Establishing and Maintaining a Firm Nominal Anchor*

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A key practical challenge for monetary policy is to gauge the extent to which the private sector perceives the central bank's nominal anchor as transparent and credible. In light of that challenge, this commentary discusses some evidence on the evolution of longer-term inflation expectations in three advanced economies and then highlights several econometric issues that are relevant in assessing whether a given central bank has effectively been following a price-level targeting regime or an inflation-targeting regime.

JEL Codes: E31, E42, E52.

1. Introduction

Central banks have a fundamental responsibility to establish and maintain a nominal anchor for the economy, which may be expressed in terms of the inflation rate, the price level, the nominal exchange rate, or some other nominal variable. Such an anchor facilitates decision making by households and businesses and reduces economic and financial uncertainty. More generally, clarity about the central bank's policy framework enhances the overall effectiveness of the monetary transmission mechanism by helping financial market participants and the general public understand how the stance of monetary policy is likely to evolve in response to changes in economic and financial conditions.

A key practical challenge is to gauge the degree of firmness of the nominal anchor, that is, to what extent does the private sector

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perceive the central bank's anchor to be transparent and credible? DePooter et al. (this issue) address this question in the context of three emerging-market economies (Brazil, Chile, and Mexico), using survey-based measures as well as financial market data on nominal and inflation-linked bond prices. Ruge-Murcia (this issue) analyzes data on actual and expected inflation to investigate the extent to which inflation-targeting (IT) regimes in advanced economies have exhibited characteristics that would tend to be associated with price-level targeting (PLT). Each of these papers is highly relevant for monetary economists and policymakers, not only for understanding developments in those particular countries but also for shedding light on the determinants of inflation expectations and on the design of monetary policy strategy and communications. In the remainder of this commentary, I will discuss some related evidence on the evolution of longer-term inflation expectations in three advanced economies, and then I will point out some specific econometric issues that are relevant in assessing whether a given central bank has effectively been following a PLT regime as distinct from an IT regime.

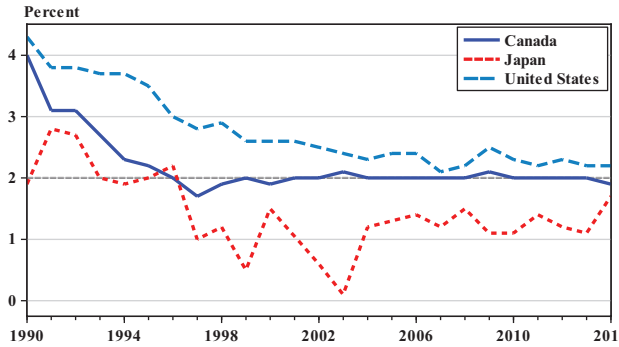
2. The Evolution of Inflation Expectations in Three Advanced Economies

In analyzing the early experiences of several inflation-targeting central banks, Bernanke et al. (1999) found that the private sector's inflation expectations tended to move only gradually in response to the announcement of an explicit inflation target. Moreover, such patterns do not necessarily reflect sluggish information flows or irrationality; rather, even professional forecasters tend to take a "wait-and-see" approach in assessing the extent to which a significant institutional change is likely to be durable over time.[1]

To illustrate these considerations, figure 1 depicts the evolution of longer-term inflation expectations for Canada, the United States, and Japan. Specifically, for each country, this figure depicts the consensus outlook of professional forecasters regarding the expected average rate of consumer price inflation six to ten years ahead, as measured by Consensus Economics longer-run surveys conducted every April over the period from 1990 through 2014.

[1]See Evans and Wachtel (1993).

Figure 1. The Evolution of Longer-Run Inflation Expectations in Three Advanced Economies



Source: Consensus Forecast longer-run surveys of CPI inflation projections six to ten years ahead, as published in April of each year. Copyright © 1990–2014 by Consensus Economics Inc. (www.consensuseconomics.com/what_are_consensus_forecasts.htm).

2.1 Canada

In early 1991, the Canadian government and the Bank of Canada agreed on a policy framework with a medium-term inflation target of 2 percent for the total consumer price index (CPI). Initially, that inflation goal does not appear to have been fully credible: As of April 1992, professional forecasters still anticipated that CPI inflation would settle at around 3 percent over the longer run. Over time, however, inflation expectations moved into line with the target, facilitated by the Bank of Canada's actions and communications and underpinned by the breadth of public support for its policy framework.

Indeed, survey evidence and financial market data indicate that inflation expectations in Canada have remained firmly anchored since the late 1990s. The Consensus Economics survey results indicate that professional forecasters' longer-run outlook for Canadian inflation has stayed very close to the 2 percent target throughout the past fifteen years. Moreover, Gürkaynak et al. (2007) analyzed Canadian daily data on forward inflation compensation—that is, the difference between forward rates on nominal and inflation-linked bonds—and found that far-forward inflation compensation did not respond significantly to either Canadian or U.S. macroeconomic news.

2.2 United States

Longer-term U.S. inflation expectations drifted steadily downward during the 1990s—a period in which the Federal Reserve did not have an explicit inflation objective but pursued a course of policy that has been characterized as "opportunistic" disinflation.[2] That course of policy effectively ended in mid-2003, when the Federal Open Market Committee (FOMC) indicated that a substantial further decline in inflation would be "unwelcome." Consequently, professional forecasters' longer-term outlook for U.S. consumer inflation leveled off at around 2 percent, although empirical analysis subsequently indicated that inflation expectations were still not as firmly anchored as in a number of other economies that had established an explicit numerical inflation objective.[3]

In January 2012, the FOMC established a longer-term inflation goal of 2 percent, as measured by the price index for total personal consumption expenditures (PCE), and has reaffirmed that inflation goal at each of its annual organization meetings since then. The PCE and CPI measures of inflation tend to deviate modestly but persistently. Thus, in gauging how firmly U.S. inflation expectations are anchored, it is also useful to consider the Federal Reserve Bank of Philadelphia's quarterly Survey of Professional Forecasters, which elicits projections for both measures of inflation. In the 2014:Q1 survey, the median projection for the ten-year average inflation rate was exactly 2 percent for the PCE price index and a notch higher at 2.3 percent for the CPI.

2.3 Japan

The Bank of Japan's (BOJ's) formulation of its nominal anchor has evolved notably over the past couple of decades.[4] During the 1990s, the BOJ's stated intention was to aim at modestly positive levels for published measures of inflation, thereby keeping the true underlying rate of inflation close to zero. In 2006 the nominal anchor was framed more specifically in terms of year-to-year changes in the CPI,

[2]See Meyer (1996) and Orphanides and Wilcox (2002).

[3]See Levin, Natalucci, and Piger (2004), Gürkaynak et al. (2007), Gürkaynak, Levin, and Swanson (2010), and Beechey, Johannssen, and Levin (2011).

[4]See Nishkizaki, Sekine, and Ueno (2014).

and policy board members' assessments of the appropriate value for the inflation goal had a midpoint of 1 percent. In early 2012, the BOJ specified a numerical inflation goal of 1 percent "for the time being," and a year later that goal was revised upward to 2 percent. In March 2013, the BOJ announced a strong commitment to taking the requisite quantitative and qualitative policy measures in order to achieve the 2 percent inflation goal.

Although the consensus longer-run outlook for Japanese CPI inflation declined gradually to around 1 percent during the 1990s, it remained quite close to that level during the 2000s, even as headline inflation was generally running below zero. Over the past year, the BOJ's actions and communications have clearly been successful in bolstering its credibility. In the latest Consensus Economics survey (published in mid-April 2014), the longer-run consensus forecast for Japanese CPI inflation now stands at 1.7 percent, up markedly from the longer-run consensus outlook of 1.1 percent in the April 2013 survey. Indeed, this measure of longer-run inflation expectations is now at its highest level since the mid-1990s. Of course, while those survey results are quite reassuring, the convergence process is not yet complete, and as BOJ officials have emphasized, further monetary policy actions could still be required over time in order to bring the private sector's inflation expectations fully into line with the BOJ's 2 percent target.

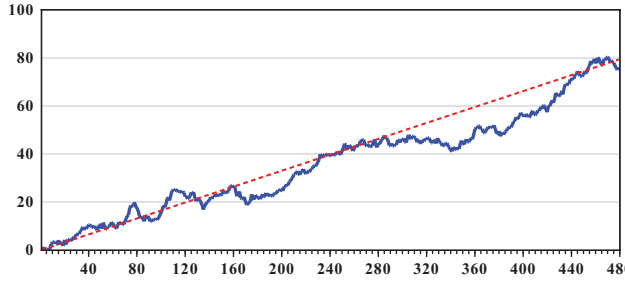
3. The Econometrics of Distinguishing PLT vs. IT

3.1 Random Walks and Time Trends

Suppose that the natural logarithm of the price level can be expressed as the sum of a time trend and a random walk; that is, $p_t = at + z_t$, where $z_t = z_{t-1} + \varepsilon_t$. For simplicity, assume a starting value of zero for the random walk (that is, $z_0 = 0$), and assume that the disturbance ε_t is a white-noise Gaussian process with mean zero and variance σ^2. Then it can be easily shown that the variance of the random walk increases linearly over time; that is, $Var(z_t) = \sigma^2 t$ for any time $t > 0$. Consequently, the standard deviation of the random walk increases as the square root of time; that is, $S.D.(z_t) = \sigma\sqrt{t}$.

Now consider a plot of the time series p_t for $t = 0, \ldots, T$. The vertical scale will roughly extend from 0 to αT, whereas the deviations

Figure 2. Stochastic Simulation of a Random Walk with Drift (calibrated to monthly data)



from trend will have magnitude of order $\sigma\sqrt{T}$. In effect, these deviations from the time trend will tend to "look small" relative to the overall scale of the graph.

To illustrate these considerations, figure 2 depicts a stochastic simulation for a random walk with drift, where the parameters are calibrated to represent a monthly time-series process for the logarithm of the price level. In particular, this process drifts upward at an annual average rate of 2 percent (that is, $\alpha = 0.167$), and the innovations have unit variance ($\sigma^2 = 1$). The solid line denotes the stochastic data, while the dashed line denotes a deterministic time trend starting from the same initial condition.

Based on the first two decades of monthly data, this random walk with drift seems to be virtually indistinguishable from a trend-stationary process. During the subsequent two decades, the series deviates persistently from the deterministic trend but still appears to revert back to that trend at the end of the fourth decade. Evidently, visual inspection is not a particularly reliable method for assessing the stationarity of an upward-trending series.

3.2 Pitfalls of Unit-Root Tests

The econometrics literature has documented the pitfalls of testing for the stationarity of a highly persistent series with negatively autocorrelated innovations.[5] For example, when the data are generated by an autoregressive moving-average (ARMA) process with a unit

[5]See Schwert (1989).

AR root and a negative MA root, then the ADF test exhibits an excessive tendency to reject the null hypothesis of a unit root, and the KPSS test exhibits an excessive tendency to accept the null hypothesis of stationarity.

Such considerations are not merely theoretical and may be particularly relevant in the context of analyzing the stationarity of CPI data. The total CPI can be expressed as the weighted average of the price index for food and energy (henceforth referred to as CPIFE) and the core price index excluding food and energy (henceforth CPIX). However, the time-series properties of CPIFE and CPIX may be markedly different.

Under an IT regime, the central bank follows a forward-looking approach in seeking to bring inflation back to target over the medium run. Thus, the CPIX *inflation rate* exhibits moderately persistent but stationary fluctuations around the inflation target, whereas the CPIX *price level* contains a random-walk component because "bygones are bygones" in determining the stance of monetary policy. Consequently, in inflation-targeting economies, CPIX inflation tends to be well described by a low-order AR process. Indeed, as shown in table 1 of Ruge-Murcia (this issue), the null hypothesis of a unit root cannot be rejected for Canadian core CPI—essentially consistent with the implications of an IT regime in which the price level is non-stationary.

In contrast, the agricultural and energy sectors are frequently subject to supply shocks (such as weather or geopolitical events) that induce large but transitory shifts in the CPIFE *price level.* Over longer periods of time, however, food and energy prices tend to move roughly in parallel with the prices of other consumer goods and services; that is, the relative price log(CPIFE/CPIX) typically exhibits trend stationarity. Consequently, in many advanced economies, the CPIFE *inflation rate* tends to be well described by an ARMA process with a negative MA root.

Thus, total CPI inflation may well exhibit a negative MA root that reflects the influence of transitory commodity price shocks. Of course, the magnitude of that root will depend on the incidence of supply shocks, the relative weights of the core and non-core components in the overall consumption basket, and the relative contribution of each component in explaining the variability of headline inflation. At any rate, in light of these considerations, substantial care is warranted in making inferences about the stationarity of total

CPI in order to assess whether a given central bank has effectively been following a strategy of IT vs. PLT.

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