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What Can We Learn from the Pandemic and the War  
about Supply Shocks, Inflation, and Monetary Policy?

Remarks by

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Policymakers and researchers have begun reassessing certain features of the economy and monetary policy in light of recent experience. After several decades in which supply was highly elastic and inflation was low and relatively stable, a series of supply shocks associated with the pandemic and Russia’s war against Ukraine have contributed to high inflation, in combination with a very rapid recovery in demand. The experience with the pandemic and the war highlights the challenges for monetary policy in responding to a protracted series of adverse supply shocks. In addition, to the extent that the lower elasticity of supply we have seen recently could become more common due to challenges such as demographics, deglobalization, and climate change, it could herald a shift to an environment characterized by more volatile inflation compared with the preceding few decades.<sup>1</sup>

Inflation in the United States and many countries around the world is very high (figure 1). While both demand and supply are contributing to high inflation, it is the relative inelasticity of supply in key sectors that most clearly distinguishes the pandemic- and war-affected period of the past three years from the preceding 30 years of the Great Moderation.<sup>2</sup> Interestingly,

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<sup>1</sup> I am grateful to Kurt Lewis of the Federal Reserve Board for his assistance in preparing this text and to Kenneth Eva for preparing the figures. This text updates the views that I discussed as part of a panel at the BIS Annual Meeting on June 24, 2022. These views are my own and do not necessarily reflect those of the Federal Reserve Board or the Federal Open Market Committee.

<sup>2</sup> Research has generated a range of estimates on the contributions from supply and demand factors. For example, Shapiro (2022) finds that demand factors are responsible for about one-third of the surge in inflation above the pre-pandemic trend, while di Giovanni and others (2022) find a number closer to two-thirds. See Adam Shapiro (2022), “How Much Do Supply and Demand Drive Inflation?” FRBSF Economic Letter 2022-15 (San Francisco: Federal Reserve Bank of San Francisco, June), <https://www.frbsf.org/economic-research/publications/economic-letter/2022/june/how-much-do-supply-and-demand-drive-inflation>; and Julian di Giovanni, Sebnem Kalemli-Ozcan, Alvaro Silva, and Muhammed Yildirim (2022), “Global Supply Chain Pressures, International Trade, and Inflation,” paper presented at the ECB Forum on Central Banking 2022, Sintra, Portugal, June 27–29, [https://www.ecb.europa.eu/pub/conferences/ecbforum/shared/pdf/2022/Kalemli-Oezcan\\_paper.pdf](https://www.ecb.europa.eu/pub/conferences/ecbforum/shared/pdf/2022/Kalemli-Oezcan_paper.pdf).

inflation is broadly higher throughout much of the global economy, and even jurisdictions that began raising rates forcefully in 2021 have not stemmed the global inflationary tide.<sup>3</sup>

In the United States, as a result of significant fiscal and monetary support, the level of private domestic final purchases recovered extremely rapidly in 2020 and 2021 to levels consistent with the pre-pandemic trend before moving below trend in 2022 (figure 2). Although demand came in near the pre-pandemic trend on an aggregate level, the pandemic induced a shift in composition that concentrated large increases in demand in certain sectors where the supply response was constrained. The shift in consumption from services to goods was so pronounced that—despite plunging at the onset of the pandemic in March 2020—real spending on goods had already risen nearly 4 percent above its pre-pandemic trend by June of that year. While a very slow rotation back toward pre-pandemic patterns of consumption has been under way for over a year, it remains incomplete more than two and a half years after the initial shutdown: In the most recent data, the level of goods spending remains 6 percent above the level implied by its pre-pandemic trend, while services spending remains a little more than 2 percent below its pre-pandemic trend (figure 3).

The supply shocks to goods, labor, and commodities have been accompanied by unusually high volatility in monthly inflation readings since the beginning of the pandemic. Since March 2020, the standard deviation of month-over-month core inflation has been 0.22 percentage point—a level of variation not seen in a 31-month period since the 1970s and more than double the standard deviation in monthly core inflation from 1990 to 2019. The initial

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<sup>3</sup> The median year-to-date total policy rate hike within the group of Brazil, Hungary, New Zealand, Norway, Peru, Poland, and South Korea is 6 percentage points. All of these countries began forceful rate hikes in 2021, and the cumulative hikes have taken policy rates in some of these countries above 10 percent. Despite this, through September 2022 core inflation in these countries was 9.5 percent year-over-year, rising 3.5 percentage points since March. See Economist (2022), “Even Super-Tight Policy Is Not Bringing Down Inflation,” October 28, <https://www.economist.com/finance-and-economics/2022/10/23/even-super-tight-policy-is-not-bringing-down-inflation>.

drivers of this high variation in monthly core inflation readings were a sharp drop in prices and subsequent bounceback in the first months of the pandemic, followed by a couple of bursts lasting three to four months each. The first burst occurred around reopening in the spring of 2021, and the second occurred amid the effects of the Delta and Omicron COVID-19 variants in the autumn of 2021 (figure 4).<sup>4</sup>

The evidence suggests that high concentrations of demand in sectors such as appliances, housing, and motor vehicles—where supply was constrained by the effects of the pandemic—played an important role initially in generating inflationary pressures. Acute constraints on shipping and on the supply of nonsubstitutable intermediate inputs like semiconductors were compounded by acute constraints on labor supply associated with the effects of the Delta and Omicron variants and later compounded further by sharp commodities supply shocks associated with Russia’s war on Ukraine.

The standard monetary policy prescription is to “look through” supply shocks, such as commodities price shocks or shutdowns of ports or semiconductor plants, that are not assessed to leave a lasting imprint on potential output.<sup>5</sup> In contrast, if supply shocks durably lower potential output such that the economy is operating above potential, monetary policy tightening is necessary to bring demand into alignment with the economy’s reduced productive capacity.

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<sup>4</sup> Pandemic fiscal measures played an important role in boosting demand, but the rapid deceleration of inflation over the summer of 2021 and subsequent rebound in inflation from October through the end of the year do not line up well with the fiscal demand impulse projected by most forecasters. For example, the Brookings Institution projected a smooth demand impulse from the American Rescue Plan that peaked at the end of last year. See Wendy Edelberg and Louise Sheiner (2021), “The Macroeconomic Implications of Biden’s \$1.9 Trillion Fiscal Package,” Brookings Institution, *Up Front* (blog), January 28, <https://www.brookings.edu/blog/up-front/2021/01/28/the-macroeconomic-implications-of-bidens-1-9-trillion-fiscal-package>.

<sup>5</sup> See, for instance, Martin Bodenstein, Christopher J. Erceg, and Luca Guerrieri (2008), “Optimal Monetary Policy with Distinct Core and Headline Inflation Rates,” *Journal of Monetary Economics*, vol. 55 (October), pp. S18–33.

Importantly, and separately from the implications for potential output, monetary policy should respond strongly if supply shocks risk de-anchoring inflation expectations.<sup>6</sup>

Although these tenets of monetary policy sound relatively straightforward in theory, they are challenging to assess and implement in practice. It is difficult to assess potential output and the output gap in real time, as has been extensively documented by research.<sup>7</sup> This is especially true in an environment of high uncertainty. The level of uncertainty around the output gap varies considerably over time, and research suggests that more muted policy reactions are warranted when uncertainty about the output gap is high.<sup>8</sup> The unexpectedly long-lasting global pandemic and the sharp disruptions to commodities associated with Russia's war against Ukraine have contributed to substantial uncertainty (figure 5).

Even so, the drawn-out sequence of shocks to the supply of labor, commodities, and key intermediate inputs, such as semiconductors, blurred the lines about what constitutes a temporary shock as opposed to a persistent shock to potential output. Even when each individual supply shock fades over time and behaves like a temporary shock on its own, a drawn-out sequence of adverse supply shocks that has the cumulative effect of constraining potential output for an extended period is likely to call for monetary policy tightening to restore balance between demand and supply.

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<sup>6</sup> Ricardo Reis makes the case that both these factors would have prescribed tighter policy in the current environment. See Ricardo Reis (2022), "The Burst of High Inflation in 2021–22: How and Why Did We Get Here?" CEPR Discussion Paper Series DP17514 (London: Centre for Economic Policy Research, July), <https://cepr.org/publications/dp17514>.

<sup>7</sup> See Athanasios Orphanides and Simon van Norden (2002), "The Unreliability of Output-Gap Estimates in Real Time," *Review of Economics and Statistics*, vol. 84 (November), pp. 569–83.

<sup>8</sup> For discussions of the time-varying nature of output gap uncertainty, see Travis J. Berge (2020), "Time-Varying Uncertainty of the Federal Reserve's Output Gap Estimate," Finance and Economics Discussion Series 2020-012 (Washington: Board of Governors of the Federal Reserve System, February; revised April 2021), <https://doi.org/10.17016/FEDS.2020.012r1>; and Rochelle M. Edge and Jeremy B. Rudd (2016), "Real-Time Properties of the Federal Reserve's Output Gap," *Review of Economics and Statistics*, vol. 98 (October), pp. 785–91. For a discussion of tempering the policy response to the output gap in response to increased uncertainty, see Athanasios Orphanides (2003), "Monetary Policy Evaluation with Noisy Information," *Journal of Monetary Economics*, vol. 50 (April), pp. 605–31.

In addition, a protracted series of supply shocks associated with an extended period of high inflation—as with the pandemic and the war—risks pushing the inflation expectations of households and businesses above levels consistent with the central bank’s long-run inflation objective.<sup>9</sup> It is vital for monetary policy to keep inflation expectations anchored, because inflation expectations shape the behavior of households, businesses, and workers and enter directly into the inflation process. In the presence of a protracted series of supply shocks and high inflation, it is important for monetary policy to take a risk-management posture to avoid the risk of inflation expectations drifting above target. Even in the presence of pandemics and wars, central bankers have the responsibility to ensure that inflation expectations remain firmly anchored at levels consistent with our target.

In monitoring inflation expectations for purposes of risk management, not only the median but also the distribution of inflation expectations can provide important information about how inflation expectations may be changing.<sup>10</sup> Survey measures suggest that the median of longer-term inflation has remained within pre-pandemic ranges consistent with 2 percent inflation (figure 6). However, starting in 2021, there has been a greater dispersion than usual of views about future inflation in survey responses, as shown in figure 6. Although initially the increased dispersion reflected a rise in expectations for significantly above-target inflation, more

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<sup>9</sup> For two recent examples of assessing longer-term inflation expectations, see Michael T. Kiley (2022), “Anchored or Not: How Much Information Does 21st Century Data Contain on Inflation Dynamics?” Finance and Economics Discussion Series 2022-016 (Washington: Board of Governors of the Federal Reserve System, March), <https://doi.org/10.17016/FEDS.2022.016>; and Danilo Cascaldi-Garcia, Francesca Loria, and David López-Salido (2022), “Is Trend Inflation at Risk of Becoming Unanchored? The Role of Inflation Expectations,” FEDS Notes (Washington: Board of Governors of the Federal Reserve System, March 31), <https://doi.org/10.17016/2380-7172.3043>.

<sup>10</sup> See, for example, Ricardo Reis (2021), “Losing the Inflation Anchor,” *Brookings Papers on Economic Activity*, Fall, pp. 307–61, [https://www.brookings.edu/wp-content/uploads/2021/09/15985-BPEA-BPEA-FA21\\_WEB\\_Reis.pdf](https://www.brookings.edu/wp-content/uploads/2021/09/15985-BPEA-BPEA-FA21_WEB_Reis.pdf). The Board’s staff recently updated the Index of Common Inflation Expectations to include the 25th and 75th percentiles of inflation expectations over the next 12 months from the University of Michigan Surveys of Consumers.

recently, following substantial cumulative monetary policy tightening, the increased dispersion has also reflected increased expectations of no inflation or even disinflation. About one-fourth of respondents to the most recent University of Michigan Surveys of Consumers anticipate that prices are likely to be the same or below their current level 5 to 10 years in the future—roughly three times the average fraction that reported such expectations before the pandemic.

Finally, it is important to explore whether any features of the inelastic supply response associated with the pandemic and the war may have implications for potential growth and macroeconomic stability in the future.<sup>11</sup> In particular, despite the unprecedented pandemic policy support for businesses of all sizes that was directed at preserving the supply side of the economy, key sectors struggled to ramp up activity after reopening. The supply response was particularly impaired in sectors where supply chains are geographically fragmented and recurring foreign COVID-19 lockdowns have reduced the reliability of foreign supplies. While conditions have improved dramatically from some of the worst periods in 2021, measures like the Global Supply Chain Pressure Index from the Federal Reserve Bank of New York indicate that total supply chain pressures still are elevated relative to pre-pandemic levels (figure 7).

The supply disruptions in key goods and commodities sectors associated with the pandemic and Russia’s war against Ukraine have highlighted the fragility of global supply chains and the risks of inelastic supply at moments of stress. Conditions have improved dramatically over the past year, judging by the return of the ISM Supplier Deliveries index to its pre-pandemic range of values (figure 8). That said, ongoing discussions about moving from “just in time” to “just in case” inventory management and from offshoring to “nearshoring” are raising

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<sup>11</sup> See, for example, Agustín Carstens (2022), “The Return of Inflation,” speech delivered at the International Center for Monetary and Banking Studies, Geneva, April 5, <https://www.bis.org/speeches/sp220405.htm>.

important questions about the extent to which businesses are likely to reconfigure global supply chains based on a reassessment of the tradeoff between cost efficiency and supply resilience.

Similarly, some have conjectured that the slow and incomplete recovery of the workforce over the course of the pandemic may be the beginning of a longer-term change in labor supply dynamics (figure 9).<sup>12</sup> In addition, the potential for more frequent and severe climate events, as we are already seeing, and for frictions in the energy transition could also lead to greater volatility of supply. Together, a combination of forces—the deglobalization of supply chains, the higher frequency and severity of climate disruptions, and demographic shifts—could lead to a period of lower supply elasticity and greater inflation volatility.

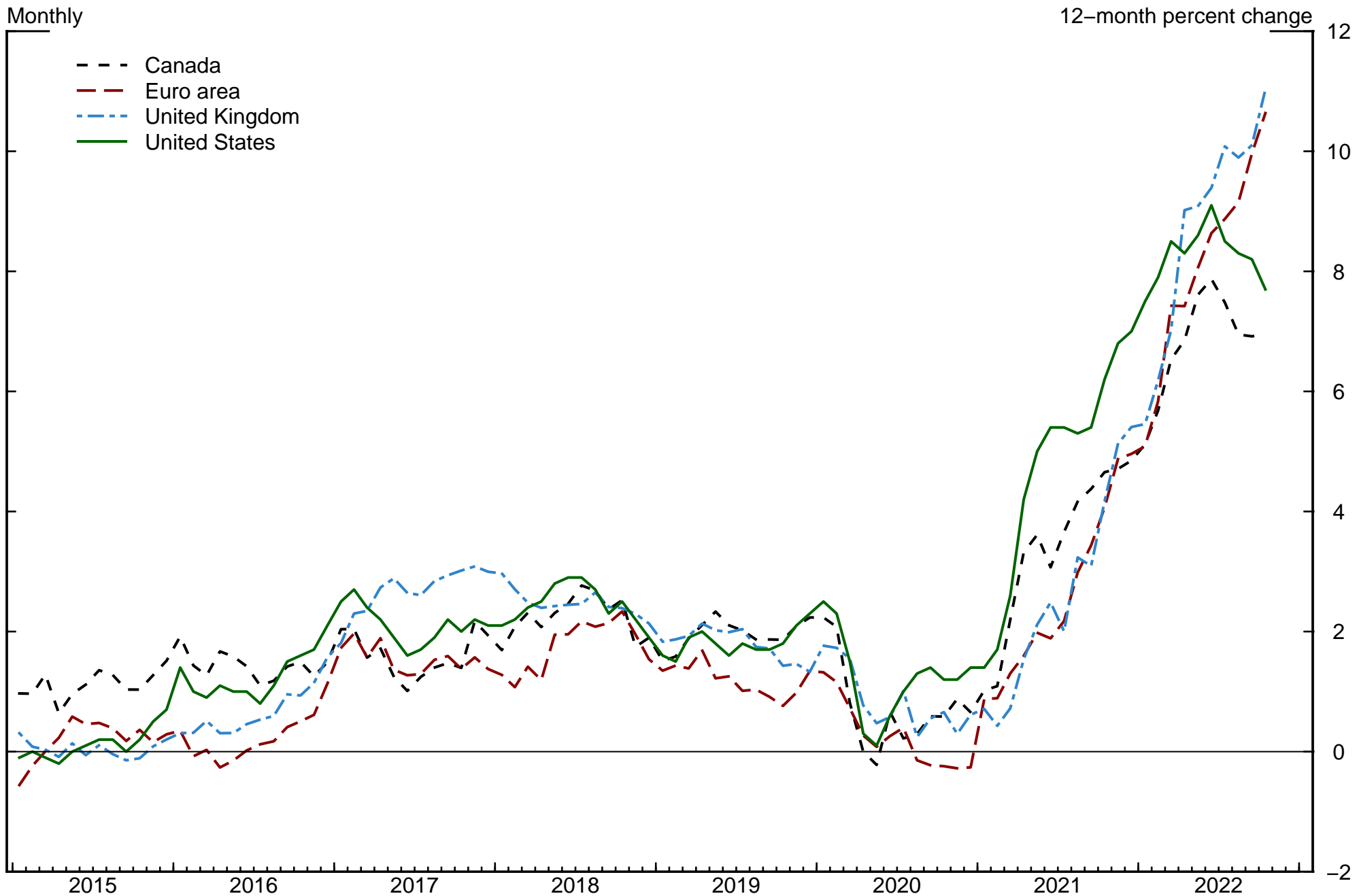
To conclude, the experience with the pandemic and the war highlights challenges for monetary policy in responding to supply shocks. A protracted series of adverse supply shocks could persistently weigh on potential output or could risk pushing inflation expectations above target in ways that call for monetary policy to tighten for risk-management reasons. More speculatively, it is possible that longer-term changes—such as those associated with labor supply, deglobalization, and climate change—could reduce the elasticity of supply and increase inflation volatility into the future.

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<sup>12</sup> See, for example, Charles Goodhart and Manoj Pradhan (2020), *The Great Demographic Reversal: Ageing Societies, Waning Inequality, and an Inflation Revival* (Cham, Switzerland: Palgrave Macmillan).



# Figure 1. Headline Inflation for Selected Countries



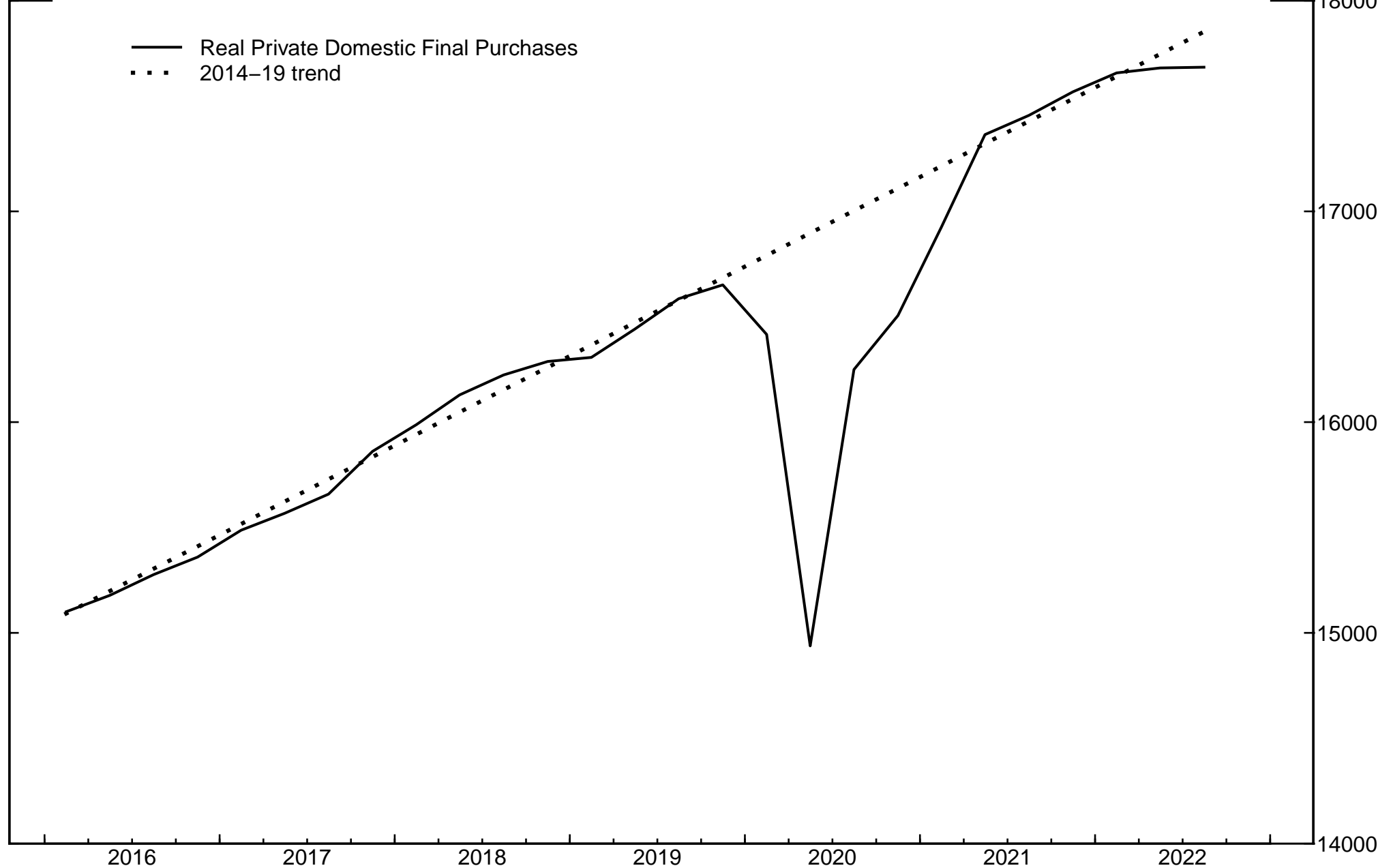
Note: Data go through October 2022.  
Source: Haver Analytics.

# Figure 2. Real Private Domestic Final Purchases

Quarterly

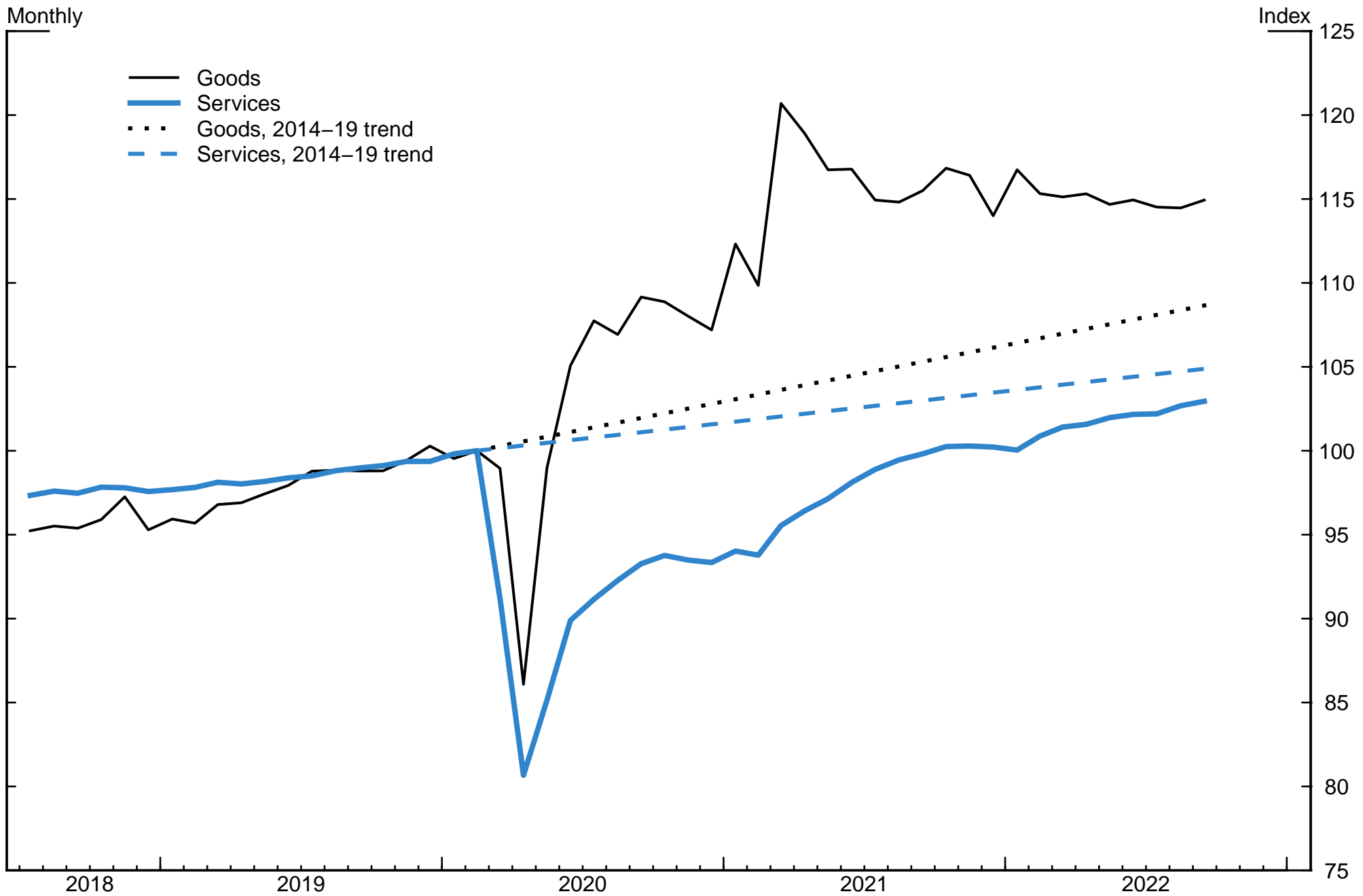
Billions of dollars

- Real Private Domestic Final Purchases
- ... 2014–19 trend



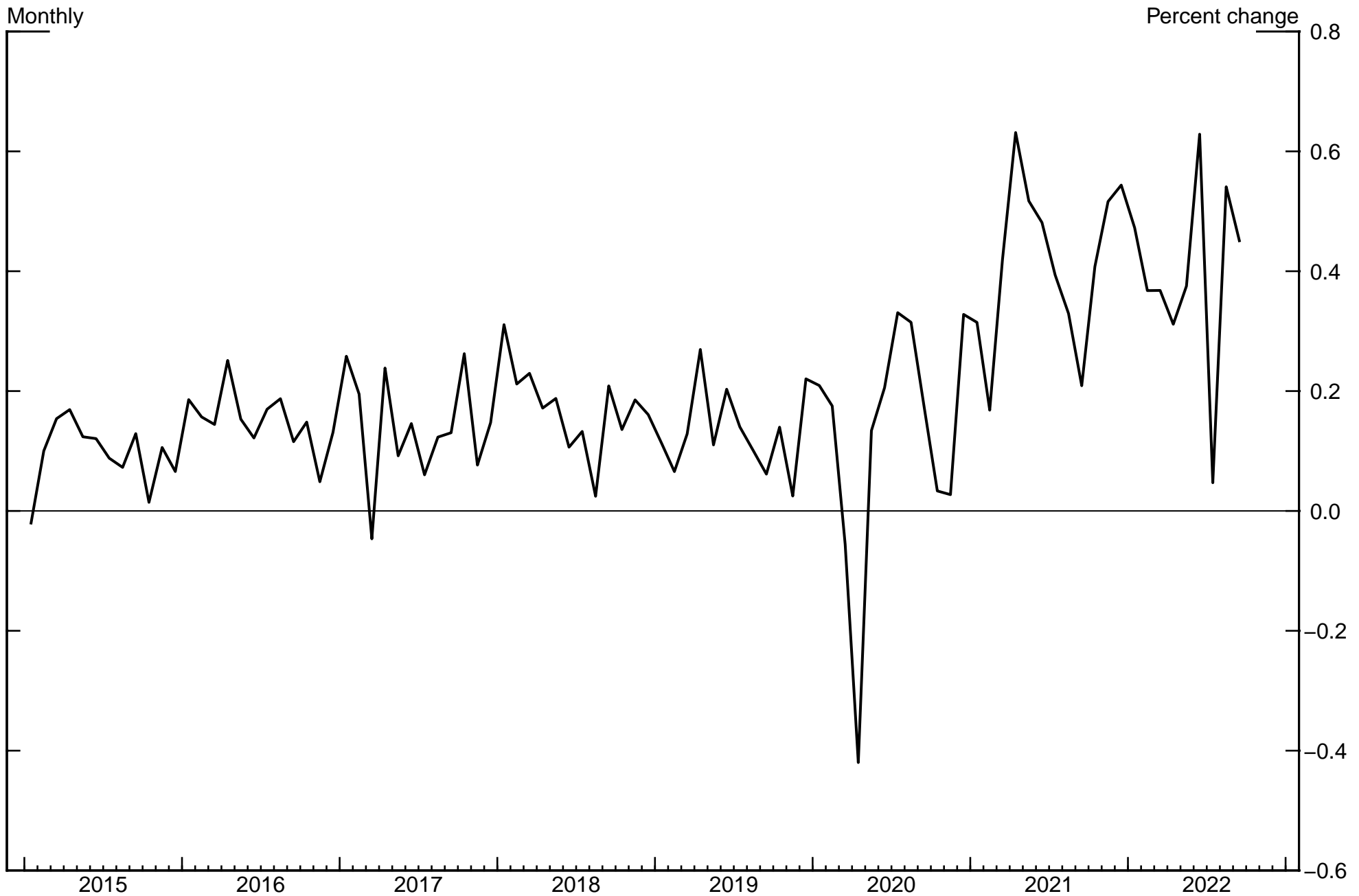
Note: Data go through 2022:Q3.  
Source: Bureau of Economic Analysis.

### Figure 3. Real Personal Consumption Expenditures



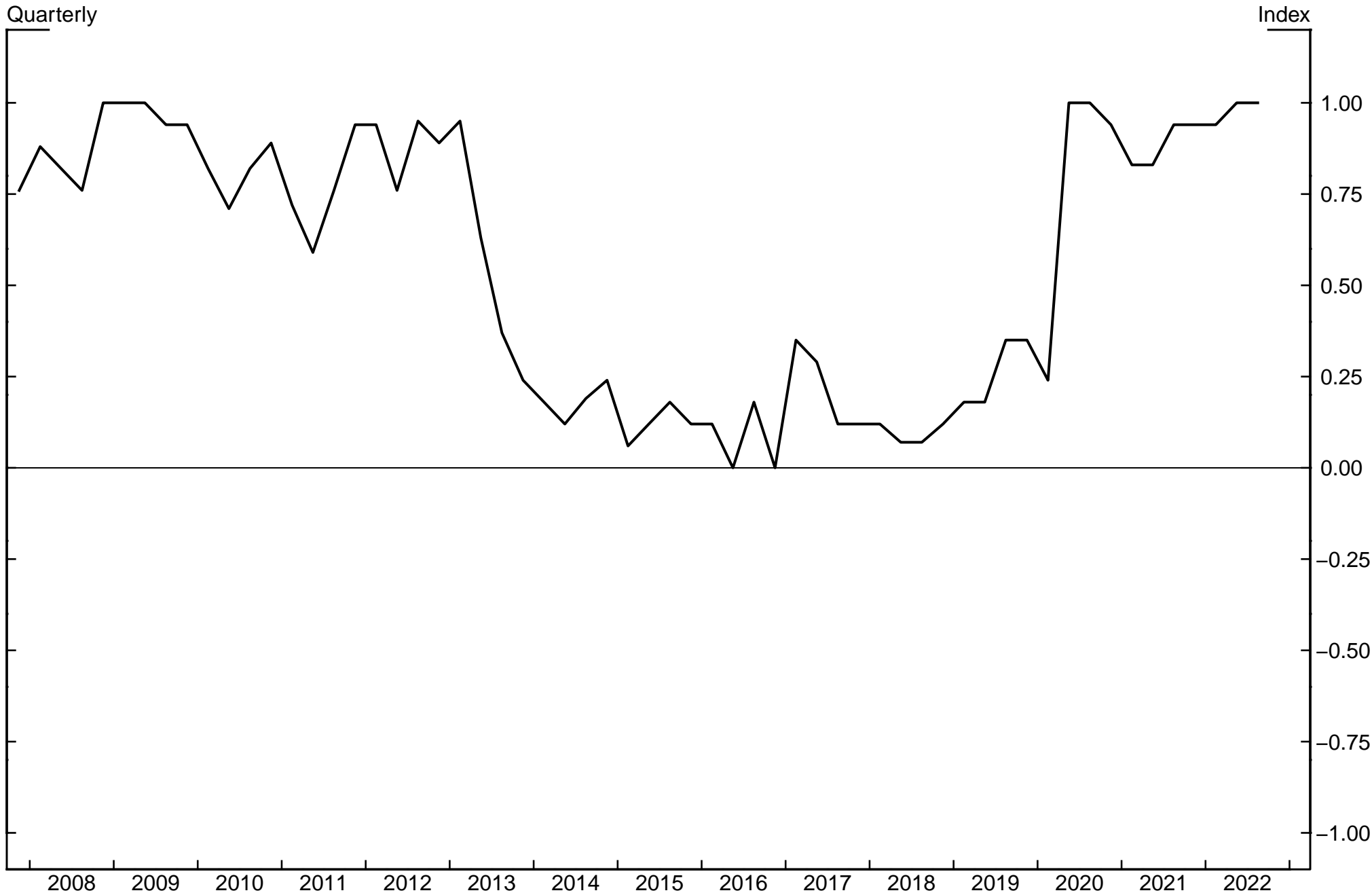
Note: Data go through September 2022.  
Source: Bureau of Economic Analysis.

# Figure 4. PCE Monthly Inflation Less Food and Energy



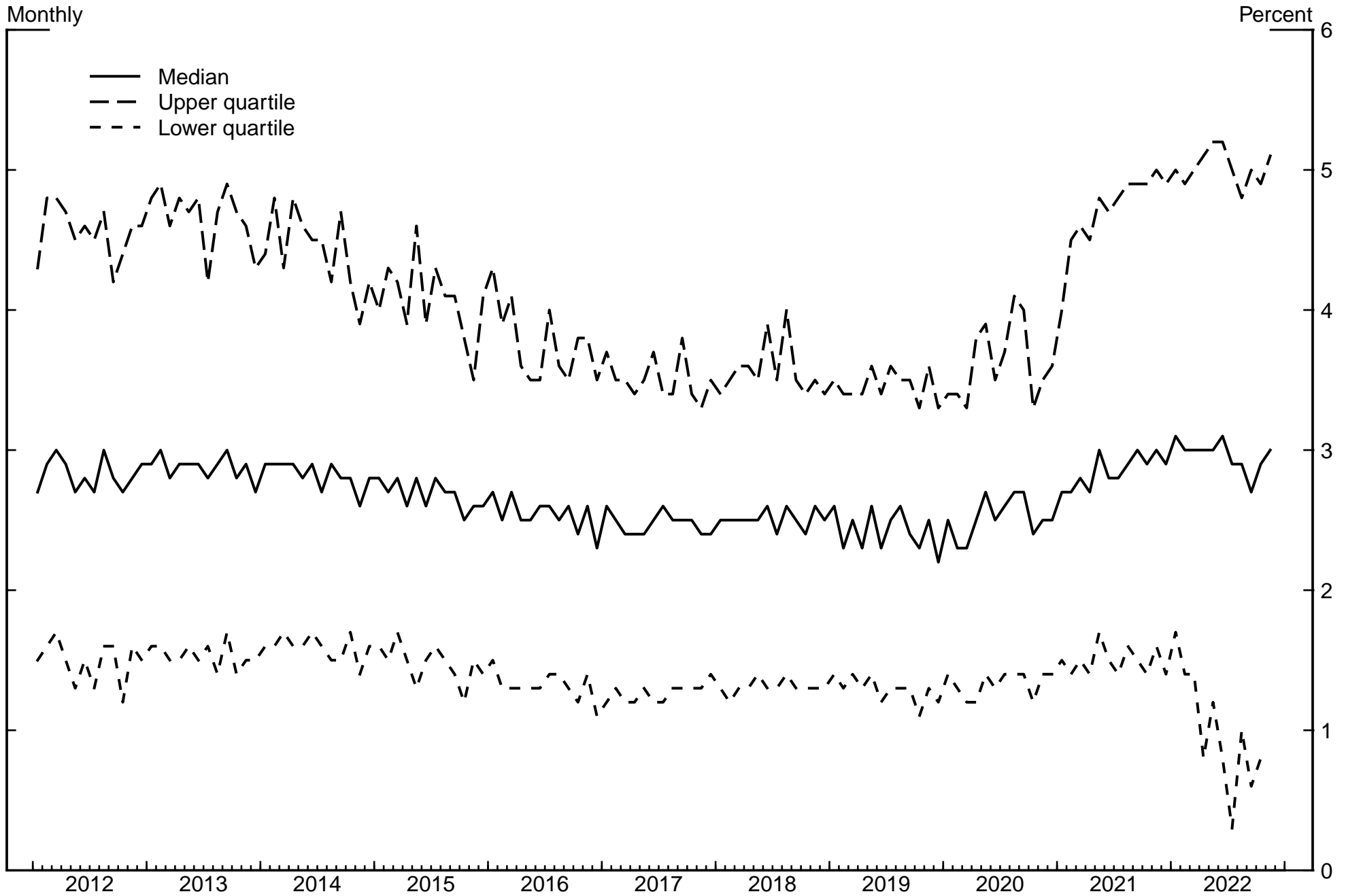
Note: Data go through September 2022. PCE is personal consumption expenditures.  
Source: Bureau of Economic Analysis.

**Figure 5. Diffusion Index of FOMC Participants' Uncertainty Assessments for GDP Growth**



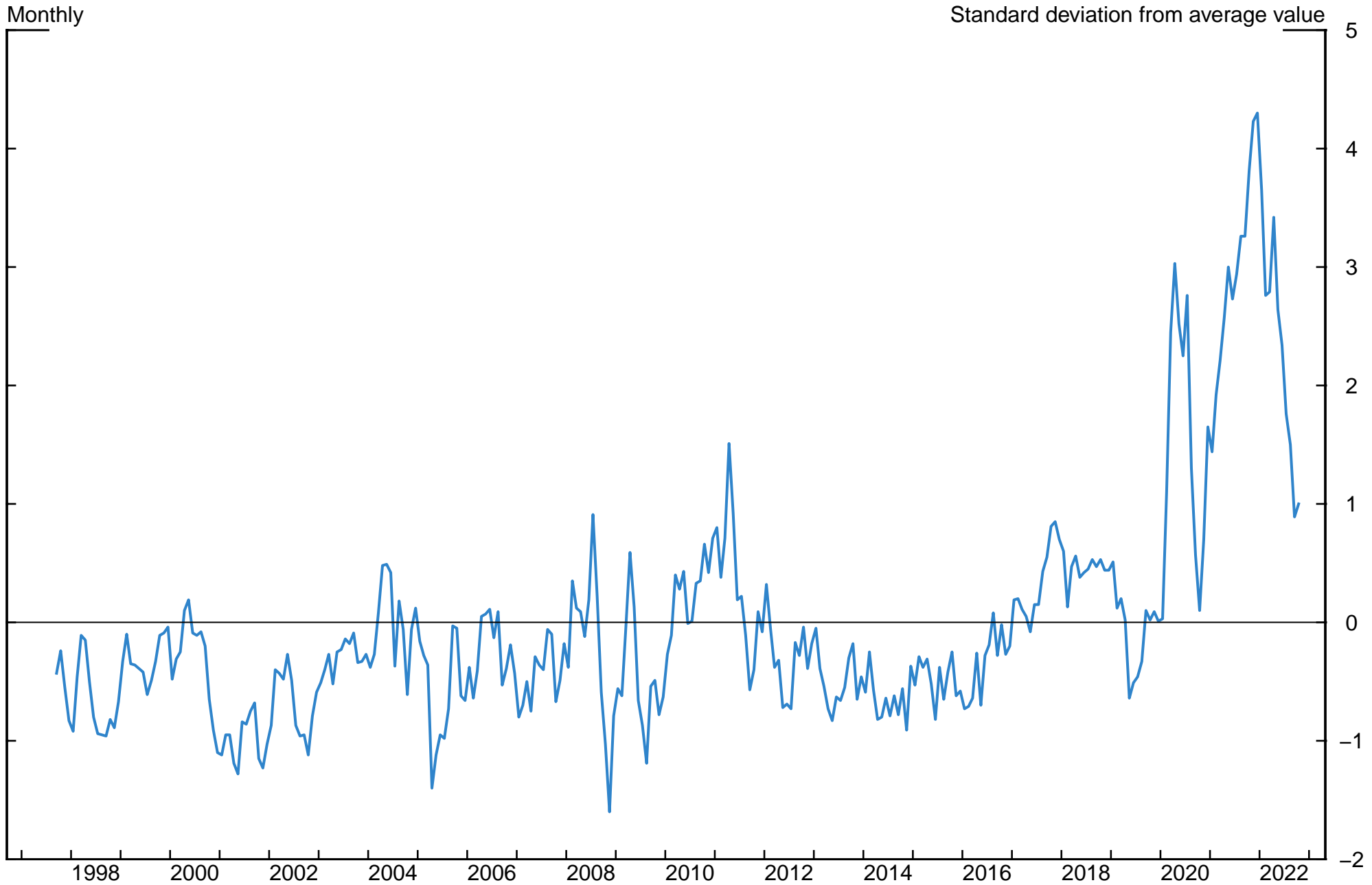
Note: Data go through 2022:Q3. FOMC is Federal Open Market Committee; GDP is gross domestic product.  
Source: Federal Reserve Board.

# Figure 6. Expected Price Change, Next 5 to 10 Years



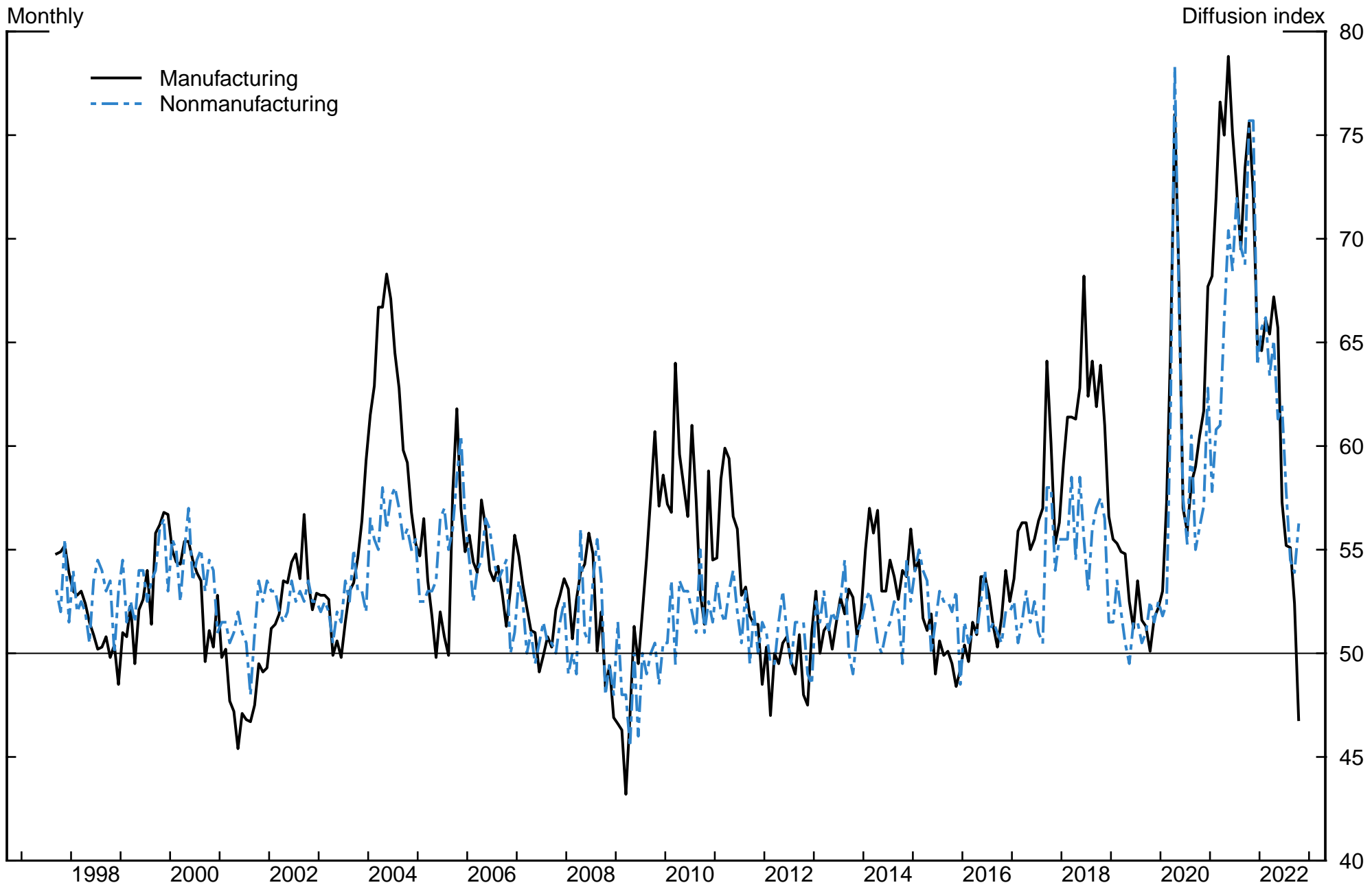
Note: Data go through November 2022.  
Source: University of Michigan Surveys of Consumers.

# Figure 7. Global Supply Chain Pressure Index



Note: Data go through October 2022.  
Source: Federal Reserve Bank of New York.

# Figure 8. ISM Supplier Deliveries Index



Note: Data go through October 2022. The ISM Supplier Deliveries Index is an inverse diffusion index, a reading above 50 percent indicates slower deliveries.  
Source: Institute for Supply Management.



**Figure 9. Labor Force Participation Rate**



Note: Data go through October 2022.  
Source: Bureau of Labor Statistics.