

Discussion of “Do Inflation-Targeting Central Banks Implicitly Target the Price Level?”*

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1. Introduction

It has been a pleasure to read Francisco’s paper. The paper tackles a very interesting question in a simple and straightforward way. There is an ongoing debate in monetary economics about the difference between inflation targeting (IT) and price-level targeting (PLT). From a theoretical perspective, the New Keynesian model points to the superiority of PLT with respect to IT, because PLT induces a history-dependent policy that mimics optimal policy under commitment (see Vestin 2006). The standard practice of central banks, however, is different, since many of them (either explicitly or implicitly) adopt an IT approach. At least so far, no central bank has dared to adopt an explicit PLT approach.¹

Moreover, recently the issue of the zero lower bound (ZLB) on the nominal interest rate that constrains monetary policy in many economies has given even more strength to the argument in favor of a PLT approach. Eggertsson and Woodford (2003) show that the optimal commitment takes the form of price-level targeting in a ZLB context. In a deflationary environment, a credible PLT central bank is able to create expectations of future inflation, which in turn stimulate demand. Federal Reserve Bank of Chicago President Evans (2012) advanced a concrete policy proposal of adopting a state-contingent price-level targeting regime. Every time the annual rate

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¹In November 2006, the Bank of Canada launched a research program to study the advantages and the feasibility of moving from IT to PLT (see Côté 2007).

of inflation would be below (or above) the target level, he argued, the price level would have to grow at a faster (slower) rate afterwards in order to close the gap between the actual and the desired price path.

This description of a PLT regime has an immediate testable empirical implication: the stationarity of deviations of the price level from the target price path. Under a pure IT policy, instead, “bygones are bygones” and hence the price level should have a unit root (as should also deviations of the price level from the target price path). This distinction is at the core of Francisco’s paper: it provides a testable implication between the two policies that the author proceeds to test looking at unit-root tests, at root mean squared errors, and at survey data on inflation expectations.

2. But What Are Central Banks Actually Doing?

However, this classical dichotomy between IT and PLT is less clear-cut than one might initially think. As noted by the author, if a central bank targets the average value of inflation over a period, then the implied behavior of inflation (and of the price level) is similar to the one implied by a PLT regime rather than an IT regime. We may call this an average inflation-targeting approach, following the work by Nessén and Vestin (2005). Assume a central bank is targeting the average inflation rate over a j -period horizon. Then, if $j = 1$, we are in a pure IT regime where “bygones are bygones” and the central bank aims at bringing the inflation rate back to its target as soon as possible. However, if $j \rightarrow \infty$, then we are in a PLT regime, because the central bank targets the average inflation over the entire horizon. Behaving as proposed by Evans (2012) is a way to accomplish it. This very simple and straightforward argument shows that the dividing line between PLT and IT is actually a very thin one, providing thus a strong motivation for Francisco’s empirical investigation. Are IT central banks actually doing PLT instead?

The question is even more intriguing if we look at the practical implementation of IT regimes, as officially declared by the IT

central banks analyzed in the paper. Looking at these central banks' websites, we read the following:²

- Bank of England: "The MPC's aim is to set interest rates so that inflation can be brought back to target within a reasonable time period";
- Bank of Canada: "Bank's monetary policy aimed at keeping inflation at the 2 per cent target midpoint";
- Reserve Bank of Australia: "The appropriate target for monetary policy in Australia is to achieve an inflation rate of 2–3 per cent, on average, over the cycle. . . . The inflation target is defined as a medium-term average rather than as a rate (or band of rates) that must be held at all times"; and
- Reserve Bank of New Zealand: "The current Policy Targets Agreement, signed in September 2012, defines price stability as annual increases in the Consumers Price Index (CPI) of between 1 and 3 percent on average over the medium term, with a focus on keeping future average inflation near the 2 percent target midpoint."

As we can see, these statements range from a j equal to 1, implying pure IT (at least this would be my reading of the Bank of England and Bank of Canada statements) to a j equal to the number of periods that defines the "medium term," or "over the cycle," for the two Reserve Banks of Australia and New Zealand. For a long enough medium term, or even if one defines the horizon as a rolling window, this practical implementation of IT is *actually* PLT: it implies a trend stationary price level. It is worth noting that the European Central Bank has a similar definition for its target of, indeed, *price stability*!³

²See www.bankofengland.co.uk/monetarypolicy/Pages/framework/framework.aspx; www.bankofcanada.ca/monetary-policy-introduction/inflation/; www.rba.gov.au/monetary-policy/inflation-target.html; and www.rbnz.govt.nz/monetary-policy/policy_targets_agreement/.

³From www.ecb.europa.eu/mopo/strategy/pricestab/html/index.en.html: "The ECB's Governing Council has announced a quantitative definition of price stability: 'Price stability is defined as a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%.' The Governing Council has also clarified that, in the pursuit of price stability, it aims to maintain inflation rates below, but close to, 2% over the medium term."

The question is, again, even more intriguing if one thinks about how economists used to judge the success of an IT policy. Many works in the literature aim at evaluating the performance of IT regimes' central banks. Many of them compare the behavior of inflation (average inflation and inflation volatility) between inflation targeters and non-inflation targeters (e.g., Walsh 2009). This type of exercise is not relevant for the argument here. Rather, to evaluate the success of an IT central bank in reaching its goal, the obvious thing to do is to analyze the behavior of actual inflation time series with respect to the official target inflation rate. But how? The first thing that comes to mind is to plot the time series for inflation and then see if the average inflation rate is equal to target.⁴ However, for the reasons above, this is what we should expect if the central bank is following a PLT policy (or an "average IT" policy) rather than a pure IT policy. Under the latter, "bygones are bygones" and there is no reason to expect that periods of inflation above average should be compensated by periods of inflation below average in order to keep the average inflation rate at the target level.

The bottom line is that the practical implementation of IT policy, very often drafted as an "average IT" policy, is actually quite close to a PLT policy. We all define some central banks as inflation targeters: but are they really doing IT or are they actually doing PLT (or average IT)? Francisco's analysis tries to answer this question, which I believe is very important and interesting.

3. Difficult (Impossible?) to Distinguish between the Two Competing Alternatives

While Francisco's research question is important, my view is that it is difficult, if not impossible, to answer it for various reasons. However, in what follows I will also try to be constructive on how his analysis could be extended to convince the reader about his findings.

⁴See Melino (2012, p. 107): "Figure 1 shows the behavior of the inflation rate (computed using the year-over-year growth rate in the CPI) for each month since 1996. In broad terms, the observed inflation process supports the view that the Bank has successfully achieved the goals of its monetary agreements with the government of Canada. The average rate of inflation over the period, 1.94 percent, differs imperceptibly from the Bank's target."

3.1 Long-Run Property

The first obvious reason is the tension between the question and the span of available data. IT and PLT have two different implications in terms of unit-root tests. Francisco does what he should to test the implications of IT vs. PLT, but the test really relates to the long-run properties of the data, while the available span of data is only twenty years at most. No unit-root test in these circumstances is going to convince the reader (see also Andy Levin's discussion) more than the simple evidence provided by the plot of the time series. To circumvent this problem, the purchasing power parity literature, for example, relied on a very long span of historical data (e.g., Lothian and Taylor 1996 use 200 years of data). So Francisco can just supplement other empirical evidence hoping to convince the skeptical reader. One possibility would be to look at panel data estimation to increase the power of the test (see Sarno and Taylor 1998). Another possible empirical exercise would be to estimate the deterministic trend model with a time-varying parameter and to run a stability test on the slope or intercept of the trend.

3.2 The Role of Policy

The unit-root testing is ultimately based on identifying a mean reversion of the price level to its deterministic trend. However, the degree of mean reversion is influenced by policy and in particular by the reaction of the central bank to inflation. Benati and Surico (2008) show that hawkishness influences inflation predictability. Similarly, Cogley, Primiceri, and Sargent (2010) show that inflation-gap persistence and predictability decreases in the United States because of a change in the response of policy to inflation. So a very hawkish policy can make a pure IT policy resemble a PLT policy, because the inflation gap is pure noise. Furthermore, Schmitt-Grohé and Uribe (2011) show that the optimal IT policy would basically keep inflation at the target each period, implying that the variance of inflation is virtually zero. Hence, an optimal IT policy would be basically equivalent to a PLT policy, because inflation will never move from its target and thus the price level will never move from its trend.

Finally, any central bank will also be (implicitly or explicitly) concerned with the level of economic activity, and hence policy would

also depend on output gap. Again, the degree of response of policy to the output gap, or any measure of economic activity, is going to affect the degree of mean reversion of the price level to trend or of inflation to the target. In a small sample, this is thus going to weaken the ability of the empirical analysis to distinguish between the two competing hypotheses of IT and PLT. Francisco's analysis does not consider this possibility. Estimating a Taylor rule with an output gap, an inflation gap, and a price-level gap term could be a way to take this into account. Moreover, it would be better to allow the parameters of the Taylor rule to vary over time in the estimation. This analysis could give us a sense of whether a central bank is more concerned with the inflation gap—i.e., IT—or the price-level gap—i.e., PLT—controlling for the fact that policy reacts also to the level of economic activity. Furthermore, it would be very likely that both parameters (on inflation and price-level gap) are significant, pointing to the fact that a central bank is never a pure price-level targeter or pure inflation targeter. This consideration leads us to a further point.

3.3 The Role of Shocks

Policy and shocks are likely to interact. The central bank may react differently to the shocks depending on the type and the size of shocks. For example, if a big shock occurs, then it could be too costly to reabsorb it, bringing the price level back to the targeted path. Thus, in response to big shocks, the central bank may decide that “bygones are bygones” and behave as an inflation targeter. Or it may decide to revert the price level back to the path, but do it very slowly to minimize the cost of absorbing the shock. Again empirically, in small samples, it would look like an inflation targeter. On the contrary, it may choose to reabsorb small shocks to the price level because this is not costly and unproblematic. An example of this sort of behavior seems to be provided in Francisco's analysis for the United Kingdom.

Furthermore, in small samples, the role of shocks becomes crucial: how much of the behavior of inflation (or price level) is due to the shocks and how much is due to policy? For example, a sequence of shocks that pushes inflation in opposite directions may mimic a PLT policy. On the contrary, a sequence of shocks that pushes inflation in the same direction may lead one to empirically detect IT.

4. A Potentially Useful Literature

The New Keynesian literature provides a structural model for inflation behavior, thanks to the New Keynesian Phillips curve (NKPC), which is

$$\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \lambda \tilde{y}_t = \lambda E_t \overbrace{\sum_{i=0}^{\infty} \beta^i \tilde{y}_{t+i}}^{\tilde{y}_t^p} = \lambda E_t \tilde{y}_t^p, \tag{1}$$

where $\hat{\pi}_t$ is the inflation gap, \tilde{y}_t is the output gap, and \tilde{y}_t^p is a “present discounted value” of future output gaps that we can call, for the moment, the “permanent output gap.” Since $\hat{\pi}_t = \hat{p}_t - \hat{p}_{t-1}$, then

$$\hat{p}_t = \hat{p}_{t-1} + \lambda E_t \tilde{y}_t^p = \lambda \sum_{i=0}^{\infty} E_{t-i} \tilde{y}_{t-i}^p. \tag{2}$$

The forecast error thus is

$$\hat{p}_t - E_{t-1}(\hat{p}_t) = \lambda E_t \tilde{y}_t^p - \lambda E_{t-1} \tilde{y}_t^p = \lambda (E_t - E_{t-1}) \tilde{y}_t^p. \tag{3}$$

Francisco is testing

$$\hat{p}_t = \hat{p}_{t-1} + \varepsilon_t, \tag{4}$$

which, given the NKPC above, would imply

$$\varepsilon_t = \lambda (E_t - E_{t-1}) \tilde{y}_t^p. \tag{5}$$

This kind of framework calls to mind the permanent income literature on testing the celebrated Hall’s result that consumption should follow a random walk. In the permanent income framework, consumption is given by

$$c_t = A_t + \sum_{i=0}^{\infty} \left(\frac{1}{1+r} \right)^i E_t y_{t+i} = A_t + y_t^p, \tag{6}$$

where A_t is financial wealth and y_t^p is the permanent income which is equal to the present discounted value of future expected income

levels. If consumption follows a random walk, then $c_t = c_{t-1} + u_t$ and (6) implies

$$u_t = \sum_{i=0}^{\infty} \left(\frac{1}{1+r} \right)^i (E_t - E_{t-1}) y_{t+i} = (E_t - E_{t-1}) y_t^p, \quad (7)$$

which is similar to (5).

This may suggest that the very large literature on the permanent income hypothesis could give some suggestions about alternative ways of empirically assessing if the price level has a unit root. For example, one could think of running an “excess sensitivity” exercise, because inflation should be orthogonal to any variable in the information set in period $t - 1$, since $E_{t-1}\varepsilon_t = 0$. One possibility would be to estimate a structural model for inflation and either look at the residuals or the forecast errors. Alternatively, add lagged inflation terms in the regression and test for their significance. Moreover, one may think in terms of “excess smoothness.” Indeed, it seems to me that the relative variance of inflation and price deviation from trend should be different under the two competing hypotheses of IT and PLT (see figure 1 of the paper). For example, using Francisco’s data set, the ratio between the two variances, $\frac{\sigma_\pi}{\sigma_p}$, is equal to 0.11 for Sweden and 0.39 for Canada. Consistent with Francisco’s results, the variance of the deviation of the price level from trend is much bigger in Sweden than in Canada, as one would expect if Sweden is following a IT policy and Canada a PLT one. More generally, one could look into the properties of the inflation time series in more detail. For example, figure 1 would suggest that the first-order autocorrelation of inflation should be close to zero under IT and negative under PLT. The Q-stats cannot reject the null hypothesis of no autocorrelation for Canada at the 5 percent significance level.

Overall, I think Francisco’s research question is very interesting, but there is no single econometric test or empirical exercise that is going to convince a skeptical reader. What the author could do, however, is gather a series of coherent empirical results coming from different empirical strategies and investigations using different frameworks.

References

- Benati, L., and P. Surico. 2008. "Evolving US Monetary Policy and the Decline of Inflation Predictability." *Journal of the European Economic Association* 6 (2–3): 634–46.
- Cogley, T. W., G. Primiceri, and T. J. Sargent. 2010. "Inflation-Gap Persistence in the U.S." *American Economic Journal: Macroeconomics* 2 (1): 43–69.
- Côté, A. 2007. "Price-Level Targeting." Bank of Canada Discussion Paper/Document d'analyse No. 2007-8.
- Eggertsson, G. B., and M. Woodford. 2003. "The Zero Bound on Interest Rates and Optimal Monetary Policy." *Brookings Papers on Economic Activity* 1: 139–211.
- Evans, C. L. 2012. "Monetary Policy in a Low-Inflation Environment: Developing a State-Contingent Price-Level Target." *Journal of Money, Credit and Banking* 44 (S1): 147–55.
- Lothian, J. R., and M. P. Taylor. 1996. "Real Exchange Rate Behavior: The Recent Float from the Perspective of the Past Two Centuries." *Journal of Political Economy* 104 (3): 488–509.
- Melino, A. 2012. "Inflation Targeting: A Canadian Perspective." *International Journal of Central Banking* 8 (S1): 105–131.
- Nessén, M., and D. Vestin. 2005. "Average Inflation Targeting." *Journal of Money, Credit and Banking* 37 (5): 837–63.
- Sarno, L., and M. P. Taylor. 1998. "The Behavior of Real Exchange Rates during the Post-Bretton Woods Period." *Journal of International Economics* 46 (2): 281–312.
- Schmitt-Grohé, S., and M. Uribe. 2011. "The Optimal Rate of Inflation." In *Handbook of Monetary Economics*, Vol. 3, ed. B. M. Friedman and M. Woodford, 653–722 (chapter 13). San Diego, CA: Elsevier.
- Vestin, D. 2006. "Price-Level versus Inflation Targeting." *Journal of Monetary Economics* 53 (7): 1361–76.
- Walsh, C. 2009. "Inflation Targeting: What Have We Learned?" *International Finance* 12 (2): 195–233.