes, Gagnon, and Collins 2022.)[5]

Figure 2 plots the four-quarter change in real (inflation-adjusted) spending on consumer durables in G-7 economies. All but Germany and Japan display a large increase in 2021. However, in Canada, France, Italy, and the United Kingdom, this large increase was preceded by a large decrease in 2020. Only in the United States is there a large increase that does not mainly reverse a previous large decrease. The level of US real spending on durable goods continued to be above its historical trend into 2023, unlike that in the other G-7 economies.

A second important driver of durable goods prices is COVID-related disruptions to production and transportation in general, which temporarily reduced the capacity to produce and transport durable goods in particular. The price effects of these disruptions were compounded by the historic mistake of nearly all global automakers to cancel orders of semiconductors in 2020 because of fear of a global recession that would sharply reduce demand for automobiles. In the event, the 2020 recession was brief and the reduction in spending was focused on services--not durables--a sharp contrast with the traditional business cycle. The upshot was that automakers found themselves desperately short of a critical component of new cars in 2021 and 2022.

There are several measures of supply chain disruption, such as the Federal Reserve Bank of New York's Global Supply Chain Pressure Index (GSCPI) and the Institute of Supply Management (ISM) Supplier Delivery Time index. A key problem with such measures is that backlogs and delays may reflect either shortfalls in supply or excesses of demand. Phil Levy (2024) shows that delays in ocean shipments in 2021 and 2022 owed more to strong demand than to losses of capacity in shipping or at US ports. The GSCPI attempts to control for demand-side influences by removing movements related to the "new orders" and "quantities purchased" subcomponents of the ISM's purchasing managers' index. However, the resulting series still shows notable declines in supply chain pressures during the recessions of 2001 and 2008-09, suggesting that demand factors have not been fully removed.[6]

Bernanke and Blanchard (2023) propose using the frequency of Google searches on the word "shortage". We choose a narrower search on the term "chip shortage" in English-speaking countries and tried various alternatives in the other G-7 countries. We prefer a

[5] Moreover, the corresponding reduction in demand for services was not deflationary because the service sector was already on the flat portion of its supply curve. Because of downward nominal wage and price rigidity, high unemployment rates in the service sector did not cause widespread reductions in services prices.

[6] Inserting the GSCPI into the regression for durable goods inflation reduces the coefficients on the growth of real durable goods spending with little change on the chip shortage coefficient or other coefficients and it reduces the sample by three years. It is modestly significant in the United States and not significant in other economies.

somewhat narrower search because strong demand may look like a shortage to buyers. By focusing on the semiconductor shortage, our measure is more limited to a mistake by motor vehicle producers and semiconductor supply conditions generally, though we cannot rule out a demand element.[7] In any case, our results do not change much if we use the Bernanke and Blanchard measure.

Figure 3 displays the frequency of Google searches on "chip shortage" or the best alternative in non-English-speaking countries. These data are from Google Trends, which begins in 2004. In the following regressions, data for earlier years are set equal to zero.

Table 2 presents results of the following regression of durable goods inflation over the period 1995Q1 through 2023Q4.[8] Labor market variables were not significant in most economies and are not included.[9]

$$\Delta PD_t = \alpha + \sum_{i=1}^{4} \rho_i \Delta PD_{t-i} + \sum_{i=0}^{1} (\beta_i \Delta PE_{t-i} + \gamma_i \Delta PF_{t-i} + \delta_i \Delta PIM_{t-i})$$

$$+ \theta\, CHIPSHORT\_US_t + \sum_{i=0}^{3} \sigma_i \Delta CD_{t-i}$$

Δ denotes annualized percent change. Note that these are one-quarter changes, unlike the four-quarter changes displayed in figure 1. *PD* is the price index for durable goods. *PE* is the price index for energy. *PF* is the price index for food. *PIM* is the price index for imports of goods and services. *PE, PF, and PIM* are expressed relative to the GDP deflator. Import price inflation is also scaled by the ratio of nominal imports to nominal GDP. For every country, the US search result for "chip shortage" yields essentially the same coefficient and equation fit as the local search result and this variable is used in table 2. *CD* is real spending on consumer durables.

To save space, table 2 presents the sums of the coefficients for each variable. The sums of the lagged durables inflation coefficients are moderate; a value of 0.4, which is roughly the median across these economies, implies that the large majority of any shock to inflation has dissipated after two or three quarters. The larger value for Japan may reflect poorer fit of the model, especially as the chip shortage and real durables demand terms had the wrong

[7] The coefficient on "chip shortage" is roughly twice as large in a regression of motor vehicle inflation as it is in a regression of durable goods inflation in the United States, supporting the interpretation that it primarily reflects semiconductor shortages.
[8] Sources and definitions of the data are described in the appendix.
[9] We included the unemployment rate and its first difference and one of these terms is statistically significant with the correct sign in Canada and Japan. However, one of these terms is significant with the wrong sign in France and the United States. Because these variables have little explanatory power in all G-7 economies, we do not include them in the final regressions.

sign and were dropped. The negative sum of lag coefficients in France may be caused by large outliers in durable goods inflation in 2020 (shown in figure 4).[10]

The energy and food price coefficients are usually positive but small. Occasional negative coefficients on energy, food, or imports may reflect interactions between the terms, as imports may include substantial amounts of food or energy.

The chip shortage variable is most important in the United States followed by the United Kingdom, Germany, Canada, and France.[11] It is negative and not significant in Italy and Japan, where it is dropped from the final regression.

The growth rate of real spending on consumer durables has a positive effect everywhere except France, Japan, and the United Kingdom, where it is not significant and is dropped from the final regression. In Italy and the United States this variable is nearly statistically significant and it has large but not significant coefficients in Canada and Germany.[12]

The colored bar sections in figure 4 display the estimated effects on durables inflation of (1) initial conditions, (2) food, energy, and import prices, (3) the chip shortage, and (4) growth of real durable goods demand. The calculations begin in 2020Q1 and the effects of the independent variables are based on their values in 2020Q1 and later. The initial conditions are defined as the sample mean of durables inflation plus lagged effects of deviations of the right-hand-side variables from their sample means in the quarters immediately prior to 2020Q1. The effects of the other variables are given by their coefficients times their deviations from their sample means starting in 2020Q1 and then adding in lagged dynamics from these effects starting in 2020Q2. In other words, a one-quarter shock to energy prices will have an effect on durables inflation that lasts more than one quarter to the extent that the lag coefficients on inflation differ from zero.

The solid black line is the annualized quarterly rate of change of prices of durable goods. The dashed black line is the sum of the colored bar contributions, which equals the fitted value of the model estimated in table 2. Figure 4 shows that fitted values of the model capture most of the surges in durable goods prices in these economies, except for Japan and the 2020Q3 outlier in France.[13]

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[10] The 2021 *Economic Survey of France* (OECD 2021) did not indicate any policy action or other special event that might have caused these outliers. Including a dummy variable for the largest outlier in 2020Q3 had only modest effects on the coefficients of interest.

[11] The contemporaneous value of *CHIPSHORT_US* yielded a higher R^2 than the first or second lag in every economy except France.

[12] To test whether US demand for durable goods drove global durables inflation, we replaced each economy's real durables spending growth with US real durables growth. The results fit better in Canada, France, and the United Kingdom and worse in Germany, Italy, and Japan. Effects on other coefficients were minimal.

[13] In Japan, large lag coefficients, including the fourth lag, contribute to an unusual contribution from initial conditions. The large fourth lag may owe to residual seasonality given our simple seasonal adjustment methodology.

The chip shortage variable is particularly important in explaining durables inflation in Canada, Germany, the United Kingdom, and the United States. The growth in real spending on durables is notably helpful in 2020 and 2021 in Canada, Germany, Italy, and the United States. Commodity and import prices were especially important in France, Italy, and Japan.

The global commodity price shock of 2022 and nondurables inflation

Russia's invasion of Ukraine in February 2022 caused the largest global commodity price shock in decades. The four-quarter changes in food and energy prices in each G-7 economy surged in 2022, reaching their highest rates since the early 1980s or late 1970s. (See figure 5.) These inflation rates remained high for about four quarters, whereas in some earlier spikes, such as 2008-09, increases were quickly reversed and thus caused less persistent inflation and economic harm. This subsection shows that these global shocks were the most important drivers of inflation in nondurable goods prices.

The European G-7 economies and Japan subsidized consumer energy spending after the invasion of Ukraine, both through subsidies to suppliers to keep energy prices lower than otherwise and through grants or tax rebates to households. Differences in energy inflation across these economies reflect differences in the approaches to energy subsidies as well as differences in the energy mix used in each economy.[14] The United States and Canada did not take any direct measures to subsidize energy, but their markets for natural gas are largely segmented from global markets, helping to limit the impact of the loss of Russian gas supplies on overall energy prices in North America.

Food price inflation was much lower and less volatile than energy price inflation, but still surged to a significant extent. Germany and the United Kingdom had the largest food price increases, but differences across these economies in food inflation were relatively small.

Labor markets also contribute to nondurable goods inflation. The conventional Phillips curve describes a negative effect of unemployment on inflation as excess workers and economic slack put downward pressure on prices.[15] Concerns about the behavior of the natural, or equilibrium, rate of unemployment in the pandemic (arising from school closures, fear of COVID, and temporary boosts to unemployment insurance) raise challenges in the use of a simple Phillips curve with the unemployment rate to model inflation. The United States and Canada relied more heavily than other countries on the unemployment benefit system for delivering pandemic assistance and the United States had longer school closures than other economies. These factors likely drove up the natural rate of unemployment along with the spike in actual unemployment in 2020, and it may have taken two or three years for the natural rate to return to its pre-pandemic level.

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[14] For example, subsidies to energy suppliers reduce measured energy inflation but subsidies to energy consumers do not reduce measured inflation (Honohan 2024).

[15] It is conventional to express the Phillips curve in terms of the gap between the unemployment rate and its natural rate. The natural rate is not directly observable but is believed to be determined by the demographic composition of the labor force and labor market policies and institutions (Brauer 2007). In some samples, it may be reasonable to treat the natural rate as constant and thus controlled by the equation intercept, as is done in the regressions of this paper that measure labor market tightness with the unemployment rate.

In response to these concerns, a number of researchers have focused on high job openings (vacancy rates) as an indicator of tight labor markets even when the unemployment rate is not especially low. It is possible that an increase in the unobserved natural rate of unemployment led to increases in both the unemployment rate and the vacancy rate. Bernanke and Blanchard (2023), Ball, Leigh, and Mishra (2022), and others have had some success using the ratio of the vacancy rate to the unemployment rate as an indicator of labor market tightness in an otherwise conventional Phillips curve. The vacancy to unemployment ratio has a positive effect on inflation because a higher number indicates a tighter labor market (more vacancies and fewer unemployed persons).

Figure 6 shows that in every G-7 economy except Italy, the unemployment rate is at or close to a 30-year low. In the economies with a long history of vacancy rate data, vacancy rates were at or near 30-year highs in 2022. But vacancy rates fell in 2023 in Canada, Germany, the United Kingdom, and the United States. (We were not able to obtain vacancy rates for more than a few years in France or Italy.) Overall, it appears that labor markets are fairly tight in most G-7 economies, with the vacancy rate pointing to an especially tight US labor market in 2022 that has since eased somewhat while remaining tight relative to the past 30 years.

Nondurable prices in these economies are well explained by food and energy prices with a contribution from labor market variables. Table 3 presents results of the following regression of nondurable goods inflation over the period 1995Q1 through 2023Q4.

$$\Delta PN_t = \alpha + \sum_{i=1}^{4} \rho_i \Delta PN_{t-i} + \sum_{i=0}^{1} \left(\beta_i \Delta PE_{t-i} + \gamma_i \Delta PF_{t-i} + \delta_i \Delta PIM_{t-i}\right)$$

$$+ \mu_0 UN_t + \mu_1 \Delta UN_t + \theta \, UN\_LOW_t$$

PN is the price index for nondurable goods. *UN* is the unemployment rate. *UN_LOW* is zero except for observations in which *UN* is below its economy-specific 25th percentile value, in which case *UN_LOW* is *UN* minus the 25th percentile value. This variable allows for a stronger nonlinear effect of the unemployment rate on inflation when unemployment is particularly low. The other variables are the same as before.

Instead of including the current and lagged levels of unemployment, the regression is specified in terms of the current level and change in unemployment. The coefficient on the level captures the long-lasting effect of unemployment on inflation, whereas the coefficient on the change captures a temporary effect.[16] Note that even temporary effects may be persistent to the extent that the coefficients on lagged inflation (ρ_i) are positive.

[16] The Phillips curve is generally viewed as a long-lasting effect of unemployment on inflation. The temporary effect of a change in unemployment has been referred to as a "speed limit" effect because it captures the notion that fast growth in activity or employment can be inflationary even when the level of activity or employment is not especially high.

The lagged nondurables inflation coefficients in every economy sum to less than 0.2, indicating a rapid return to mean inflation after any shock, consistent with relatively stable expectations of future inflation and a short price adjustment process.

The sums of the energy, food, and import price coefficients are usually positive and often strongly significant. In some cases, a negative coefficient may reflect interactions between the terms, as imports may include substantial amounts of food or energy.

A regression of nondurable goods inflation with the vacancy/unemployment ratio, *V/U*, instead of *UN* had a higher R^2 in Japan and the United States and it is shown in table 3. In these cases, *UN_LOW* is not statistically significant and is dropped. Note that *V/U* already incorporates an element of nonlinearity because low values of unemployment in the denominator have outsized effects on the value of the ratio.

In Canada, Germany, and the United Kingdom, a model with the unemployment rate (including a nonlinear term for extra low unemployment) had a higher R^2 than a regression with *V/U*, and it is displayed in the table.[17] We were unable to find a historical series of the vacancy rate for France and Italy and thus report the results with unemployment rates for these economies.

For Canada, France, Germany, and the United Kingdom, the main effect of unemployment on nondurables inflation arises from the coefficient on the *change* in the unemployment rate, which always has the correct (negative) sign, is large everywhere except Italy, and is statistically significant in Canada. The coefficient on the level of unemployment is small and not significant. An additional nonlinear effect of extra-low rates of unemployment has the correct sign and is large in several economies, but is statistically significant only in Germany.

For the United States and Japan, the coefficient on the level of *V/U* is indeed positive and is strongly significant for the United States. The coefficient on the change in *V/U* is also positive and significant in both economies, implying both a positive long-term effect of the vacancy/unemployment ratio on inflation as well as a strong but temporary "speed limit" effect of changes in the ratio.[18]

The colored bars in figure 7 display the estimated effects of (1) initial conditions, (2) food, energy, and import prices, and (3) labor market conditions on nondurables inflation since 2019. The effect of initial conditions (the dark blue portion of the bars) primarily reflects the historical mean of nondurables inflation with only tiny deviations in the first few quarters from the lagged effects of inflation rates before 2020. The medium green portion of the bars represents the contribution to nondurables inflation from commodity and import prices falling in 2020 and then rising faster than their historical average in 2021 and

[17] Haskel, Martin, and Brandt (2023) find a significant effect of *V/U* on wage inflation in the United Kingdom.
[18] For the United States, the job quits rate is not statistically significant in addition to or in place of the *V/U* ratio.

2022. The pink portion of the bars represents the effects of labor market slack in early 2020 and then tight labor markets in 2022 and 2023. The dashed line is the sum of the three colored bar portions, which equals the model fitted value; it tracks the top of the bars whenever all three contributions are positive.

Figure 7 shows that the commodity and import price effects are the dominant driver of nondurables prices (the solid black line) over this period. The labor market effects are most pronounced in Canada, Japan, and the United States and least apparent in Italy and the United Kingdom.[19] Note the much larger scale in the latter two economies, which had the largest increases in commodity prices and nondurables inflation. Overall, a conventional nonlinear Phillips curve model can explain most of the fall, rise, and subsequent decline of nondurable goods inflation in these economies.

Labor markets and services prices

The contribution of services prices to the 2021-22 surge came later than that of goods prices. It may reflect tight labor markets across all the G-7 economies, with the possible exception of Italy. Labor costs are a much higher share of services prices than of goods prices. Even though services have little or no tangible substance, commodity prices can be important owing to their role as an input in industries such as transportation and restaurants.

Table 4 presents results of the following regression of services inflation over the period 1995Q1 through 2023Q4.[20]

$$\Delta PS_t = \alpha + \sum_{i=1}^{4} \rho_i \Delta PS_{t-i} + \sum_{i=0}^{1} (\beta_i \Delta PE_{t-i} + \gamma_i \Delta PF_{t-i} + \delta_i \Delta PIM_{t-i})$$

$$+ \mu_0 UN_t + \mu_1 \Delta UN_t + \theta\, UN\_LOW_t$$

PS is the price index for services. The other variables are the same as those used in the nondurable goods regression above. The lagged services inflation coefficients are somewhat higher than those for nondurable goods, reflecting greater stickiness in services inflation. Nevertheless, even the Italian cumulative lag coefficient of 0.72 indicates fairly rapid mean reversion of inflation, with a half-life of shocks that is less than three calendar quarters.

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[19] The positive labor market contributions in 2020 in Japan are puzzling. Replacing *V/U* with *UN* in the Japan regression eliminates this anomalous result with very little change in the other estimated effects.

[20] A regression of inflation in housing services in the United States yields very similar results to those for overall services inflation. Although labor costs are not viewed as the most important contributor to housing costs, wage income may be important in driving overall housing demand and thus prices, including rental rates.

The energy, food, and import price coefficients are usually positive but generally lower than for both durable and nondurable goods. Again, negative coefficients may reflect interactions between the terms, as imports may include substantial amounts of food or energy.

As in the nondurables inflation regression of table 3, the coefficient on the change in unemployment is negative and larger than the coefficient on the level of unemployment, which is never significantly different from zero. Given the moderately large coefficients on the lagged dependent variable, even a temporary effect of unemployment can persist for a few quarters. There is an additional permanent nonlinear effect of very low rates of unemployment (*UN_LOW*) in Germany and Japan. The *UN_LOW* coefficient was positive but not significant in France, Italy, and the United Kingdom and is dropped in these economies.

The services inflation regressions for Canada and the United States employ the ratio of job vacancies to unemployed persons (*V/U*) because this specification has a higher R^2 than that with *UN* and *UN_LOW* in these economies. The coefficients on both the level and the change of *V/U* are positive and the level effects are strongly significant. These results imply both a positive long-term effect of *V/U* on inflation as well as a temporary "speed limit" effect of changes in *V/U*.[21]

Figure 8 shows that these models explain most of the rise in services inflation. The labor market is dominant in Canada, Germany, Japan, and the United States. Commodity and import prices are relatively more important in France, Italy, and the United Kingdom. However, there are notable unexplained portions of services inflation in all economies except Italy. It is worth noting that the abrupt decline in services inflation in the United States in the last three quarters of 2023 was reversed in the first quarter of 2024 (not shown) when services inflation bounced back to 5.3 percent, consistent with continued pressure from a still-hot, albeit gradually cooling, labor market.

Conclusions

In 2021-22, a trinity of unrelated shocks caused the largest surge of inflation experienced by G-7 economies in roughly 40 years. The trinity consists of (1) a plethora of pandemic-related demand and supply disruptions, (2) the global commodity price shock caused by Russia's invasion of Ukraine, and (3) tight labor markets.

These results are obtained in separate models of inflation in the three main components of consumption: durable goods, nondurable goods, and services. Inflation in durable goods is not well explained by a standard model. Durable goods inflation was driven by the shift in demand to durable goods as well as supply disruptions and bottlenecks, especially in the United States. Durable goods are the smallest contributor to COVID era inflation in these economies.

[21] For the United States, the job quits rate is not statistically significant in addition to or in place of the V/U ratio.

Inflation in nondurable goods and in services is well explained by a standard model with commodity and import prices and labor market conditions, including a nonlinear effect of the unemployment rate in some economies. Cumulating the effects of these underlying driving variables across the three components of inflation from 2020Q1 through 2023Q4, we find that commodity and import prices are the largest contributor to COVID era inflation in France, Germany, Italy, and the United Kingdom—economies that were most severely affected by the loss of Russian gas supplies. Tight labor markets are the largest contributors in Canada, Japan, and the United States.

As of early 2024, labor markets remain relatively tight in G-7 economies, with the possible exception of Italy. Pandemic-induced reductions in labor supply are mostly reversed, so that tight labor markets primarily reflect the legacy of extraordinarily easy monetary and fiscal policies in 2020 and 2021. Easy macroeconomic policies boosted labor demand and enabled the rapid economic recovery in 2021-22. Monetary and fiscal policies began to tighten in 2022, but it seems that policy tightening so far has not led to a significant weakening of labor market conditions.

The pandemic-related demand and supply disruptions in durable goods have largely reversed and commodity prices are back in historical ranges, allowing a large decline of inflation in 2023 that is likely to continue in 2024. Tight labor markets, however, may keep inflation above its pre-pandemic levels for a while longer, especially in the United States. The effects of tight labor markets are least pronounced in France and Italy. In Japan, they are a welcome development after years of falling well below the target for inflation.

References

Amatyakul, Pongpitch, Deniz Igan, and Marco Lombardi. 2024. Sectoral Price Dynamics in the Last Mile of Post-COVID-19 Disinflation. *BIS Quarterly Review*, March 2024: 45-57. Available at https://www.bis.org/publ/qtrpdf/r_qt2403d.htm.

Ball, Laurence, Daniel Leigh, and Prachi Mishra. 2022. Understanding US Inflation during the COVID Era. *Brookings Papers on Economic Activity*, Fall 2022: 1-54. Available at https://www.brookings.edu/articles/understanding-u-s-inflation-during-the-covid-era/.

Benigno, Pierpaolo, and Gauti Eggertsson. 2023. *It's Baaack: The Surge of Inflation in the 2020s and the Return of the Non-Linear Phillips Curve*. NBER Working Paper 31197. Cambridge, MA: National Bureau of Economic Research. Available at https://www.nber.org/papers/w31197.

Bernanke, Ben, and Olivier Blanchard. 2023. *What Caused the US Pandemic Era Inflation?* NBER Working Paper 31417. Cambridge, MA: National Bureau of Economic Research. Available at https://www.nber.org/papers/w31417.

Bernanke, Ben, and Olivier Blanchard. 2024. *An Analysis of the Post-Pandemic Inflation in Eleven Economies.* NBER Working Paper 32532. Cambridge, MA: National Bureau of Economic Research. Available at https://www.nber.org/papers/w32532.

Bounajm, Fares, Jean Roc, and Yang Zhang. 2024. *Sources of pandemic-era inflation in Canada: an application of the Bernanke and Blanchard model*. Staff Analytical Note 2024-13. Ottawa: Bank of Canada. Available at https://www.bankofcanada.ca/2024/06/staff-analytical-note-2024-13/.

Brauer, David. 2007. *The Natural Rate of Unemployment*. CBO Working Paper 2007-06. Washington: Congressional Budget Office. Available at https://www.cbo.gov/publication/18566.

Brooks, Robin, and Peter Orszag. 2023. The COVID Inflation Shock, Monetary Policy Gradualism, and Lingering Supply Chain Effects. Manuscript dated March 2023. Available at https://www.iif.com/portals/0/Files/content/Research/Brooks-Orszag%20IMF-IPD%20Inflation%20Conference%20.pdf.

Comin, Diego, Robert Johnson, and Callum Jones. 2023. *Supply Chain Constraints and Inflation*. NBER Working Paper 31179. Cambridge, MA: National Bureau of Economic Research. Available at https://www.nber.org/papers/w31179.

Dao, Mai Chi, Pierre-Olivier Gourinchas, Daniel Leigh, and Prachi Mishra. 2024. Understanding the International Rise and Fall of Inflation Since 2020. Manuscript dated May 2024. Available at https://www.sciencedirect.com/science/article/pii/S0304393224001119?via%3Dihub.

Firat, Melih, Otso Hao. 2023. *Demand vs. Supply Decomposition of Inflation: Cross-Country Evidence with Applications*. IMF Working Paper WP/23/205. Washington, D.C.: International Monetary Fund. Available at https://www.imf.org/en/Publications/WP/Issues/2023/09/28/Demand-vs-539665.

Forbes, Kristin, Joseph Gagnon, and Christopher Collins. 2022. Low Inflation Bends the Phillips Curve around the World. *Economia*, *45* (89), 52-72. Available at https://doi.org/10.18800/economia.202201.003.

Gagnon, Joseph, and Christopher Collins. 2019. *Low inflation bends the Phillips curve*. PIIE Working Paper 19-6. Washington, D.C.: Peterson Institute for International Economics. Available at https://www.piie.com/publications/working-papers/low-inflation-bends-phillips-curve.

Gagnon, Joseph, and Asher Rose. 2023. *How did Korea's fiscal accounts fare during the COVID-19 pandemic?* PIIE Policy Brief 23-8. Washington, D.C.: Peterson Institute for International Economics. Available at https://www.piie.com/publications/policy-briefs/how-did-koreas-fiscal-accounts-fare-during-covid-19-pandemic.

Gagnon, Joseph, and Asher Rose. Forthcoming. *Why Did Inflation Rise and Fall So Rapidly? Lessons from the Korean War*. PIIE Working Paper. Washington, D.C.: Peterson Institute for International Economics.

Gudmundsson, Tryggvi, Chris Jackson, and Rafael Portillo. 2024. *The Shifting and Steepening of Phillips Curves during the Pandemic Recovery: International Evidence and Some Theory*. IMF Working Paper WP/24/7. Washington, D.C.: International Monetary Fund. Available at https://www.imf.org/en/Publications/WP/Issues/2024/01/12/The-Shifting-and-Steepening-of-Phillips-Curves-During-the-Pandemic-Recovery-International-543712.

Ha, Jongrim, M. Ayhan Kose, Franziska Ohnsorge, and Hakan Yilmazkuday. 2023. *What Explains Global Inflation*. Policy Research Working Paper 10648. Washington: World Bank Group. Available at https://www.worldbank.org/en/research/brief/global-inflation.

Haskel, Jonathan, Josh Martin, and Lennart Brandt. 2023. Recent UK Inflation: An Application of the Bernanke-Blanchard Model. Manuscript dated November 27, 2023. Available at https://www.bankofengland.co.uk/-/media/boe/files/speech/2023/november/recent-uk-inflation-an-application-of-the-bernanke-blanchard-model-paper.pdf.

Hansen, Niels-Jakob, Frederik Toscani, and Jing Zhou. 2023. *Euro Area Inflation after the Pandemic and Energy Shock: Import Prices, Profits, and Wages*. IMF Working Paper WP/23/131. Washington, D.C.: International Monetary Fund. Available at https://www.imf.org/en/Publications/WP/Issues/2023/06/23/Euro-Area-Inflation-after-the-Pandemic-and-Energy-Shock-Import-Prices-Profits-and-Wages-534837.

Honohan, Patrick. 2024. *The Inflation Surge in Europe*. PIIE Policy Brief 24-2. Washington, D.C.: Peterson Institute for International Economics. Available at https://www.piie.com/sites/default/files/2024-05/pb24-2.pdf.

IMF. 2024. *Fiscal Monitor*. Washington: International Monetary Fund. Available at https://www.imf.org/en/publications/fm.

Jordà, Òscar, and Fernanda Nechio. 2023. Inflation and Wage Growth since the Pandemic. *European Economic Review* 156 (July): 104474.

Koch, Christoffer, and Diaa Noureldin. 2023. *How We Missed the Inflation Surge: An Anatomy of Post-2020 Inflation Forecast Errors*. IMF Working Paper WP/23/102. Washington, D.C.: International Monetary Fund.

Levy, Phil. 2024. *Did Supply Chains Deliver Pandemic-Era Inflation?* PIIE Policy Brief 24-10. Washington, D.C.: Peterson Institute for International Economics. Available at https://www.piie.com/publications/policy-briefs/2024/did-supply-chains-deliver-pandemic-era-inflation.

Mortensen, Dale, and Christopher Pissarides. 1999. New Developments in Models of Search in the Labor Market. In Ashenfelter, Orley, and David Card. *Handbook of Labor Economics*, vol. 3, ch. 39, p. 2567-2627.

Nakamura, Koji, Shogo Nakano, Mitsuhiro Osada, and Hiroki Yamamoto. 2024*. What Caused the Pandemic-Era Inflation? Application of the Bernanke-Blanchard Model to Japan*. Bank of Japan Working Paper No. 24-E-1. Tokyo: Bank of Japan. Available at https://www.boj.or.jp/en/research/wps_rev/wps_2024/data/wp24e01.pdf.

OECD. 2021. *Economic Survey of France*. Paris: Organization for Economic Cooperation and Development. Available at https://www.oecd.org/economy/france-economic-snapshot/.

Petrosky-Nadeau, Nicolas, and Lu Zhang. 2021. Unemployment Crises. *Journal of Monetary Economics* Vol. 117: 335-53. Available at https://econpapers.repec.org/article/eeemoneco/v_3a117_3ay_3a2021_3ai_3ac_3ap_3a335-353.htm.

Phillips, A.W. 1958. The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861–1957. *Economica* 25: 283–99. Available at https://doi.org/10.1111/j.1468-0335.1958.tb00003.x.

Appendix: Data sources and definitions

Sources

The primary source for US data is the Bureau of Economic Analysis National Accounts database via https://fred.stlouisfed.org/. For other (non-US) G-7 economies, national accounts data were collected from Macrobond using Organization for Economic Cooperation and Development (OECD) data. For other G-7 economies, durable goods and semi-durable goods were combined into a single category. The price index for this combined category was created using chain weighting on the underlying data.

Food and energy inflation data for all countries come from the World Bank Global Database of Inflation at https://www.worldbank.org/en/research/brief/inflation-database.

Unemployment rates are obtained from the Bureau of Labor Statistics (BLS) via https://fred.stlouisfed.org/ for the United States and Macrobond using OECD Labor Force Survey for the other G-7 economies.

The US job vacancy rate was obtained from the BLS Job Openings and Labor Turnover Survey database via https://fred.stlouisfed.org/. The vacancy rate was extrapolated backwards using data from Petrosky-Nadeau and Zhang (2021) available at https://drive.google.com/file/d/1NcuUMRR4_fOwJW6qHb-XxitVSXXONBHW/view. The German vacancy rate is from OECD *Main Economic Indicators* (MEI) via https://fred.stlouisfed.org/. The Japanese vacancy rate was constructed from the total number of vacancies from Statistics of Japan (table 6 at https://www.e-stat.go.jp/stat-search/files?page=1&layout=datalist&toukei=00450222&tstat=000001020327&cycle=1&tclass1=000001218240&tclass2val=0) and the labor force size from OECD MEI via https://fred.stlouisfed.org/. The UK vacancy rate is from OECD MEI via https://fred.stlouisfed.org/ and was extended before 2018 using the Bank of England's Millenium of Macroeconomic Data weblink at https://www.bankofengland.co.uk/statistics/research-datasets. The Canadian vacancy rate is provided by Bounajm, Roc, and Zhang (2024) at https://www.bankofcanada.ca/?p=239093. The Canadian vacancy rate was extrapolated for the last two quarters of 2023 using data from Statistics Canada at https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410039801.

Data are available from 1993Q4 through 2023Q4, except for the United Kingdom (1995Q1), Italy (1996Q1), and Japan (1994Q1).

All data are reported in seasonally adjusted terms except for Japanese consumption components. We seasonally adjusted Japanese quarterly consumption inflation rates (used in regressions) by regressing them on three mean-zero quarterly dummies and using the residuals plus the intercept term. Four-quarter inflation rates displayed in figure 1 are based on the original unadjusted data.

Our proxy for supply shortages is constructed using data from Google Trends on frequency of search results. For the United States, United Kingdom, and Canada, the term "chip shortage" is used. Different terms are used in non-English speaking countries: "半導体不足" in Japan, "chipmangel" in Germany, "crisi semiconduttori" in Italy, and "penurie composants" in France. Results are available from 2004 to present at a monthly frequency, with the peak month indexes at 100. We converted the data to a quarterly frequency using averages within each quarter. We extrapolated data before 2004 at 0.

Definitions

PN	price index for consumption of nondurable goods.
PD	price index for consumption of durable and semi-durable goods[22]
PS	price index for consumption of services
PE	energy component of consumer price index, ratio to GDP price index
PF	food component of consumer price index, ratio to GDP price index
PIM	price index for imports of goods and services, ratio to GDP price index (the *PIM* inflation rate is scaled by the ratio of imports to GDP)
UN	unemployment rate, percent of labor force
UN_LOW	zero except for observations in which *UN* is below its economy-specific 25th percentile value, in which case *UN_LOW* is *UN* minus the 25th percentile value
VAC	job vacancy rate, percent of labor force
V/U	ratio of job vacancies to unemployment
CD	real consumption of durable and semi-durable goods
CHIPSHORT	Google Trends search results by economy for the term "chip shortage" or foreign-language equivalent

[22] The United States does not report semi-durable goods. For the United States, *PD* and *CD* refer to durable goods only.

Table 1. Average PCE inflation in 2020-23 was much higher than in 2016-19 (average percent change over four years)							
	Canada	France	Germany	Italy	Japan	United Kingdom	United States
Inflation target	2.0	2.0	2.0	2.0	2.0	2.0	2.0
2016-2019 average annual inflation	1.4	1.0	1.4	0.7	0.5	1.5	1.6
2020-2023 average annual inflation	3.4	3.6	4.4	3.8	1.8	4.7	3.9
Change in average inflation (percentage points)	2.0	2.6	3.0	3.1	1.3	3.2	2.3
of which							
Durable goods	0.4	0.3	0.5	0.3	0.3	0.4	0.5
Nondurable goods	0.8	0.9	1.6	1.5	0.7	1.0	0.7
Services	0.8	1.4	0.8	1.3	0.3	1.7	1.1
Shares in nominal consumption (percent, 2016-2023 average)							
Durable goods	20	15	21	17	14	19	11
Nondurable goods	25	30	28	32	29	22	21
Services	55	54	51	51	58	59	67

PCE = personal consumption expenditures
Note: In this table, durable goods include semi-durable goods in countries that report both.
Source: Authors' calculations using data described in the appendix.

Table 2. Durable goods inflation, 1995Q1-2023Q4							
Variable	Canada	France	Germany	Italy	Japan	United Kingdom	United States
Lagged Δ*PD*	0.55** (0.12)	-0.13 (0.30)	0.58** (0.09)	0.29** (0.10)	0.85** (0.11)	0.45** (0.13)	0.27* (0.11)
Δ*PE*	0.01 (0.01)	-0.12 (0.10)	0.03* (0.01)	0.03** (0.01)	0.05 (0.05)	-0.02 (0.02)	-0.02 (0.01)
Δ*PF*	0.07 (0.05)	0.36* (0.15)	0.04 (0.02)	0.16** (0.05)	0.20* (0.09)	0.09 (0.09)	0.03 (0.06)
Δ*PIM*	-0.02 (0.08)	0.87* (0.33)	-0.11 (0.06)	-0.06 (0.06)	0.84 (0.72)	0.26 (0.21)	0.53** (0.20)
CHIPSHORT_US	0.04** (0.01)	0.01 (0.04)	0.05** (0.01)			0.08** (0.02)	0.12** (0.02)
Δ*CD*	0.13 (0.18)		0.16 (0.21)	0.18 (0.11)			0.05 (0.02)
Constant	-0.17 (0.25)	-0.03 (0.61)	-0.12 (0.14)	0.33* (0.15)	-0.04 (0.37)	-0.02 (0.32)	-1.53** (0.24)
Observations	116	116	116	107	115	111	116
R^2	0.47	0.35	0.76	0.57	0.6	0.34	0.80

*p < 0.05, **p < 0.01. Robust standard errors are in parentheses.
Note: Semi-durable goods (where available) have been added to durable goods in these regressions.
Source: Authors' calculations using data described in the appendix.

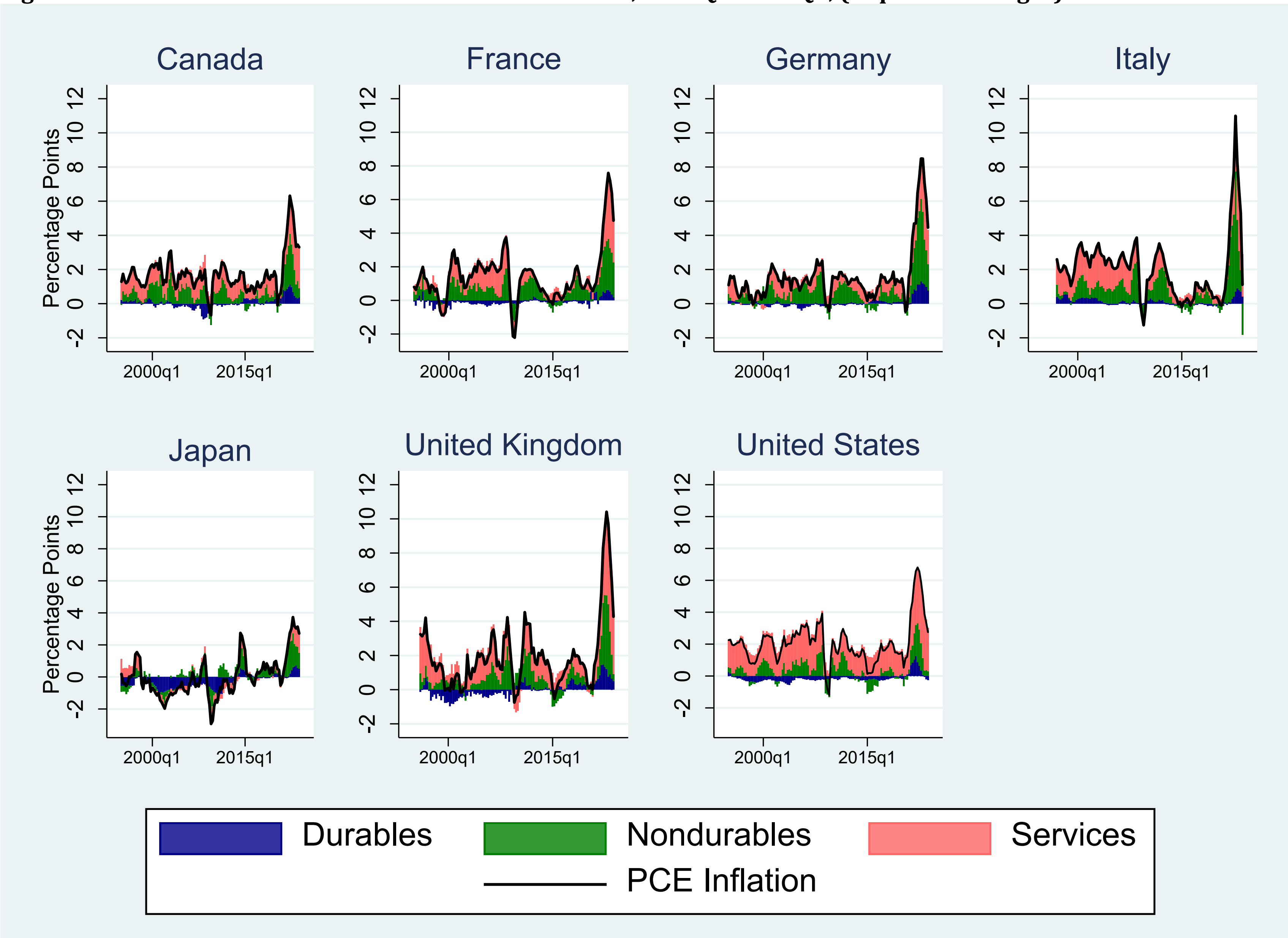
Table 3. Nondurable goods inflation, 1995Q1-2023Q4							
Variable	Canada	France	Germany	Italy	Japan	United Kingdom	United States
Lagged ΔPN	0.12 (0.14)	0.12 (0.11)	0.18 (0.13)	-0.06 (0.15)	0.00 (0.15)	-0.04 (0.11)	0.16 (0.13)
ΔPE	0.18** (0.03)	0.24** (0.03)	0.17** (0.04)	0.22** (0.05)	0.24** (0.05)	0.29** (0.02)	0.12** (0.02)
ΔPF	-0.01 (0.08)	0.37** (0.07)	0.17* (0.08)	0.42** (0.09)	0.46** (0.08)	0.32** (0.09)	0.19 (0.11)
ΔPIM	-0.04 (0.16)	0.14 (0.16)	0.63** (0.20)	0.69** (0.16)	1.25 (0.70)	0.63** (0.21)	1.65** (0.56)
V/U					1.16 (0.64)		1.69** (0.49)
$\Delta V/U$					8.38** (3.20)		4.80* (2.33)
UN	0.19 (0.24)	-0.21 (0.25)	0.15 (0.17)	-0.13 (0.14)		0.21 (0.29)	
ΔUN	-1.64** (0.29)	-0.41 (0.81)	-1.11 (1.05)	-0.01 (0.43)		-1.24 (1.27)	
UN_LOW	-1.80 (0.93)	-1.05 (1.20)	-2.06* (0.98)	-0.21 (0.49)		-1.37 (1.28)	
Constant	-0.16 (2.02)	3.30 (2.39)	0.18 (1.28)	3.05 (1.51)	0.43 (0.60)	0.56 (1.71)	0.12 (0.40)
Observations	116	116	116	103	115	111	116
R^2	0.61	0.78	0.60	0.90	0.67	0.81	0.84

*p < 0.05, **p < 0.01. Robust standard errors are in parentheses.
Source: Authors' calculations using data described in the appendix.

Table 4. Services inflation, 1995Q1-2023Q4							
Variable	Canada	France	Germany	Italy	Japan	United Kingdom	United States
Lagged Δ*PS*	0.23 (0.20)	0.45** (0.13)	0.22 (0.18)	0.72** (0.11)	0.57** (0.17)	0.30 (0.17)	0.67** (0.09)
Δ*PE*	0.00 (0.01)	0.02 (0.03)	0.02 (0.02)	0.01 (0.01)	0.03 (0.02)	0.05** (0.02)	0.00 (0.01)
Δ*PF*	-0.02 (0.03)	0.10 (0.06)	0.05 (0.04)	0.13* (0.05)	0.06 (0.03)	0.15 (0.09)	0.00 (0.03)
Δ*PIM*	-0.09 (0.05)	0.09 (0.17)	-0.09 (0.11)	0.20** (0.07)	0.17 (0.22)	0.03 (0.14)	0.35** (0.10)
V/U	4.06** (0.92)						0.54** (0.17)
ΔV/U	1.77 (2.35)						1.47* (0.60)
UN		-0.19 (0.22)	0.03 (0.07)	0.00 (0.10)	-0.12 (0.12)	-0.19 (0.16)	
Δ*UN*		-1.44* (0.68)	-0.48 (0.59)	-0.71* (0.30)	-1.44* (0.59)	-2.71 (1.50)	
UN_LOW			-0.79 (0.47)		-1.30 (1.50)		
Constant	0.01 (0.29)	2.48 (1.99)	0.69 (0.63)	0.52 (1.19)	0.54 (0.54)	2.25* (1.09)	0.57** (0.21)
Observations	116	116	116	103	115	111	116
R^2	0.45	0.45	0.28	0.60	0.41	0.27	0.73

*p < 0.05, **p < 0.01. Robust standard errors are in parentheses.
Source: Authors' calculations using data described in the appendix.

Figure 1. Contributions to PCE inflation in G-7 economies, 1995Q1-2023Q4, (4-quarter changes)



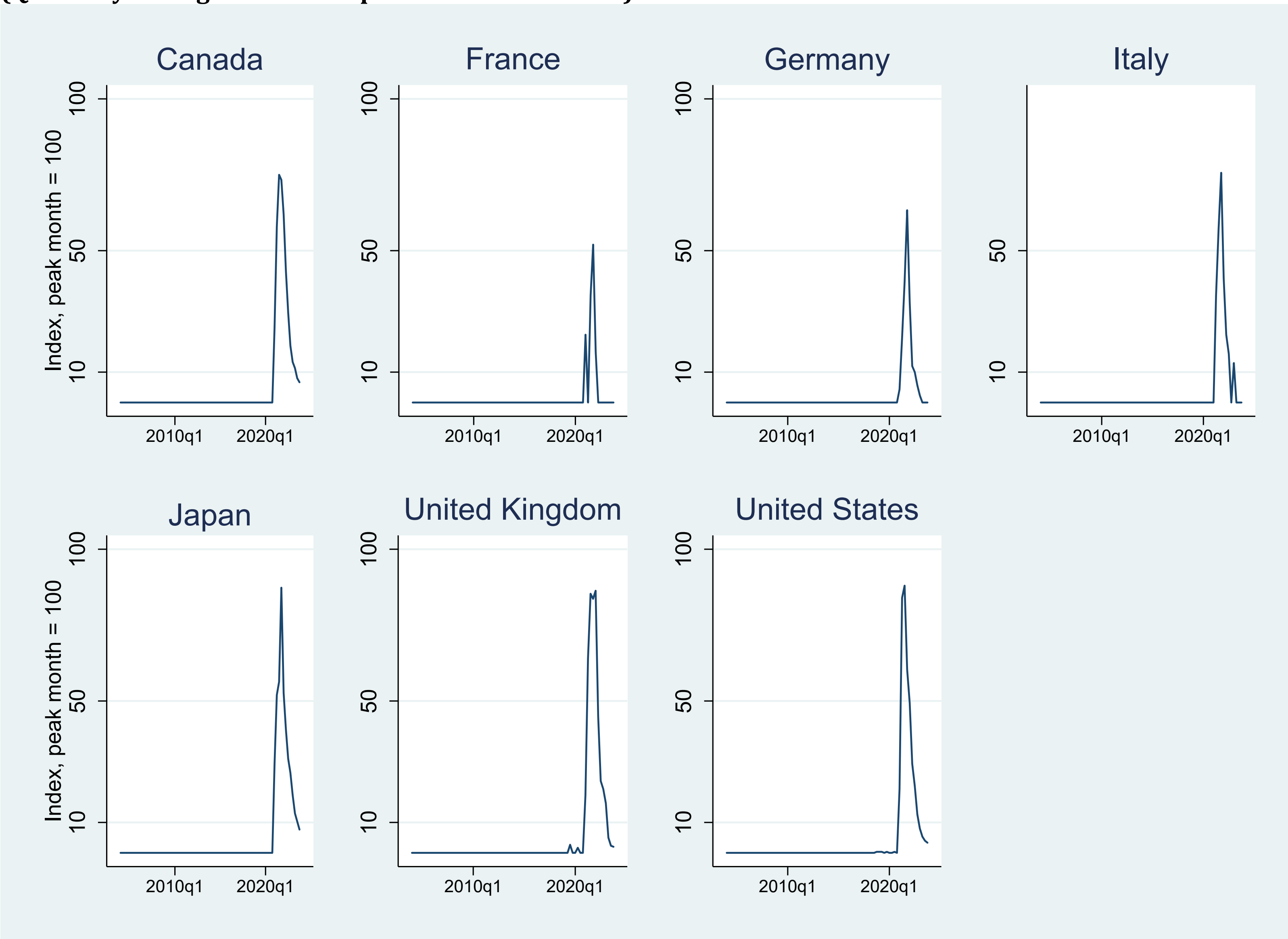
PCE = personal consumption expenditures

Source: Authors' calculations using data described in the appendix.

Figure 2. Real (inflation-adjusted) growth in consumption of durable goods, 1995Q1-2023Q4, (4-quarter changes)

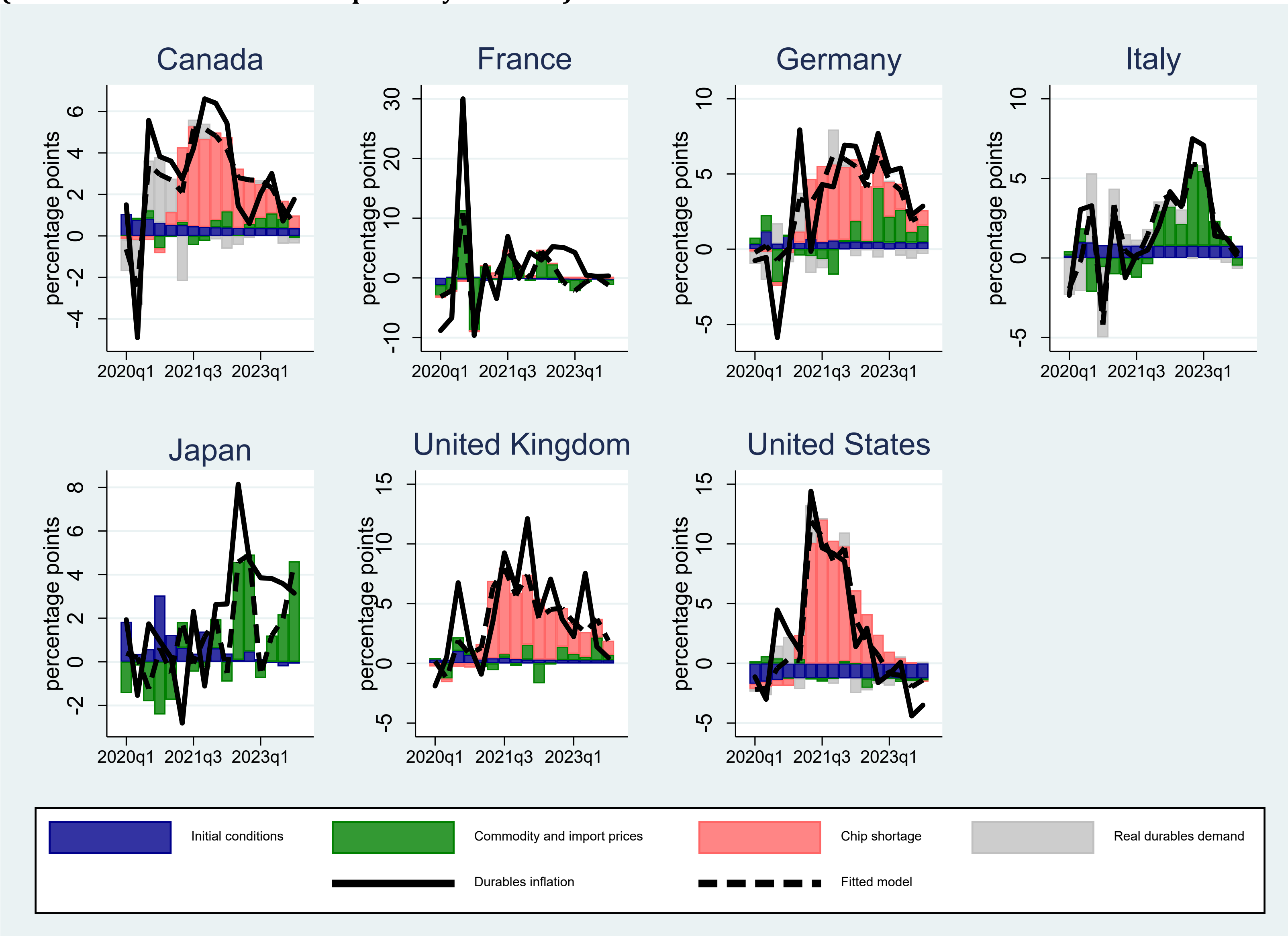
Source: Authors' calculations using data described in the appendix.

Figure 3. Frequency of Google searches for "chip shortage" or similar in G-7 economies, 2004Q1-2023Q4 (Quarterly average index with peak month set at 100)



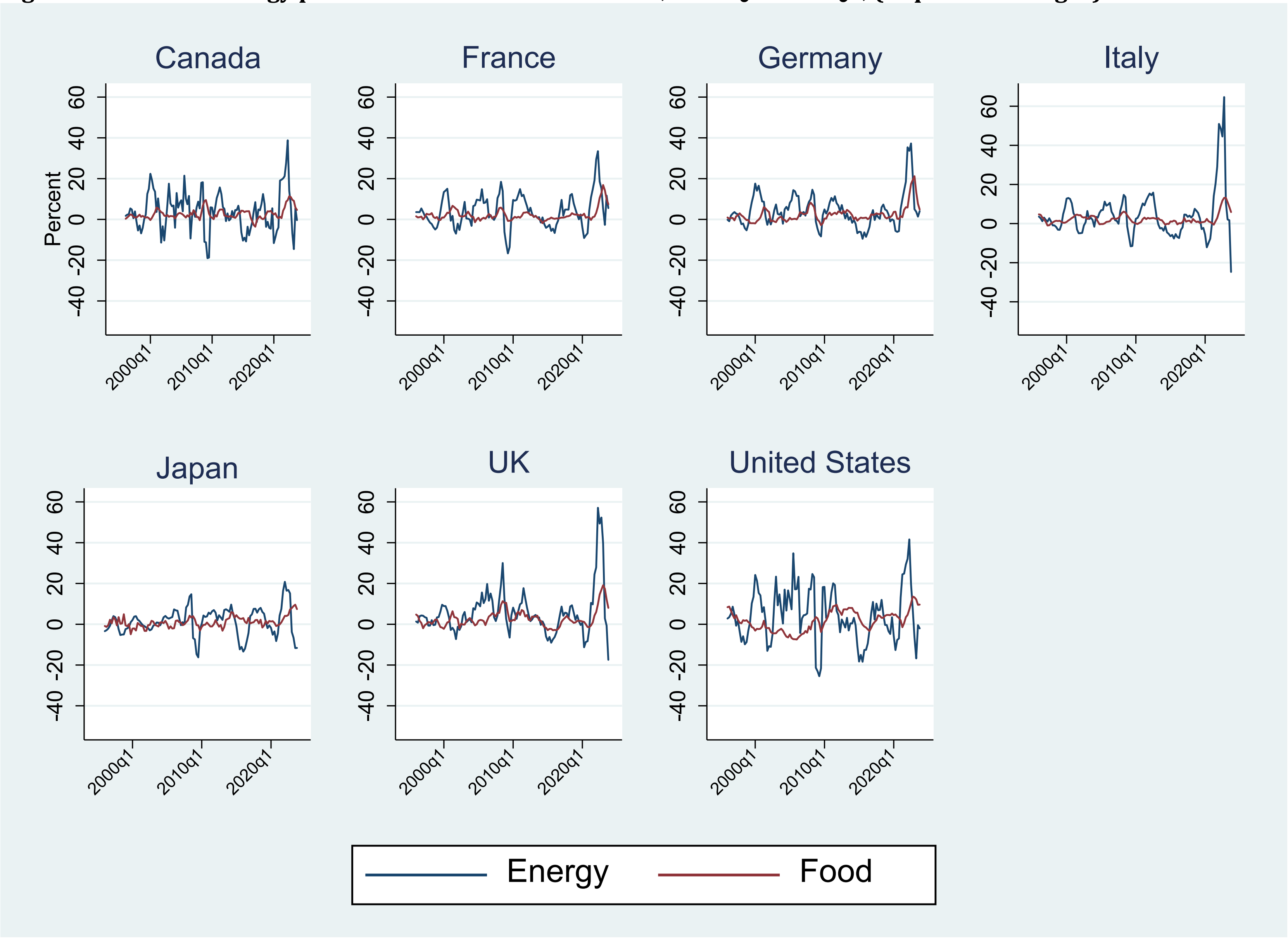
Source: Google Trends.

Figure 4. An augmented model of durable goods prices fits well in many economies, 2020Q1-2023Q4 (contributions to annualized quarterly inflation)



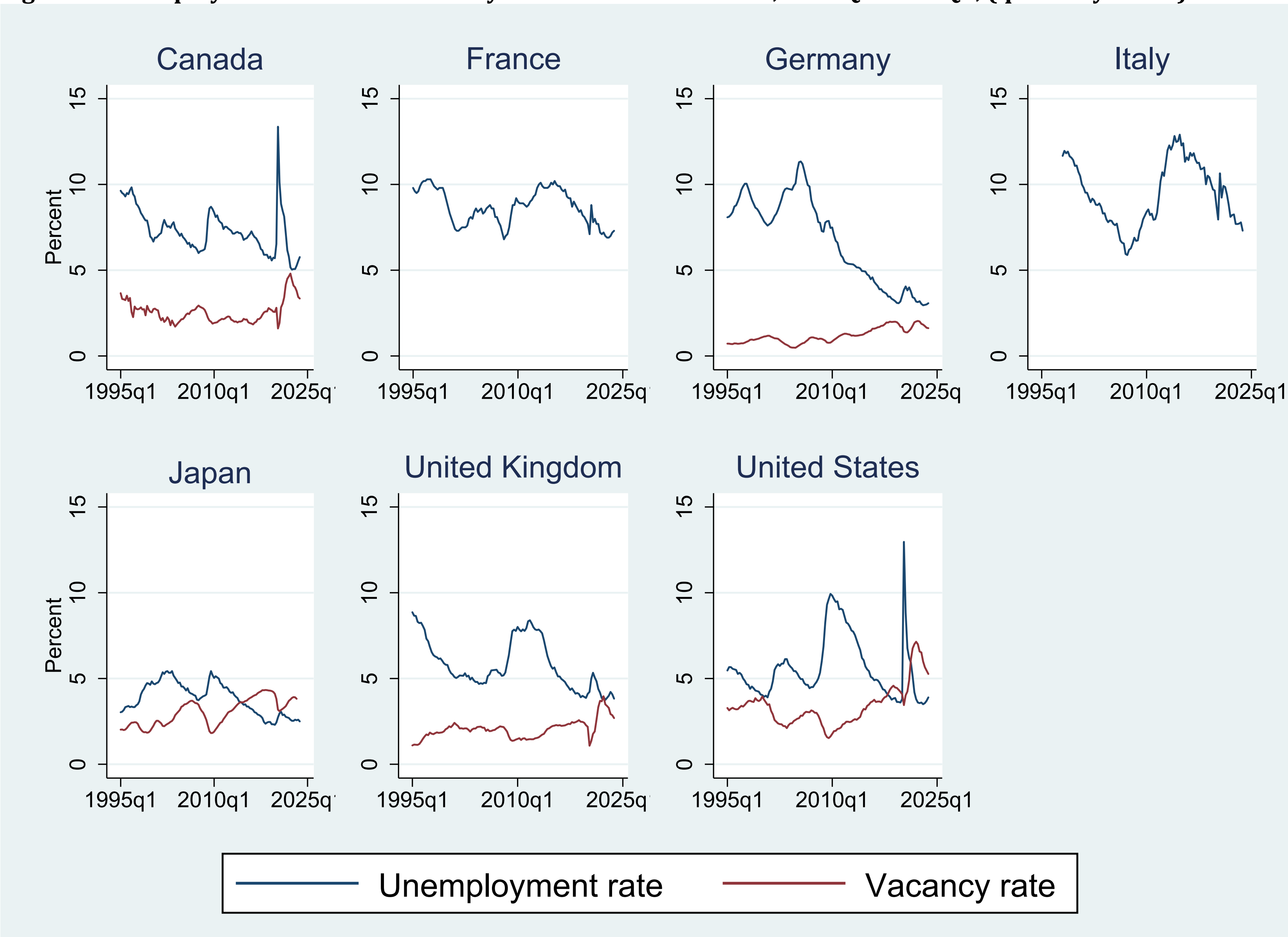
Source: Authors' calculations using data and results from table 2.

Figure 5. Food and energy price inflation in G-7 economies, 1995Q1-2023Q4, (4-quarter changes)



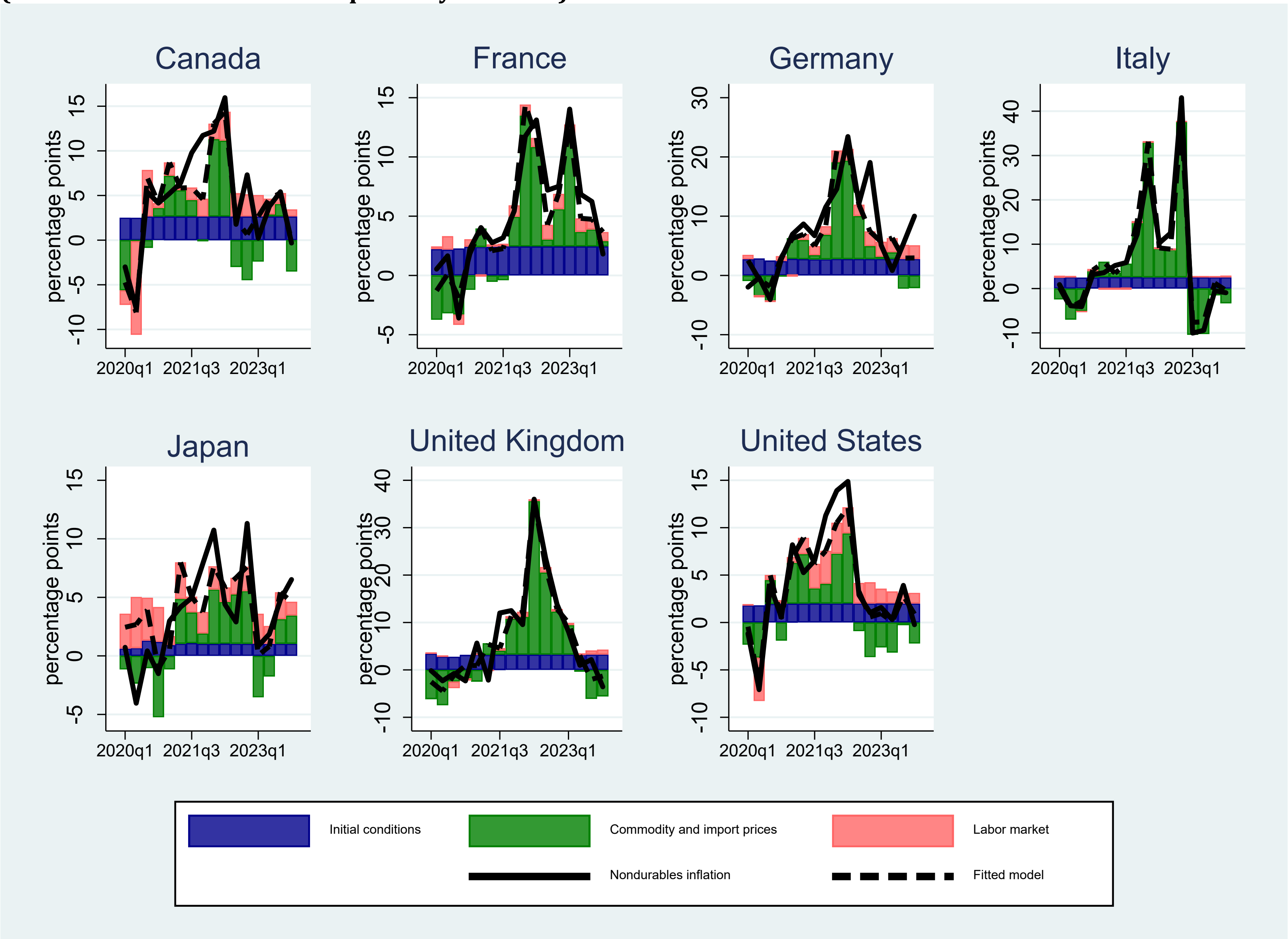
Source: Authors' calculations using data described in the appendix.

Figure 6. Unemployment Rates and Vacancy Rates in G-7 Economies, 1995Q1-2023Q4, (quarterly levels)



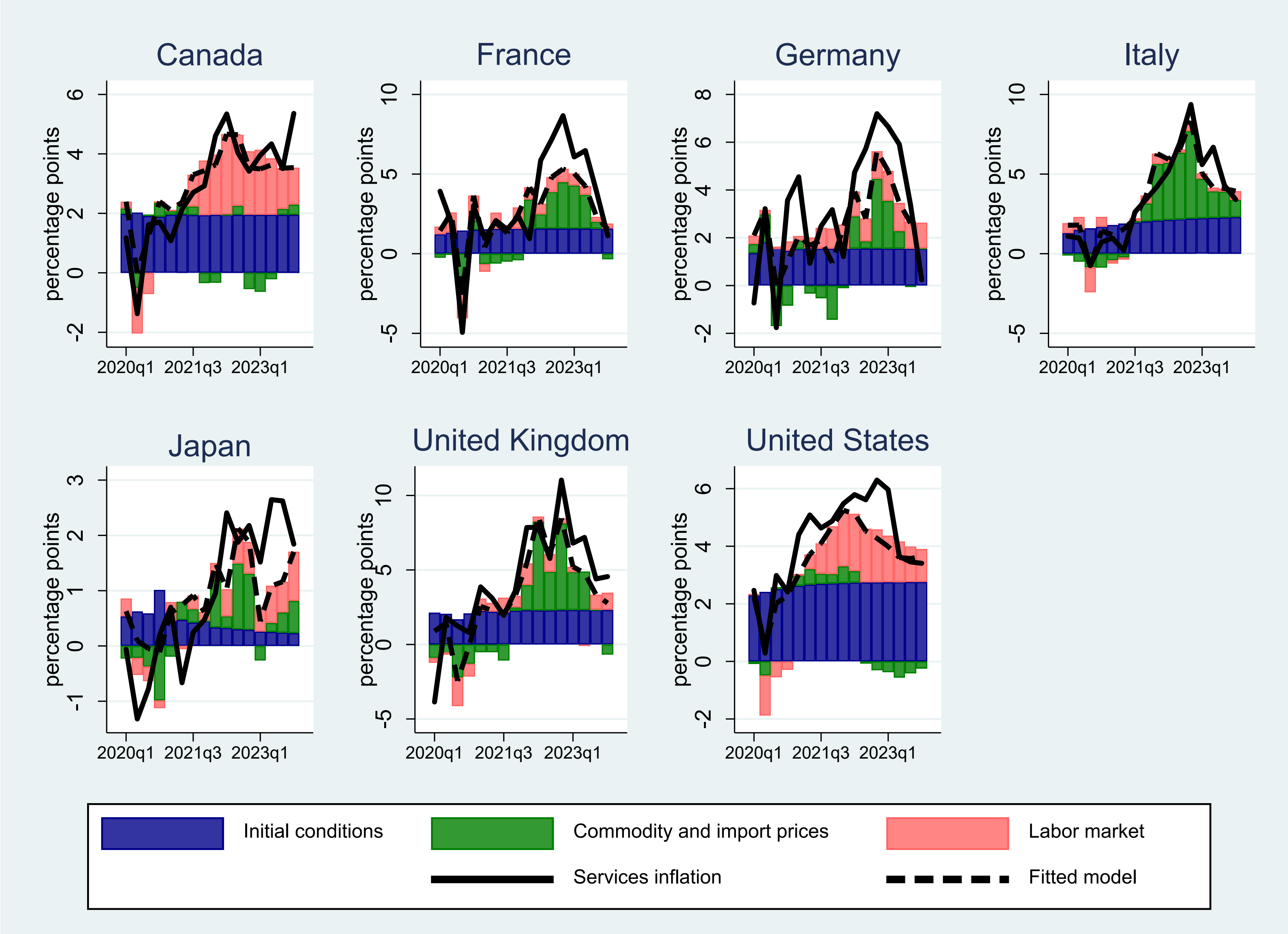
Source: Data described in the appendix.

Figure 7. A nonlinear Phillips curve model of nondurable goods prices fits well, 2020Q1-2023Q4 (contributions to annualized quarterly inflation)



Source: Authors' calculations using data and results from table 3.

Figure 8. A nonlinear Phillips curve model of services prices fits moderately well, 2020Q1-2023Q4, (4-quarter changes)



Source: Authors' calculations using data and results from table 4.