

Expected and Realized Inflation in Historical Perspective

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Economists have long discussed the importance of inflation expectations on economic outcomes. An early and prominent example is the “Fisher effect”—Irving Fisher’s famous hypothesis that expected inflation is equal to the difference between nominal and real interest rates (Fisher 1896, 1907, 1930). Fisher did not claim that this insight was original but referred to antecedents including a 1740 pamphlet by William Douglass as well as better-known earlier writers like John Stuart Mill and Alfred Marshall (Dimand 1999).

The basic Fisher effect relationship raises theoretical and empirical questions about inflation expectations. How are inflation expectations determined: namely, are they backward-looking or forward-looking? Additionally, is there a two-way relationship between inflation expectations and inflation itself? For example, past inflation may shape current inflation expectations, but current inflation expectations may also shape current and future inflation. There are a variety of mechanisms that would imply inflation and inflation expectations are interconnected. For instance, if workers expect high inflation, they may ask their employer for a raise so that their incomes keep up with the cost of living. However, the employer may then raise prices to compensate for the higher wage bill, creating inflation. In this example, higher inflation expectations create inflation. Similarly, suppose a firm changes their prices only once a quarter. Then, the firm will consider how much their costs will rise over the course of the upcoming quarter when setting their price—again, higher inflation expectations are self-fulfilling and result in higher inflation. On the other hand, if inflation has been high in recent months, individuals who extrapolate their beliefs from recent inflation may increase their inflation expectations – that is, higher inflation may result in higher inflation expectations.

These questions and mechanisms are at the heart of monetary policy today. If inflation expectations were both accurate and adjusted in real time precisely with nominal interest rates, then it would be difficult for the Federal Reserve to alter real interest rates. Therefore, the conduct of modern monetary policy relies on an understanding of inflation expectations. Indeed, Federal Reserve Chair Jerome Powell (2019) remarked in Congressional testimony that “in our thinking, inflation expectations are the most important driver in actual inflation.” Furthermore, a staff report of the Federal Reserve Bank of New York explains that “monitoring and managing consumers’ expectations have become primary goals of policy makers, and are central components of modern monetary policy” (Armantier et al. 2016).

In this paper, we provide historical context for the relationship between realized and expected inflation—a relationship that, even now, provokes considerable controversy (Rudd 2021). We begin with a discussion of early theoretical thought about how inflation expectations are formed. Next, we discuss measures of inflation expectations and their empirical relationship to current and future realized inflation. Lastly, we provide a narrative account of the relationship between expected and realized

inflation in the United States during key periods including the Great Depression of the 1930s, the Great Inflation of the 1970s, the Great Recession of 2008-9, and the recent COVID-19 pandemic.

How Are Inflation Expectations Set?

Once Irving Fisher popularized the importance of inflation expectations for economic outcomes, it became necessary to model inflation expectations to test hypotheses such as the Fisher effect. Initially, Fisher modelled expectations as a weighted sum of current and past inflation. This backwards-looking approach is known as adaptive expectations. However, in the late 1960s and early 1970s, other economists noted shortcomings in the slow-to-adjust expectations and developed rational expectations. Under rational expectations, a forward-looking framework, economic agents use all relevant information to determine their expectations.

“To Be Forewarned Is to Be Forearmed”

Irving Fisher (1867-1947) is well-known for his role in the development and popularization of price indexes,¹ as well as his contributions to economic thought on interest rates, inflation, and expected inflation. In reference to the difference between expected and realized inflation, Fisher (1911) argued that “the real evils of changing price levels do not lie in these changes per se, but in the fact that they usually take us unawares.”² Put another way, individuals are unable to perfectly forecast inflation, so they cannot be sure how far money will go in terms of buying goods in the future. Thus, any contracts written in terms of money will result in an uncertain payoff in terms of goods. Fisher believed that improvements in knowledge could reduce the difference between expected and realized inflation and therefore mitigate the cost of inflation:

“It has been shown that to be forewarned is to be forearmed, and that a foreknown change in price levels might be so taken into account in the rate of interest as to neutralize its evils. While we cannot expect our knowledge of the future ever to become so perfect as to reach this ideal, ... nevertheless every increase in our knowledge carries us a little nearer that remote ideal.”

However, Fisher also acknowledged that cognitive constraints and inattention would make it difficult for the average businessman, with limited theoretical knowledge, to form reasonably accurate

¹ For a discussion of the development of price indexes preceding and contemporaneous with Fisher in this journal, see Persky (1998).

² This idea was also not altogether new. Lowe (1823, p. 96), for example, argued that “contracts for a series of years ought to be made with reference to the power of money in purchasing the necessaries and comforts of life.”

inflation expectations. Fisher wrote this during the classical gold standard era when prices were relatively stable over the longer run (Klein 1975). Indeed, an “implication of the tendency for price levels to revert toward a long-run stable value under the gold standard was that it insured a measure of predictability with respect to the value of money: though prices would rise or fall for a few years, inflation or deflation would not persist” as noted in Bordo (1981, p. 11). The difficulty of forming accurate inflation expectations would only be exacerbated by the tumultuous times to come.

As World War I began in 1914, many countries suspended the convertibility of currency to gold. Ultimately, this brought about the end of the classical gold standard and resulted in a large increase in inflation, reaching as high as 20 percent in 1917. Then with the deep recession of 1920-21 came an extreme deflation with prices falling briefly at a rate of 20 percent a year.³ Even as the world returned to gold in 1925, this time under the gold exchange standard,⁴ prices were less stable than under the classical gold standard (Bordo 1981). The volatility of inflation resulted in increased attention to prices and inflation. In response to public demand for information about price indices, Fisher established the Index Number Institute in the 1920s, which for some years operated out of his home and sold information to newspapers. By 1929, his wholesale price index reached a newspaper audience of 5 million (Vogt 2020).

The Great Depression began in 1929 and brought with it a sharp deflation. Fisher believed that the deflation was unanticipated and was thus costly (Allen 1977). Accordingly, he was interested in understanding how people formed their inflation expectations. These expectations played a central role not only in his understanding of the Great Depression, but also in his *Theory of Interest* (1930). In Part IV, Chapter XIX of that book, he wrote:

How is it possible for a borrower or lender to foresee variations in the general price level with the resultant increase or decrease in the buying power of his money? A change in the value of money is hard to determine. Few business men have any clear ideas about it ... Yet it may be true that they do take account, to some extent at least, even if unconsciously, of a change in the buying power of money ... If inflation is going on, they will scent rising prices ahead ... And today especially, foresight is clearer and more prevalent than ever before. The business man makes a definite effort to look ahead not only as to his own

³ Estimates of inflation and deflation are calculated as the percent change from a year ago of the general price level. The data for the general price level were obtained from the NBER Macrohistory Database (FRED series M04051USM324NNBR). Note that inflation as calculated using the wholesale price level (FRED series M04049USM052NNBR) is more volatile with prices rising by as much as 40 percent in 1917 and falling by as much as 50 percent in 1921.

⁴ Under the classic gold standard, participating countries guaranteed their currency was convertible to a specified amount of gold, and thus needed to hold gold reserves. Under the gold exchange standard, participating countries guaranteed their currency could be exchanged for either gold directly at a fixed rate or to another currency which could then be converted to gold at a fixed rate. The United Kingdom and the United States only held gold reserves. Other countries on the gold exchange standard could hold gold, dollars, or pounds as reserves. The gold exchange standard ended in 1931 when Britain withdrew.

particular business but as to general business conditions, including the trend of prices.

Adaptive Expectations

Understanding how inflation expectations are formed and how to model them was key to Fisher's research agenda. For example, the "Fisher effect" hypothesis that the nominal interest rate is the sum of the real interest rate and expected inflation predicts a strong, positive correlation between nominal interest rates and expected inflation. To test this hypothesis, Fisher modeled expected inflation as a weighted average of current and past inflation, reasoning that "price changes do not exhaust their effects in a single year but manifest their influence with diminishing intensity." Fisher's "adaptive" approach to modeling expectations had the benefits of simplicity and feasibility.

However, there are obvious shortcomings as well: for example, it assumes that the structure that generates inflation expectations stays the same over time. For the United States, Fisher found the highest correlation between nominal interest rates and a weighted average of past inflation over 20 years—a time lag later critiqued by Cagan (1965) as implausibly long.

While Fisher's analysis emphasized how realized inflation might affect expected inflation, it did not explore the reverse direction of causality. The *bidirectional* relationship between realized and expected inflation was made prominent by Edmund Phelps (1968) and Milton Friedman (1968). Before their work, it was widely believed that policy makers could always use expansionary monetary policy to reduce unemployment at the cost of more inflation. This trade-off was believed to hold even in the long run (Gordon 2018, as discussed in this journal by Hall and Sargent 2018). But Friedman (1968, p. 11) claimed that the trade-off between unemployment and inflation was actually temporary because it "comes not from inflation per se, but from unanticipated inflation" — that is, the difference between realized and expected inflation. Friedman was arguing that expected inflation itself is a determinant of unemployment and therefore inflation.

Furthermore, Friedman (1968, p.11) continued with "...unanticipated inflation... generally means... a rising rate of inflation." This is the direct result of the assumption, shared by Phelps, that inflation expectations were formed in an adaptive or backward-looking manner. This view implied that policymakers could only keep unemployment below its "natural rate"⁵ in the short run by "accelerating" inflation to stay ahead of the public's backward-looking expectations. In other words, inflation must be higher than what was expected to reduce unemployment below its natural rate. But if inflation expectations are formed in a backwards-looking manner, then expected inflation for the next period will rise. In order to maintain the low unemployment rate, inflation must once again surpass

⁵ The natural rate of unemployment is the lowest level of unemployment an economy can sustain without rising inflation.

the newly-revised expectations, and so on.

However, modelling expectations as backward-looking is unlikely to be appropriate in all contexts. In fact, Friedman acknowledged this shortcoming; for instance, in settings with high inflation, he argued that the adjustment of expectations would likely occur rapidly.

Rational Expectations

These concerns led Lucas (1972, 1973) and Sargent and Wallace (1976) to modify the models of Friedman and Phelps by incorporating the assumption of rational expectations (attributed to Muth 1961). If inflation expectations are rational, they incorporate all information that is useful in forecasting future inflation. For example, Sargent (1973, p. 447) showed that interest rates contain information that is useful in predicting inflation, which “implies that it is probably inadequate to hypothesize that expectations of inflation are simply naive extrapolations of past rates of inflation, since that involves supposing that readily available information about the subsequent course of inflation goes unused.”

Lucas’ work based on rational expectations found that unanticipated changes in inflation were required to change output or unemployment, much like Friedman and Phelps argued. That is, expectations affect output, unemployment, and thus inflation. The rational expectations revolution that followed these innovations was described as “one of the defining features in the rebuilding of macroeconomics” by Coibion and Gorodnichenko (2012). Indeed, rational expectations are used in the New Keynesian approach, which started in the late 1970s and 1980s and has become the dominant modelling approach for macroeconomics (as discussed in this journal by Galí 2018).

The New Keynesian model features firms seeking to maximize their profits while subject to a pricing friction. A common friction is “Calvo (1983) pricing,” which assumes only some firms will be allowed to change their prices each period. This results in forward-looking pricing decisions. Firms set their price not only for the current period, but possibly for several future periods in which they will not be allowed to change their price. Overall, firms’ inflation expectations influence the prices that firms set, and thus, inflation expectations affect realized inflation. Therefore, inflation in the current period of the New Keynesian model is a function of expected inflation (and a measure of economic slack such as the deviation of the unemployment rate from its natural rate). This relationship is the famed New Keynesian Phillips curve.

Are Measures of Inflation Expectations Related to Realized Inflation?

Given the theoretical relationships between inflation and inflation expectations, it is natural to ask if this relationship holds empirically. To answer this question, direct measures of inflation expectations are necessary and can be derived from surveys or asset prices. These measures of inflation expectations are indeed strongly correlated with contemporaneous and future inflation when calculated over long samples, such as decades. However, over shorter time frames, such as a few years, the relationship can weaken.

Survey Measures of Expected Inflation

Over the years, many surveys have been created to solicit direct measures of inflation expectations of professional forecasters, households, and firms. The questions posed to respondents have varied along two key dimensions. First, questions have differed in which price index they refer; for example, surveys of households tend to ask for inflation expectations for “prices in general,” while professional forecaster surveys tend to specify the price index, such as the Consumer Price Index. Second, questions have differed across the horizon of inflation expectations requested; for example, some questions ask about short horizons, such as the coming quarter, year, or two years, while others ask about long horizons, such as the next five or ten years.

The oldest, continuous survey of inflation expectations is the Livingston Survey. It was started in 1946 by financial journalist Joseph Livingston for the *Philadelphia Inquirer*. Respondents, who were economists working in industry, government, banking, and academia, were asked twice a year to provide their forecasts for over a dozen variables, including the Consumer Price Index, for several time horizons. Initially, the effort was for the purposes of journalism rather than academic research (as discussed in this journal by Thomas 1999). However, economists in the 1970s went in search of expectations data to test the new theory of rational expectations and found the Livingston Survey. Given the new interest in the survey, Livingston partnered with the Philadelphia Federal Reserve to manage and share the data with economists in a centralized manner. When Livingston died in 1989, the Philadelphia Federal Reserve took the survey over (Croushore 1997). It is available at <https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/livingston-survey>. The Livingston survey is still used today, but less often than newer surveys available at higher frequencies.

In 1969, the National Bureau of Economic Research and the American Statistical Association partnered to develop a new quarterly survey. The purpose was to create a representative survey of professional forecasters with sufficient frequency and a long, consistent time series (Zarnowitz and Braun 1993). Today the survey is known as the Survey of Professional Forecasters, includes approximately 40 forecasters, and is conducted by the Federal Reserve Bank of Philadelphia. The data is available at <https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/survey-of->

[professional-forecasters](#). At first, the only inflation forecasts collected were for inflation as measured by the gross domestic product deflator, but additional forecast variables and horizons have been introduced over the years. Forecasts of Consumer Price Index inflation are available since 1981Q3 for shorter time horizons, and since 1991Q4 for the 10-year horizon.

Beyond surveys of professional forecasters, there are also surveys of households. Notably, the Michigan Survey of Consumers was created by George Katona at the University of Michigan's Survey Research Center in 1946. Katona believed consumers were powerful economic agents, whose consumption and savings decisions could induce expansions and recessions. He further posited that consumption and savings choices are affected by expectations, and thus he set out to measure economic expectations (Curtin 2016). Before 1959, the Michigan Survey of Consumers was conducted irregularly—sometimes twice, sometimes three times annually. The survey was then quarterly from 1959 through the end of 1977 and has been monthly since 1978. One-year-ahead inflation expectations of consumers have been solicited monthly since 1978, and five- to 10-year-ahead expectations have been collected irregularly since 1979 and monthly since 1990. Today, the survey consists of roughly 500 consumers each month and some respondents are surveyed twice. For more information and data from this survey, see <https://data.sca.isr.umich.edu/>.

When referring to survey data on inflation expectations in this essay, we focus on the Livingston Survey, the Survey of Professional Forecasters, and the Michigan Survey of Consumers. However, we should mention some newer surveys. The Federal Reserve Bank of New York started its own Survey of Consumer Expectations in 2013. This monthly survey of roughly 1,300 consumers solicits expectations on topics such as inflation, job prospects, earnings, and sometimes is supplemented by modules on special topics. Despite its short time series, a strength of this survey is that respondents are surveyed monthly for up to twelve consecutive months which allows for analysis of how a given individual's beliefs change across time. The survey is available at https://www.newyorkfed.org/research/staff_reports/sr800.html.

The Federal Reserve Bank of Atlanta started the Business Inflation Expectations Survey in 2011. The monthly survey includes about 300 panelists representing businesses of a range of sizes that are headquartered in the southeastern states within the district of the Atlanta Federal Reserve. Information is available at <https://www.atlantafed.org/research/inflationproject/bie>. Based on the New Keynesian Phillips' curve, the inflation expectations that matter for realized inflation are those of firms. However, in the United States, a long-running, nationally representative survey is not available. That said, recent evidence suggests consumer expectations may be a good proxy for firm expectations. For instance, Coibion et al. (2018b) show that in New Zealand consumer expectations are similar to firm expectations.

Market Measures of Inflation Expectations

Inflation expectations can also be derived from financial markets. The main market-based measure of inflation expectations uses Treasury Inflation-Protected Securities (TIPS). This approach provides high-frequency measures of inflation expectations but conflates inflation expectations with other risks and has a shorter time series than some of the aforementioned surveys.

The principal for TIPS is adjusted based on Consumer Price Index inflation. If there is inflation, the principal rises, and if there is deflation, the principal falls. Furthermore, the interest rate paid on TIPS applies to the adjusted principal. Thus, one can compare what investors are willing to pay for a Treasury security that is not inflation-protected to an otherwise identical Treasury security that is inflation-protected and calculate what is referred to as the “breakeven” point. This point reveals the inflation compensation which market participants require to avoid inflation exposure. Gürkaynak et al. (2010) estimate a nominal Treasury yield curve as well as a TIPS yield curve, from which they compute “breakeven inflation,” for any horizon. These inflation compensation measures are largely driven by inflation expectations but are also affected by other factors. For instance, the market for TIPS is smaller and less liquid than the market for nominal Treasuries, so some of the differences in yields is driven by differential liquidity premia. Furthermore, the difference in yields also reflects inflation risk premia—investors recognize that realized inflation may differ from their expected inflation.

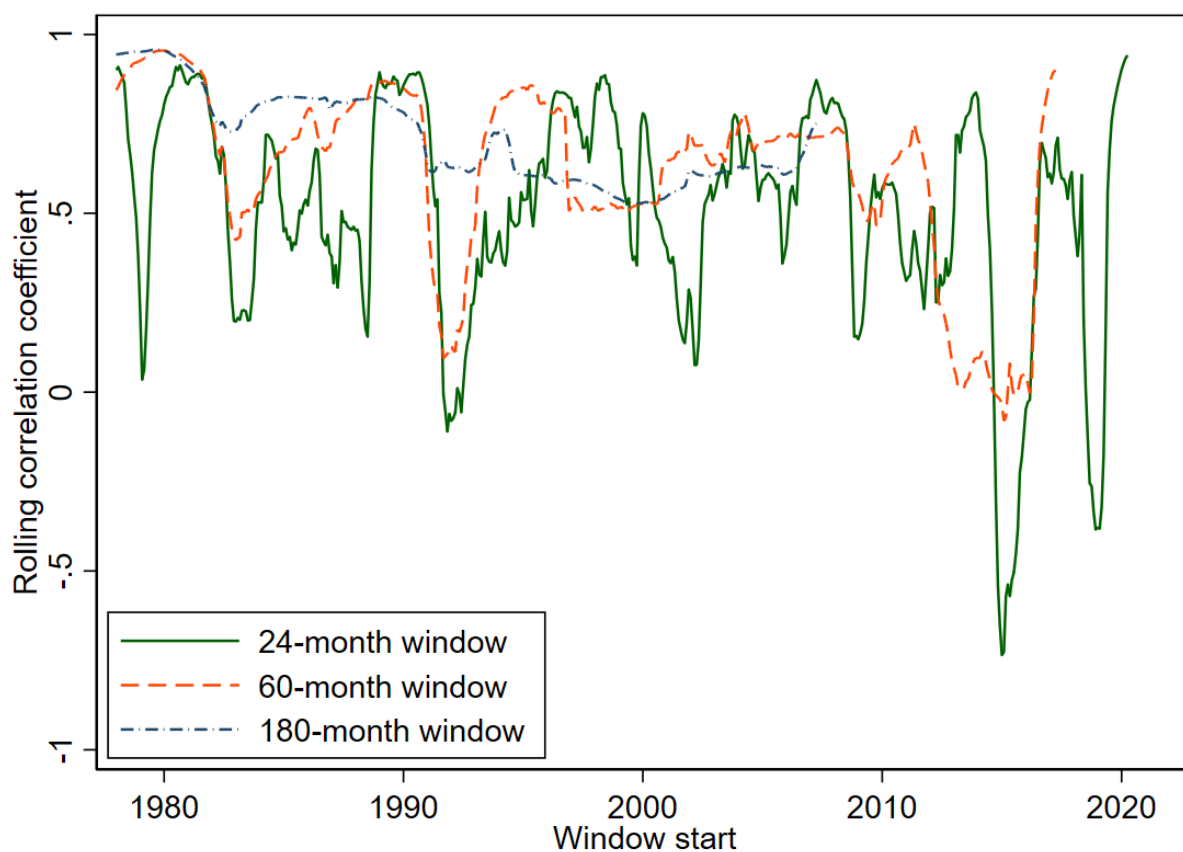
Another shortcoming is that TIPS were not traded until 1997. To create a longer time series, researchers have calculated inflation expectations based on “synthetic” TIPS. For example, Groen and Middeldorp (2013) use the relationship between TIPS yields and a selection of 108 long-running time series—including nominal yields on Treasury securities, measures of economic growth, measures of financial stress like volatility and credit spreads, private-sector expectations of the GDP deflator from the Survey of Professional Forecasters, and the “output gap” between the actual and natural rate of unemployment—to construct “synthetic TIPS” rates since 1971.

Correlations Between Realized and Expected Inflation

Inflation and measures of expected inflation are highly correlated over long periods of time. For example, from January 1978 to February 2022, the correlation between one-year horizon, Michigan Survey of Consumers’ inflation expectations and Consumer Price Index inflation is 0.92. For any 15-year window, the correlation is at least 0.52 and averages 0.71. However, over shorter windows, the correlation is occasionally near zero and at times even negative. Figure 1 plots correlations between one-year horizon, Michigan Survey of Consumers’ inflation expectations and Consumer Price Index

inflation for rolling windows with lengths of two, five, and 15 years. Overall, the correlation between consumer inflation expectations and realized inflation is strong and largely stable over long samples; however, there are frequent deviations over shorter samples.

Figure 1: Rolling Window Correlation of Inflation and Expected Inflation



Source: Correlations between the median, Michigan Survey of Consumers, one-year horizon inflation expectations and Consumer Price Index inflation are plotted for rolling windows with lengths of 24, 60, and 180 months. Correlations are plotted at the start of the sample window.

This pattern is also seen in the correlation amongst different measures of inflation expectations, as well as the correlations with future inflation. That is, over long samples there are strong, positive correlations; however over shorter samples these series can be uncorrelated or negatively correlated. Table 1 reports the pairwise correlation coefficients between current inflation, the Michigan Survey of Consumer's one-year-ahead inflation expectations, the Survey of Professional Forecaster's one-year-ahead inflation expectations, and next year's realized inflation for the long, four-decade window of 1981 to 2021 and a short, one-decade window of 2011 to 2021. Over the four-decade window, in Panel A, all measures are positively correlated. For example, both consumer and professional inflation

expectations have a strong, positive correlation with current inflation (coefficients of 0.74 and 0.80, respectively). Furthermore, consumer and professional inflation expectations have a positive correlation with future inflation (albeit to a smaller extent, with coefficients of 0.19 and 0.49, respectively). The measures of inflation expectations of consumers and professionals are also highly correlated with each other over this long sample, with a correlation coefficient of 0.65.

Over the one-decade window, in Panel B, consumer and professional inflation expectations are still positively correlated with current inflation (coefficients of 0.36 and 0.35, respectively). However, the rest of the correlations in Panel B are close to zero or even negative. For instance, consumer and professional expectations are uncorrelated with future inflation (coefficients of 0.03 and -0.03, respectively). Furthermore, the measures of inflation expectations are negatively correlated with each other. Overall, this pattern of strong relationships over the long periods of time, but breakdowns over short samples suggests that there is still much to be learned about the nature and stability of the relationship between inflation and the inflation expectations of various economic agents.

Table 1: Correlations between Inflation, Future Inflation, and Expected Inflation

A. Correlation Coefficients 1981-2021

	Inflation	Future Inflation	Michigan Survey
Inflation	1.00		
Future Inflation	0.29	1.00	
Michigan Survey of Consumers	0.74	0.19	1.00
Survey of Professional Forecasters	0.80	0.46	0.65

B. Correlation Coefficients 2011-2021

	Inflation	Future Inflation	Michigan Survey
Inflation	1.00		
Future Inflation	-0.08	1.00	
Michigan Survey of Consumers	0.36	0.03	1.00
Survey of Professional Forecasters	0.35	-0.03	-0.31

Source: Correlations between Consumer Price Index inflation, one-year-ahead Consumer Price Index Inflation, Michigan Survey of Consumers one-year inflation expectations, and Survey of Professional Forecasters one-year Consumer Price Index inflation expectations are computed at quarterly frequency from 1981Q3 to 2021Q1 (159 observations) and from 2011Q1 to 2021Q1 (41 observations).

Although the correlations in Table 1 between inflation expectations and future inflation may appear low, note that inflation is difficult to forecast, and inflation expectations are indeed one of the best ways to predict inflation. Ang et al. (2007) show that in forecasting future inflation, survey-based measures

of expectations outperform a variety of more complicated econometric models such as time series models, Phillips curve-inspired models, and term structure models. Surveys of professionals such as the Livingston Survey and the Survey of Professional Forecasters produce the most accurate forecasts, but the accuracy of the Michigan Survey of Consumers' is not far behind.

Modelling the Relationship Between Expected and Realized Inflation

Researchers have sought to go beyond these correlations and model the extent to which shifts in inflation expectations cause changes in future inflation. The identification difficulties are formidable and solutions involve both data and modelling.

One approach is to estimate the New Keynesian Phillips curve. Estimates of this relationship based on survey data of inflation expectation can be sensitive to the choice of survey, sample, and inflation series, and it is not clear which survey expectations to use since surveys of firms' inflation expectations are limited. However, Coibion and Gorodnichenko (2015) and Coibion et al. (2018a; 2018b) argue in favor of using consumer inflation expectations as a proxy for the expectations of price-setters in firms. Doing so results in stable estimates of the New Keynesian Phillips curve that imply that inflation responds strongly to changes in short-run expected inflation.

Substantial debates have surrounded whether the New Keynesian Phillips curve can represent inflation dynamics in a realistic manner (Cogley and Sbordone 2008). So, an alternative approach is to estimate a vector autoregression—that is, an essentially model-free approach that only uses past values of macroeconomic variables to predict future values. A summary of the work on inflation expectations using vector autoregressions is that shocks to expectations—especially longer-run expectations—affect realized inflation and the effect is persistent. Conversely, shocks to actual inflation do not significantly affect long-run or short-run inflation expectations (presumably because such shocks are expected to be temporary). Moreover, long-run expectations significantly affect short-run expectations, but not vice versa (Clark and Nakata 2008; Clark and Davig 2008; Clark and Davig 2009).

While estimates of the New Keynesian Phillips curve and vector autoregression models help understand the relationship between inflation and inflation expectations over long samples, these approaches struggle to capture the subtleties of the relationship between inflation and inflation expectations during short-lived but major events.

A Narrative History of Inflation Expectations and Inflation

A narrative account of inflation and expected inflation in the United States offers compelling evidence of the importance of long-run expectations and policy regime changes in inflation dynamics, as well as a more nuanced interpretation of the relationship between actual and expected inflation.

Inflation Expectations in the Great Depression

Although inflation expectations surveys are not available for the Great Depression era, a “cottage industry” of research beginning in the early 1990s has attempted to pinpoint whether and when the deflation of 1930-32 was anticipated and when consumers began to expect a return to positive inflation (Romer and Romer 2013, p. 68). Binder (2016) has categorized the approaches in this literature as time-series approaches (Cecchetti 1992; Dorval and Smith 2013), market approaches based on asset prices (Hamilton 1992), and narrative approaches (Nelson 1991; Romer and Romer 2013).

Most of this literature concludes that the deflation was mostly unanticipated at the start of the Depression. For example, Hamilton (1992) shows that futures prices were above spot prices for most commodities, indicating that investors did not expect prices to fall. This finding is consistent with Fisher’s (1993) “debt deflation theory,” in which unanticipated deflation results in unexpectedly high real interest rates and constitutes a transfer of real wealth from debtors to creditors. This increase in borrowers’ indebtedness causes financial distress, including bankruptcies and impaired credit intermediation (Bernanke 1983). The resulting credit contraction, in turn, reduces aggregate demand and leads to further deflation, in a “vicious spiral” (Fisher 1933, p. 346).

After the start of the Great Depression and once deflation had set in, to the extent inflation expectations were backwards-looking, inflation expectations would have decreased substantially and likely turned negative. Thus, even as nominal interest rates were low, real interest rates would have been high, dampening demand, thus deepening the Depression and placing additional downward pressure on prices (Schwartz 1981). The restoration of positive inflation expectations was crucial for ending the deflationary spiral and enabling the recovery. President Franklin D. Roosevelt’s new macroeconomic policy regime, which began in March 1933 and included the exit from the gold standard, successfully shifted inflation expectations sharply upward in a forward-looking manner. Lacking direct survey- or market-based measures of inflation expectations during this era, the literature has relied on a variety of other approaches but has consistently reached the same conclusion: inflation expectations rose rapidly (Eggertsson 2008). For example: Jalil and Rua (2016) document the rise in the frequency of inflation discussions in the news as a proxy for higher inflation expectations; while Temin and Wigmore (1990) provide anecdotal evidence in line with a rise in inflation expectations, such as a large shift of assets from cash, which loses value during inflation, to the stock market, which

tends to rise with inflation.

Following the rise in inflation expectations, a rapid expansion ensued. Inflation itself rose quickly, likely in part because of the rise in inflation expectations. This dramatic episode demonstrates how expectations of deflation or inflation can be self-fulfilling and illustrates the power of a regime change to shift beliefs about inflation in a sudden and drastic manner.

Inflation Expectations from World War II through the Korean War

The recovery from the Great Depression lasted from 1933 through 1937, when the Fed raised rates in light of rising inflation. Soon thereafter, World War II began. Major wars are often associated with large swings in both actual and expected inflation, and this was certainly the case in World War II. When the United States entered the war, the Fed issued a statement that it was “...prepared to use its powers to assure at all times an ample supply of funds for financing the war effort...” (Board of Governors 1943, p. 1). In the wartime environment of fiscal dominance, inflation was volatile and inflation expectations were likely unanchored. To combat wartime inflation without raising interest rates, the government, supported by the Fed, imposed price and wage controls, rationing, and tighter consumer credit regulations. In 1946, a burst of inflation then followed the removal of price controls (Rockoff 1981). According to Friedman and Schwartz (1963, p. 597), “in the immediate postwar years, the public at large anticipated a substantial decline in prices at some future date. The mildness of the 1948-49 recession and the failure of prices to retreat more than slightly from their postwar highs must have weakened that expectation, and the outbreak of the Korean War gave it the coup de grace.”

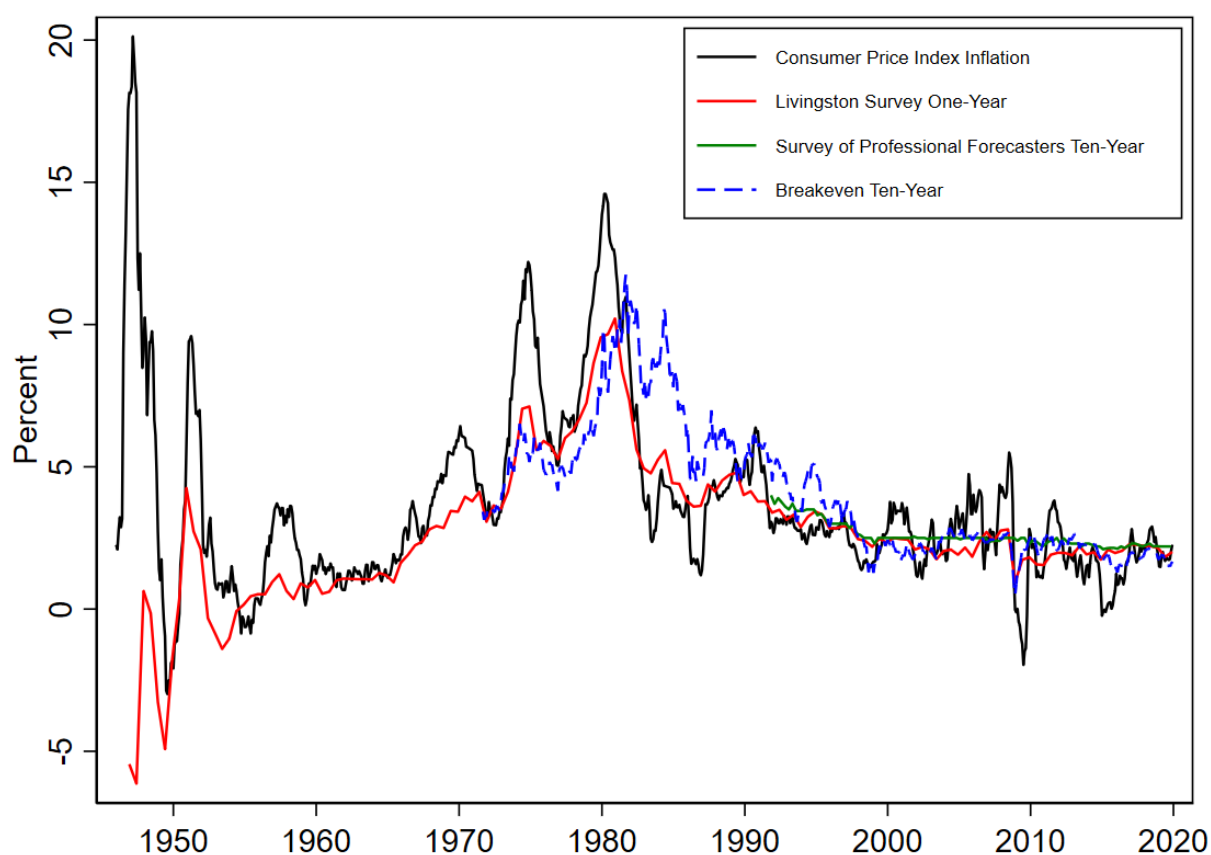
With the start of the Korean War in 1950, consumer inflation expectations rose, driven in part by backward-looking memories of inflation and scarcities associated with World War II (Binder and Brunet 2022).⁶ A contemporary observer, Ginsburg (1952, p. 518), wrote that inflation was “mostly speculative ... consumers manifested in the market their anticipations of future shortages and price increases—and thus, in large measure, brought about with their fears the very conditions against which they sought to insure themselves.” That is, expectations of inflation led to purchasing of goods in ways which resulted in shortages—which in turn led to actual inflation.

The Livingston Survey of inflation expectations had just begun at this time, and the survey evidence is consistent with this story. Figure 2 plots the Livingston Survey’s median, one-year-ahead, inflation expectations along with realized inflation and some more recent measures of inflation expectations. Notice that the median Livingston inflation expectation was approximately negative five

⁶ Binder and Brunet (2022) rely on consumer inflation expectations from the Survey of Consumer Finances, a representative survey of consumers that primarily collects information on a household’s balance sheet. The survey was conducted annually from 1946 to 1971, in 1977, and every three years since 1983.

percent in late 1946, as people expected the postwar inflation to reverse itself. The United States entered the Korean War in June 1950. Later that same year, median inflation expectations reached four percent. Inflation and expectations stabilized following the Fed-Treasury Accord of 1951, when an agreement was reached that the Fed would focus on its dual mandate of full employment and low inflation, rather than simply seeking to accommodate federal borrowing with low interest rates. The newly independent Fed enjoyed strong credibility through the early 1960s (Bordo and Siklos 2014). Inflation expectations of Livingston forecasters from 1952 to 1964 were low and stable, averaging 0.5 percent and ranging from -1.4 to 1.3 percent, while realized inflation averaged 1.3 percent.

Figure 2: Realized and Expected Inflation from 1946 to 2019



Source: Consumer Price Index inflation is the year-over-year percent change in the consumer price index for all urban consumers (from FRED series CPIAUCSL, or M04128USM350NNBR before 1948). From the Livingston Survey, we use the median forecast for the Consumer Price Index growth rate from the base period to 12 months ahead (series G_BP_To_12M). From the Survey of Professional Forecasters, we use the 10-year-ahead forecast for Consumer Price Index inflation (series INFCPI10YR). Ten-year inflation breakevens from the Treasury Inflation Protected Securities (TIPS) market since 1999 are from Gürkaynak et al. (2010) (series BKEVEN10). Synthetic TIPS 10-year breakevens before 1999 are from Groen and Middeldorp (2013).

The Great Inflation of the 1970s and the Volcker Disinflation

Livingston forecasters' inflation expectations began to rise in the mid-1960s, along with actual inflation, as shown in Figure 2. Bordo and Siklos (2014) argue that the Fed lost credibility for low inflation in the mid- to late 1960s, when it allowed inflation to creep upwards in order to accommodate the Johnson administration's expansionary fiscal policies—often referred to as the “guns and butter” fiscal policy of pursuing both the Vietnam War and expanded social programs. William McChesney Martin (1969), near the end of his 18-year term as Federal Reserve Chair, reflected that “my term as chairman is ending on a note reminiscent of its beginning. It began with a mighty effort by the Federal Reserve to control the inflation that accompanied the Korean conflict. It is ending with another mighty effort—against the background of another land war in Asia—to control the current inflation and expectations of further inflation.” Martin added,

I believe that we are making progress against the forces that give rise to inflation ... And we are also, I think, putting some dents in the inflationary expectations that have motivated many of our businesses and consumers. After several years of rapidly rising prices, it is only natural that many spending decisions would be motivated by the fear that prices will be higher next year ... But there is evidence now, however fragmentary, that these attitudes are changing, however slowly.

In retrospect, Martin was overly optimistic. Under Arthur Burns, Martin's successor as Fed Chair, both actual and expected inflation continued to rise. When Paul Volcker replaced Burns in 1979, he recognized the problematic feedback between rising inflation and rising inflation expectations. Volcker (1979) argued before Congress:

An entire generation of young adults has grown up since the mid-1960's knowing only inflation, indeed an inflation that has seemed to accelerate inexorably. In the circumstances, it is hardly surprising that many citizens have begun to wonder whether it is realistic to anticipate a return to general price stability, and have begun to change their behavior accordingly. Inflation feeds in part on itself, so part of the job of returning to a more stable and more productive economy must be to break the grip of inflationary expectations.

Goodfriend and King (2005, p. 986) argue that Fed actions in 1979 and 1980 “merely contained inflation in the face of sharply rising inflation expectations.” From transcripts of the meetings of the Federal Open Market Committee, Goodfriend and King find that the continuation of rising inflation expectations in 1981 finally convinced the Fed to make a more decisive and sustained effort to reduce

inflation. Inflation and expected inflation finally began a steady decline, falling below five percent in 1982 and below four percent in 1983, as the economy exited from a pronounced recession. Figure 2 also displays 10-year-ahead inflation expectations of professional forecasters, as well as inflation expectations based on the 10-year breakevens from Treasury Inflation Protected Securities (with synthetic values prior to 1999 as discussed in the previous section). The 10-year breakeven measure suggests that inflation expectations fell slowly and were volatile throughout the 1980s and 1990s. However, inflation expectations as derived from 10-year breakeven or from median professional forecasts stabilized by the late 1990s.

This process of stabilizing inflation expectations is also apparent in the Michigan Survey of Consumers data on inflation expectations. Median consumer inflation expectations at the one-year and five- to 10-year horizon are plotted in Panel A of Figure 3. During the 1980s, longer-run inflation expectations fell more slowly than shorter-run expectations, hovering around five percent until 1986, and not falling below four percent until 1991. Panel B of Figure 3 shows consumer disagreement about short- and long-run inflation, measured by the cross-sectional interquartile range of inflation expectations. Disagreement rose and then declined with inflation in the late 1970s and early 1980s. Interestingly, longer-run disagreement fell by more than shorter-run disagreement, and remains lower, signaling improved anchoring of long-run household expectations—that is, even when households disagree about inflation over shorter horizons, they are more in agreement about inflation over the longer run.⁷

The Great Inflation of the 1970s and the following Volcker disinflation highlighted the importance of anchoring inflation expectations to stabilize actual inflation, and this lesson has remained highly influential for policymakers to the present day. Federal Reserve Chair Janet Yellen (2015), for instance, has attributed the Great Inflation to the “emergence of an ‘inflationary psychology’ whereby a rise in actual inflation led people to revise up their expectations for future inflation” which “caused inflation—actual and expected—to ratchet higher over time.” Lessons from this episode prompted the widespread adoption of inflation targeting frameworks in the years that followed.

Inflation Targeting Before and After the Great Recession

Beginning with New Zealand in 1990, central banks around the world began implementing a monetary policy framework called inflation targeting (for a thorough survey, see Svensson 2010). Inflation targeting involves an announced numerical inflation target and implementation of monetary

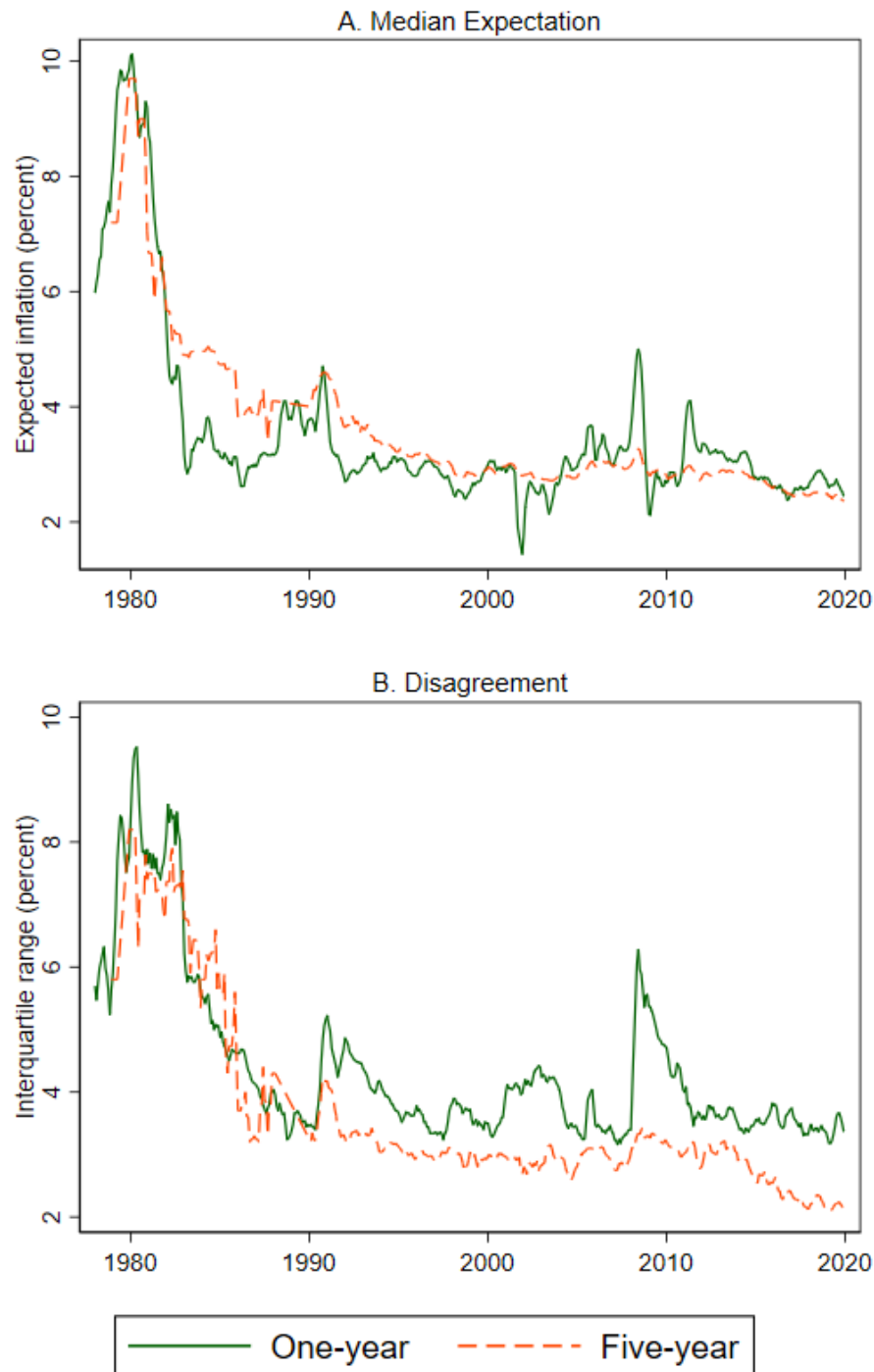
⁷ Binder (2017) uses this data to construct an uncertainty index for inflation expectations, based on consumers’ propensity to round their forecasts to multiples of five percent. In qualitative terms, this index follows the same general pattern of rising and falling as the disagreement index discussed in the text.

policy that gives a large role to the inflation forecast, along with transparency and accountability. By 2010, there were roughly 25 inflation-targeting countries. The circumstances for undertaking the policy have varied. For instance, inflation targeting was implemented in New Zealand (with other reforms) following dissatisfaction with the previous government. In the United Kingdom, inflation targeting was adopted in 1992, after being forced away from a fixed exchange rate regime (Petursson 2005). Despite the varied circumstances under which monetary authorities came to inflation targeting, one goal (either explicit or implicit) of adopting the strategy was to anchor inflation expectations and, in turn, stabilize inflation itself. The early empirical evidence, which relied on case studies or small samples, found that inflation targeting was successful in both goals (Bernanke et al. 1999; Neumann and von Hagen 2002), although subsequent work was less conclusive and pointed to the challenges of identifying the *causal* effects of inflation targeting.⁸

In the United States, discussions about implementing an inflation target began in the mid-1990s, but the Federal Reserve's explicit target of two percent for inflation as measured by the Personal Consumption Expenditures index was announced only in 2012 (Shapiro and Wilson 2012). As shown earlier in Figure 2, professional forecasters' long-run forecasts for Consumer Price Index inflation had fallen and stabilized near 2.5 percent in 1998. Since Consumer Price Index inflation is around half a percentage point higher than Personal Consumption Expenditures inflation (Binder et al. 2020), due to the different baskets of goods and varying methods of calculating the two indexes, a 2.5 percent Consumer Price Index inflation forecast is consistent with the two percent Personal Consumption Expenditures inflation target. This suggests that some professional forecasters may have believed that the Fed had an implicit inflation target before the explicit announcement in 2012. In fact, a questionnaire added to the Survey of Professional Forecasters in 2007Q4 asked respondents whether they believed the Fed had a numerical target for long-run inflation. Of the 45 respondents, 23 believed that the Fed had such a target.

⁸ In emerging market economies, inflation targeters experienced lower and less volatile inflation than non-targeters (Gonçalves 2008; Lin and Ye 2009). For developed countries, there was no significant difference between targeters and non-targeters: both saw a decline in the level and volatility of inflation (Ball and Sheridan, 2004). However, as Gertler (2004) notes, classifying advanced economies into inflation targeting and non-inflation targeting is not a sharp distinction. Many of the non-targeters were either implicitly following an inflation target or had hybrid targets for inflation and money growth. Therefore, the results for advanced economies can be difficult to interpret and may even suggest that inflation targeting has lowered inflation rates and volatility (Svensson 2010).

Figure 3: Consumer Inflation Expectations and Disagreement, 1978-2019



Source: From the Michigan Survey of Consumers, we use the median one-year horizon inflation expectations (series px1_med_all) and median five- to 10-year horizon inflation expectation (series px5_med_all). Disagreement is the interquartile range of inflation expectations from the Michigan Survey of Consumers. For visual clarity, centered five-month moving averages are displayed for each series.

For consumers, the reaction to inflation targeting appears somewhat different. From Figure 3, see that consumers' longer-run inflation expectations and disagreement trended slightly downward in the

years following the 2012 Fed announcement. All remain lower and more stable than the same series for the shorter horizon. However, median longer-run inflation expectations have stayed closer to three percent rather than two percent, and disagreement among the general population remains much higher than for professional forecasters. Other surveys have explicitly asked consumers whether they know the inflation target and find that most do not (Binder and Rodrigue 2018; Binder 2020a; Binder 2021). Hence, the 2012 announcement itself may have done relatively little to anchor consumers' expectations. Rather, years of low inflation may have reduced the “inflationary psychology” of earlier decades. As then-Fed chair Yellen remarked (2015), “Anchored inflation expectations were not won easily or quickly: Experience suggests that it takes many years of carefully conducted monetary policy to alter what households and firms perceive to be inflation’s ‘normal’ behavior.”

By the time the Great Recession began in 2007, inflation expectations of consumers and professionals had been low and stable for several years, due in part to implicit inflation targeting and a reduction in inflationary psychology. This anchoring of inflation expectations played a key role in inflation stabilization during and after the Great Recession. Inflation stayed surprisingly stable through the dramatic rise in unemployment in the Great Recession (rather than declining) and again through the recovery (rather than increasing). This weak co-movement between unemployment and inflation became known as the “missing disinflation” and “missing re-inflation” puzzles and prompted proclamations of the death of the Phillips curve’s relationship between inflation and economic slack. But, incorporating anchored long-run inflation expectations can help solve both puzzles and revive the New Keynesian Phillips curve (Jørgenson and Lansing 2019; Hazell et al. 2020). This implies that anchored long-term inflation expectations can powerfully stabilize inflation. In our view, this is the most compelling explanation of inflation dynamics from 2008 to 2019.

The Inflation Surge of 2021

At the beginning of the COVID-19 pandemic early in 2020, it was difficult to predict whether the impact would be inflationary or disinflationary, because of the difficulty of distinguishing supply and demand shocks (Cochrane 2020). The solid green line in the top panel of Figure 4 shows that inflation as measured by the Consumer Price Index declined in the first few months of the pandemic then rebounded slightly in the later months of 2020. In mid-2021 as the Covid-19 pandemic continued, aggregate demand recovered but supply remained constrained, and both inflation expectations and inflation itself began to rise.

During this time, how did inflation expectations of different groups adjust? The second panel of Figure 4 shows the evolution of consumer inflation expectations from the Michigan Survey over one-

and five-year horizons, professional forecaster inflation expectations from the Survey of Professional Forecasters over the 10-year horizon, and market-implied inflation expectations imputed from Treasury Inflation Protected Securities for a 10-year horizon. Median consumer inflation expectations declined by much less than inflation expectations from the other sources. Why did consumer inflation expectations differ from realized inflation and from the expectations of professional forecasters' expectations at the start of the pandemic? At least three explanations have been proposed.

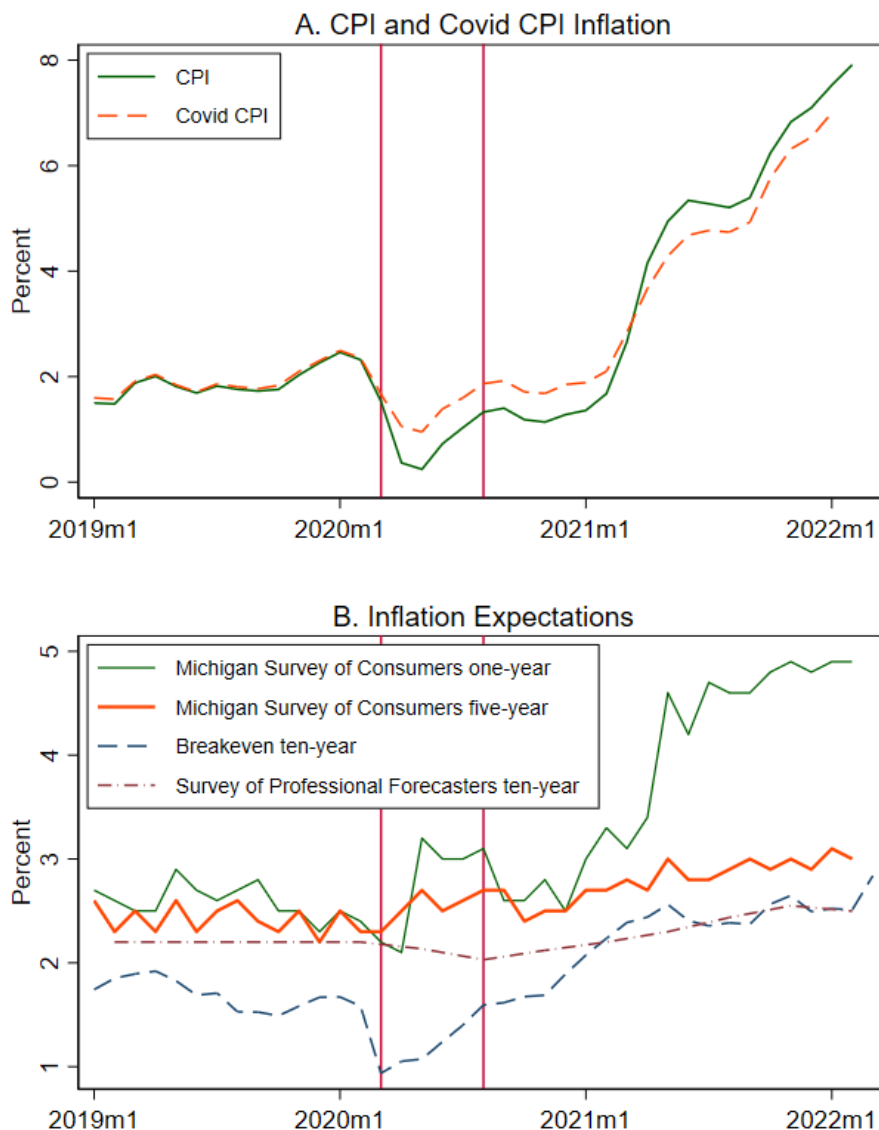
First, the pandemic may have shifted consumption patterns in ways that led to consumers experiencing price pressures that differed from the basket of goods behind the Consumer Price Index (CPI). Cavallo (2020) calculated a "Covid CPI" series, which uses credit and debit card transaction data to adjust the weights in the basket of goods underlying the Consumer Price Index in order to match the new expenditure patterns. For the first year of the pandemic, Covid CPI inflation was higher than official Consumer Price Index inflation. Thus, consumers were experiencing inflation at a higher rate than represented by the official Consumer Price Index, and consumers have been shown to rely heavily on their experienced price changes when forming their expectations (Cavallo et al. 2017). In contrast, professional forecasters and financial market participants tend to rely on official information sources.

A second possible explanation for the discrepancy between consumer and professional forecasters' expectations, especially during the early disinflationary part of the pandemic, is that consumers may not distinguish between supply shocks and demand shocks, but instead may simply associate bad news with high inflation (Binder and Makridis 2020; Binder 2020b; Kamdar 2019). Thus, consumers' expectations can greatly diverge from actual inflation and from professional forecasters' expectations when there is an adverse aggregate demand shock, as in the Great Recession and early stages of the pandemic. Binder (2020a) surveyed consumers on March 5 and 6, 2020, shortly after the Fed's emergency rate cut on March 3 (which 38 percent of survey respondents knew about). Consumers who were more concerned about the pandemic had significantly higher inflation expectations, consistent with prior research showing that many consumers seem to lack a clear understanding of the drivers of inflation or of the role of monetary policy.

Third, the inflation expectations of consumers may be less responsive to the release of official macroeconomic news than the expectations of professional forecasters and market participants. For market participants, it is possible to test how inflation expectations respond to macroeconomic news and announcements using an event-study approach, since market data on Treasury Inflation-Protected Securities is available at daily frequency. Bauer (2015) shows that inflation compensation responds to macroeconomic data surprises, including surprises to the "core" Consumer Price Index (which leaves out prices changes in the volatile food and energy categories). For consumers, daily data on inflation expectations is generally not available, though some researchers have conducted their own daily

surveys around announcements of interest. Monetary policy announcements seem to have minimal effects on consumer inflation expectations (Lamla and Vinogradov 2019), and the June 2021 release of the Consumer Price Index, which came in surprisingly high, only affected the inflation expectations of highly-numerate consumers (Binder 2021).

Figure 4: Inflation and Expected Inflation Since 2019



Source: Panel A plots Consumer Price Index inflation and Cavallo's (2020) "Covid CPI" inflation. Panel B plots the inflation expectations for several groups: for consumers, a one-year and five-year horizon from the Michigan Survey of Consumers; for financial market participants, from Treasury Inflation Protected Securities 10-year breakevens; and from the Survey of Professional Forecasters 10-year Consumer Price Index inflation forecasts. There are vertical lines at March 2020, when COVID-19 was declared a pandemic, and August 2020, when "average inflation targeting" was adopted by the Federal Reserve.

In addition to Covid, another development that may have affected inflation expectations and inflation in recent years was the August 2020 announcement by the Federal Reserve that it would adjust its policy framework from an “inflation targeting” approach previously announced in January 2012 to an “average inflation targeting” approach. The shift in terminology implies that if inflation is below the target level for some time, then it will be allowed to rise above target in the future, and vice versa. In discussions of average inflation targeting, Fed officials emphasize “the importance of having well-anchored inflation expectations, both to foster price stability and to enhance our ability to promote our broad-based and inclusive maximum-employment goal” (Powell 2021).

Like the January 2012 inflation targeting announcement, the average inflation targeting announcement did not have drastic immediate effects on expectations. Rather, inflation expectations, especially at longer horizons, rose gradually with inflation itself. Treasury Inflation Protected Security-implied 10-year inflation expectations steadily rose from one percent in May 2020 to 2.4 percent in July 2021, while the median professional forecast from the Survey of Professional Forecasters rose from 1.9 percent to 2.4 percent. The Michigan Survey of Consumers’ expectations also rose with realized inflation beginning in late 2020, especially at the one-year horizon. These short-run expectations are at 4.9 percent as of February 2022. Consumer inflation disagreement also rose and remains elevated.

Given the recent increases in expectations and realized inflation, monetary policymakers must consider the risk of inflation expectations becoming unanchored if inflation remains elevated for an extended period. For professional forecasters, the microdata shows some evidence of weakening anchoring. Binder et al. (2021) suggest a measure of expectations anchoring based on the deviations of individual forecasters’ long-run inflation expectations from target over a rolling window. This measure declined—implying improved anchoring—from 2012 until 2018. But in windows that include the pandemic or rising inflation, forecasters are increasingly reporting long-run inflation forecasts that are farther from target, even as the median forecast remains relatively close to target. For consumers, short-run inflation expectations have sharply risen. Consumers have been shown to be more attentive to inflation when inflation is high (Coibion et al. 2020). This raises the prospect that consumers may become more attentive and their long-run inflation expectations could become less anchored in a high inflation environment. Overall, if long-run inflation expectations of firms and consumers increase, the possibility of persistently higher inflation will rise.

As policymakers move to reduce inflation, higher and unanchored inflation expectations could complicate their task. Accordingly, policymakers should pay careful attention to developments in inflation expectations. We suggest a particular focus on the level of and disagreement in long-run inflation expectations.

References

- Adam, Klaus, and Mario Padula. 2011. "Inflation Dynamics and Subjective Expectations in the United States." *Economic Inquiry* 49 (1): 13-25.
- Allen, William R. 1977. "Irving Fisher, F.D.R., and the Great Depression." *History of Political Economy* 9:560–587.
- Ang, Andrew, Geert Bekaert, and Min Wei. 2007. "Do Macro Variables, Asset Markets, or Surveys Forecast Inflation Better?" *Journal of Monetary Economics* 54 (4): 1163-1212.
- Armantier, Oliver, Giorgio Topa, Wilbert van der Klaauw, and Basit Zafar. 2016. "An Overview of the Survey of Consumer Expectations." *Federal Reserve Bank of New York Staff Report*, (800).
- Ball, Laurence, and Niamh Sheridan. 2004. "Does Inflation Targeting Matter?" In *The Inflation Targeting Debate*, chapter 6. University of Chicago Press.
- Bauer, Michael. 2015. "Inflation Expectations and the News." *International Journal of Central Banking*, Vol. 11.
- Bernanke, Ben S. 1983. "Irreversibility, Uncertainty, and Cyclical Investment." *Quarterly Journal of Economics* 97 (1):85–106.
- Bernanke, Ben S., Thomas Laubach, Frederic S. Mishkin, and Adam S. Posen. 1999. *Inflation Targeting: Lessons from the International Experience*. Princeton University Press.
- Binder, Carola. 2016. "Estimation of Historical Inflation Expectations." *Explorations in Economic History* 61:1–31.
- Binder, Carola. 2017. "Measuring Uncertainty Based on Rounding: New Method and Application to Inflation Expectations." *Journal of Monetary Economics* 90 (C):1–12.
- Binder, Carola, and Alex Rodrigue. 2018. "Household Informedness and Long-Run Inflation Expectations: Experimental Evidence." *Southern Economic Journal* 85 (2): 580-598.
- Binder, Carola, and Christos Makridis. 2020. "Stuck in the Seventies: Gas Prices and Consumer Sentiment." *Review of Economics and Statistics* 104 (2): 293-305.
- Binder, Carola. 2020a. "Coronavirus Fears and Macroeconomic Expectations." *Review of Economics and Statistics* 102(4):721-730.
- Binder, Carola. 2020b. "Long-run Inflation Expectations in the Shrinking Upper Tail." *Economics Letters* 186:108867.
- Binder, Carola. 2021. "Household Expectations and the Release of Macroeconomic Statistics." *Economics Letters* 207(110041).
- Binder, Carola and Gillian Brunet. 2022. "Inflation Expectations and Consumption: Evidence from 1951." *Economic Inquiry* 60 (2): 954-974.
- Binder, Carola, Wesley Janson, and Randal Verbrugge. 2021. "Out of Bounds: Do SPF Respondents Have Anchored Inflation Expectations?" Unpublished.
- Board of Governors of the Federal Reserve System. 1943. "Thirtieth Annual Report of the Board of Governors of the Federal Reserve System Covering Operations for the Year 1943." Washington, DC: Board of Governors of the Federal Reserve System, 1943.
- Bordo, Michael D. 1981. "The Classical Gold Standard: Some Lessons for Today." *Federal Reserve Bank of St. Louis* pages 1–17.
- Bordo, Michael, and Pierre Siklos. 2014. "Central Bank Credibility, Reputation and Inflation Targeting

- in Historical Perspective.” NBER Working paper 20693.
- Cagan, Phillip. 1956. *Studies in the Quantity Theory of Money*, chapter The Monetary Dynamics of Hyperinflation. University of Chicago Press.
- Cagan, Phillip. 1965. *Determinants and Effects of Changes in the Supply of Money, 1875-1960*. National Bureau of Economic Research.
- Calvo, Guillermo A. 1983. “Staggered Priced in a Utility-Maximizing Framework.” *Journal of Monetary Economics* 12 (3): 383-398.
- Cavallo, Alberto, Guillermo Cruces, and Ricardo Perez-Truglia. 2017. "Inflation Expectations, Learning, and Supermarket Prices: Evidence from Survey Experiments." *American Economic Journal: Macroeconomics* 9 (3): 1-35.
- Cavallo, Alberto. 2020. “Inflation with COVID Consumption Baskets.” Harvard Business School Working Paper No. 20-124.
- Cecchetti, Stephen G. 1992. “Prices During the Great Depression: Was the Deflation of 1930-1932 Really Unanticipated?” *American Economic Review* 82 (1):141–156.
- Clark, Todd E., and Troy Davig. 2008. “An Empirical Assessment of the Relationships among Inflation and Short- and Long-term Expectations.” *Federal Reserve Bank of Kansas City Research Working Paper* (08-05).
- Clark, Todd E., and Troy Davig. 2009. “The Relationship Between Inflation and Inflation Expectations.” Federal Open Market Committee Memo.
- Clark, Todd E., and Taisuke Nakata. 2008. “Has the Behavior of Inflation and Long-Term Inflation Expectations Changed?” *Economic Review - Federal Reserve Bank of Kansas City* 93(1): 17.
- Cochrane, John H. 2020. *Economics in the Time of COVID-19*, chapter Coronavirus Monetary Policy. VoxEU.org eBook, CEPR Press, pp. 105–108.
- Cogley, Timothy, and Argia M. Sbordone. 2008. “Trend Inflation, Indexation, and Inflation Persistence in the New Keynesian Phillips Curve.” *American Economic Review* 98(5): 2101-2126.
- Coibion, Olivier, and Yuriy Gorodnichenko. 2012. “What Can Survey Forecasts Tell us about Information Rigidities?” *Journal of Political Economy* 120 (1):116–159.
- Coibion, Olivier, and Yuriy Gorodnichenko. 2015. “Is the Phillips Curve Alive and Well after All? Inflation Expectations and the Missing Disinflation.” *American Economic Journal: Macroeconomics* 7(1):197–232.
- Coibion, Olivier, Yuriy Gorodnichenko and, Rupal Kamdar. 2018a. “The Formation of Expectations, Inflation, and the Phillips Curve.” *Journal of Economic Literature* 56(4):1447–1491.
- Coibion, Olivier, Yuriy Gorodnichenko, and Saten Kumar. 2018b. “How Do Firms Form Their Expectations? New Survey Evidence.” *American Economic Review* 108 (9): 2671-2713.
- Coibion, Olivier, Yuriy Gorodnichenko, Saten Kumar, and Mathieu Pedemonte. 2020. "Inflation Expectations as a Policy Tool?" *Journal of International Economics* 124: 103297.
- Croushore, Dean D. 1997. “The Livingston Survey: Still Useful After All These Years.” *Business Review-Federal Reserve Bank of Philadelphia* 2: 1.
- Curtin, Richard. 2016. “George Katona: A Founder of Behavioral Economics.” *Routledge Handbook of Behavioral Economics*. Routledge, 30-47.
- Dimand, Robert W. 1999. “Irving Fisher and the Fisher Relation: Setting the Record Straight.” *Canadian Journal of Economics*, 32: 3 (May), 744-750.
- Dorval, Bill, and Gregor W. Smith. 2013. “Interwar Deflation and Depression.” *Queen’s Economics*

Department Working Paper (1310).

Eggertsson, Gauti B. 2008. "Great Expectations and the End of the Depression." *American Economic Review* 98(4):1476–1516.

Fisher, Irving. 1911. *The Purchasing Power of Money: Its Determination and Relation to Credit, Interest, and Crises*. The Macmillan Co.

Fisher, Irving. 1930. *The Theory of Interest*. Macmillan, New York.

Fisher, Irving. 1933. "The Debt Deflation Theory of Great Depressions." *Econometrica* 1 (4):337-357.

Friedman, Milton. 1968. "The Role of Monetary Policy." *American Economic Review* 58:1–17.

Friedman, Milton, and Anna Jacobson Schwartz. 1963. *A Monetary History of the United States, 1867-1960*. Princeton University Press, Princeton.

Galí, Jordi. 2018. "The State of New Keynesian Economics: A Partial Assessment." *Journal of Economic Perspectives*, 32 (3): 87-112.

Gertler, Mark. 2004. Comment. In: Bernanke, B.S., Woodford, M. (Eds.), *The Inflation Targeting Debate*. NBER Book Series Studies in Business Cycles. University of Chicago Press, Chicago, pp. 276–281.

Ginsburg, David. 1952. Price Stabilization, 1950-1952: Retrospect and Prospect. *University of Pennsylvania Law Review* 100 (4):514–543.

Goodfriend, Marvin, and Robert G. King. 2005. "The Incredible Volcker Disinflation." *Journal of Monetary Economics* 52:981–1015.

Gonçalves, Gonçalves, Carlos Eduardo S., and João M. Salles. 2008. "Inflation Targeting in Emerging Economies: What do the Data Say?" *Journal of Development Economics* 85 (1-2), 312-318.

Gordon, Robert J. 2018. "Friedman and Phelps on the Phillips Curve Viewed from a Half Century's Perspective." *Review of Keynesian Economics* 6 (4):425–436.

Groen, Jan J. J., and Menno Middelorp. 2013. *Creating a History of U.S. Inflation Expectations*. *Liberty Street Economics*.

Gürkaynak, Refet S., Brian Sack, and Jonathan H. Wright. 2010. "The TIPS Yield Curve and Inflation Compensation." *American Economic Journal: Macroeconomics* 2 (1):70–92.

Hall, Robert E., and Thomas J. Sargent. 2018. "Short-Run and Long-Run Effects of Milton Friedman's Presidential Address." *Journal of Economic Perspectives* 32 (1): 121-34.

Hamilton, James D. 1992. "Was the Deflation During the Great Depression Anticipated? Evidence from the Commodity Futures Market." *American Economic Review* 82 (1):157–178.

Hazell, Jonathon, Juan Herreño, Emi Nakamura, and Jón Steinsson. 2020. "The Slope of the Phillips Curve: Evidence from US States." NBER Working paper 28005.

Jalil, Andrew J., and Gisela Rua. 2016. "Inflation Expectations and Recovery in Spring 1933." *Explorations in Economic History* 62:26–50.

Jørgensen, Peter and Kevin J. Lansing. 2019. "Anchored Inflation Expectations and the Flatter Phillips Curve." Federal Reserve Bank of San Francisco Working Paper Series. 2019-27.

Kamdar, Rupal. 2019. "Inattentive Consumer: Sentiment and Expectations." Unpublished

Klein, Benjamin. 1975. "Our New Monetary Standard: The Measurement and Effects of Price Uncertainty, 1880-1973." *Economic Inquiry* pages 461–484.

Lamla, Michael and Dmitri Vinogradov. 2019. "Central Bank Announcements: Big News for Little

- People?" *Journal of Monetary Economics* 108: 21–38.
- Lin, Shu, and Haichun Ye. 2009. "Does Inflation Targeting Make a Difference in Developing Countries?" *Journal of Development Economics* 89 (1), 118-123.
- Lowe, Joseph. 1823. *On the Present State of England*. London.
- Lucas, Robert E. 1972. "Expectations and the Neutrality of Money." *Journal of Economic Theory* 4:103–124.
- Lucas, Robert E. 1973. "Some International Evidence on Output-Inflation Tradeoffs." *American Economic Review* 63:326–334.
- Martin, Jr., William McChesney. 1969. "Reminiscences and Reflections: Remarks before The Business Council, Hot Springs, Virginia." October 17, <https://fraser.stlouisfed.org/title/statements-speeches-william-mcchesney-martin-jr-448/reminiscences-reflections-7946/>.
- Muth, John F. 1961. "Rational Expectations and the Theory of Price Movements." *Econometrica* 29 (3):315–335.
- Nelson, Daniel B. 1991. "Was the Deflation of 1929-1930 Anticipated? The Monetary Regime as Viewed by the Business Press." *Research in Economic History* 13:1–65.
- Neumann, Manfred JM, and Jürgen Von Hagen. 2002. "Does Inflation Targeting Matter?" *Federal Reserve Bank of St. Louis Review* 84 (4): 127-148.
- Persky, Joseph. 1998. "Price Indexes and General Exchange Values." *Journal of Economic Perspectives* 12 (1):197–205.
- Pétursson, Thórarinn G. 2005. *Inflation Targeting and its Effects on Macroeconomic Performance*. Number 2005/5 in SUERF Studies. SUERF - The European Money and Finance Forum.
- Phelps, Edmund S. 1968. "Phillips Curve, Expectations of Inflation, and Optimal Inflation Over Time." *Economica* 34.
- Powell, Jerome. 2019. "Oversight on The Monetary Policy Report To Congress Pursuant To The Full Employment And Balanced Growth Act Of 1978." US Senate Committee on Banking, Housing, and Urban Affairs, February 26, <https://www.govinfo.gov/content/pkg/CHRG-116shrg35838/html/CHRG-116shrg35838.htm>.
- Powell, Jerome. 2021. "Transcript of Chair Powell's Press Conference." Federal Reserve Board of Governors, September 22, <https://www.federalreserve.gov/mediacenter/files/FOMCpresconf20210922.pdf>.
- Rockoff, Hugh. 1981. "Price and Wage Controls in Four Wartime Periods." *Journal of Economic History* 41 (2):381–401.
- Romer, Christina D., and David H. Romer. 2013. "The Missing Transmission Mechanism in the Monetary Explanation of the Great Depression." *American Economic Review* 103 (3):66–72.
- Rudd, Jeremy B. 2021. "Why Do We Think That Inflation Expectations Matter for Inflation? (And Should We?)." Finance and Economics Discussion Series Board of Governors of the Federal Reserve System 2021-062.
- Sargent, Thomas J., and Neil Wallace. 1976. "Rational Expectations and the Theory of Economic Policy." *Journal of Monetary Economics* 2 (2):169–183.
- Sargent, Thomas J. 1973. "Interest Rates and Prices in the Long Run: A Study of the Gibson Paradox." *Journal of Money, Credit and Banking* 5 (1):385–449.
- Sargent, Thomas J. 1980. "Rational Expectations and the Reconstruction of Macroeconomics." Federal Reserve Bank of Minneapolis Quarterly Review 4 (3): 15-19.

- Schwartz, Anna. 1981. *The Great Depression Revisited*, chapter Understanding 1929-1933. Martinus Nijhoff, Boston.
- Shapiro, Adam and Daniel J. Wilson. 2019. "The Evolution of the FOMC's Explicit Inflation Target." *Federal Reserve Bank of San Francisco Economic Letter* 12.
- Svensson, Lars E. O. 2010. Inflation Targeting. In *Handbook of Monetary Economics*, volume 3 of *Handbook of Monetary Economics*, pages 1237–1302. Elsevier.
- Temin, Peter, and Barrie A. Wigmore. 1990. "The End of One Big Deflation." *Explorations in Economic History*, 27(4):483–502.
- Thomas, Lloyd B. 1999. "Survey Measures of Expected US Inflation." *Journal of Economic Perspectives* 13 (4): 125-144.
- Vogt, Arthur. 2020. *Encyclopedia of Mathematics*, chapter Fisher, Irving.
- Volcker, Paul. 1979. "Statement before the Joint Economic Committee of the US Congress," October 17, <https://fraser.stlouisfed.org/title/statements-speeches-paul-a-volcker-451/statement-joint-economic-committee-8205>.
- Yellen, Janet. 2015. "Inflation Dynamics and Monetary Policy at the University of Massachusetts, Amherst." Federal Reserve, September 24, <https://www.federalreserve.gov/newsevents/speech/yellen20150924a.htm>.
- Zarnowitz, Victor, and Phillip Braun. 1993. "Twenty-Two Years of the NBER-ASA Quarterly Economic Outlook Surveys: Aspects and Comparisons of Forecasting Performance." *Business Cycles, Indicators, and Forecasting*. University of Chicago Press, pp. 11-94.