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POLICY BRIEF

An Evaluation of Nominal GDP versus Price-Level Targeting

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May 2019

In the Federal Reserve Act, Congress charged the Federal Reserve (Fed) with attaining "maximum employment, stable prices, and moderate long-term interest rates," a charge frequently called the dual mandate.[1] In pursuit of these goals, the Fed has, like other major central banks over approximately the past 20 years, in effect conducted a flexible inflation targeting (FIT) strategy. Under this strategy, a central bank implements policy to achieve a specific target inflation rate in the medium-to-long run but is free to pursue stabilization of the real economy in the short run, the time frame within which monetary policy can affect real variables like output or employment.

Since, under the FIT policy, inflation has been less than the Fed's 2 percent target for about a decade, economists have begun searching for policy alternatives that would enhance the ability of monetary policy to achieve the dual mandate. One prominent proposal is to target the path of the price level, as opposed to targeting just the inflation rate. Another would aim for a path of the level of spending on final goods and services as measured by nominal GDP (NGDP). Both of these proposals, *path targets*, are subtly different from *growth targets*, such as an inflation objective of 2 percent or a target of a chosen numerical value for the growth rate of NGDP. In particular, growth targets do not correct for deviations of actual inflation or NGDP from the desired path. Rather, growth targets "let bygones be bygones."[2]

How do the outcomes of different path targets compare with each other and with the FIT policy that lets bygones be bygones? In this brief, we present evidence that a path target for NGDP may be preferable to a path target for the price level. In addition, we also find that the NGDP path target would have been superior to a continuation of the implicit FIT policy pursued by the Fed before and after the Great Recession. An implication of our results is that a path target for NGDP may promote faster postcrisis recoveries from recessions, including the Great Recession.

Before we present our empirical evaluation of price-level and NGDP-level targeting, in the next section we provide a general discussion of how monetary policymakers respond to shocks to aggregate demand and supply under these alternative policy strategies. We then present our empirical analysis, which is followed by a conclusion that includes a brief comparison to selected earlier studies.

HOW WOULD MONETARY POLICYMAKERS RESPOND TO AGGREGATE DEMAND AND SUPPLY SHOCKS UNDER PRICE-LEVEL AND NGDP-LEVEL TARGETING?

Aggregate Demand Shocks

When an economy experiences an unexpected change—a shock—in aggregate demand, prices and output move in the same direction. For example, a negative aggregate demand shock, one type of disturbance that can cause a recession, means that firms cut back production owing to the decline in demand for goods and cut prices both to rid themselves of excess inventories and to try to attract additional purchases. Negative demand shocks may be caused by a fall in consumer or business confidence (or both), a decline in purchases of export goods by agents elsewhere in the world, or by a financial crisis that disrupts financial markets, lowering asset values and reducing consumption and investment. In response to a negative aggregate demand shock, monetary policymakers generally lower the policy interest rate with the aim of stimulating aggregate demand to offset the price and output effects of the shock.

An attractive feature of path targets—for either the price level or NGDP—is that, in the face of demand shocks, they hypothetically lead to faster recovery after a recession. Why? Consider a situation similar to the past decade, when the actual inflation rate was persistently below target and the economy was recovering from the Great Recession. In principle, a FIT policy provides enough stimulus to move the inflation rate back to target and maintain it there, but as detailed in note 2, it does not try to achieve the target path on average over the medium-to-long run.[3] Assuming both strategies aim to achieve their respective targets over the same time horizon, attaining a price-level path established before the inflation undershoot requires a more expansionary monetary policy than with inflation targeting; policy must correct the undershooting of the path target for the price level. The result should be a faster return of output and employment to desired levels and a period of inflation somewhat higher than the target. Therefore, under the price-level path target policy, bygones are not bygones. Note, however, that targeting a price-level path will also generate more variable inflation rates than with inflation targeting, since the inflation rate must overshoot the rate consistent with the target path following a dip below target to reestablish the original price path.[4]

As with inflation targeting, a growth target for NGDP without the commitment to return to the target path would only aim to attain the desired growth rate without raising NGDP back to the desired path. A target path for NGDP in the face of a negative aggregate demand shock would

require a relatively expansionary monetary policy to return NGDP to the desired path; NGDP would be temporarily above the growth rate path in order to correct the "miss" when NGDP was below its desired path.

Aggregate Supply Shocks

A negative aggregate supply shock, in contrast, tends to lower output but raise the general level of prices. Common examples include an abrupt upward movement in the relative price of oil stemming from, for example, a reduction in world oil supply or an increase in the world demand for oil or natural disasters such as a destructive hurricane or earthquake.

When the economy faces a temporary supply shock, policymakers face a dilemma. Consider first inflation or price-level path targeting. With a negative supply shock, output tends to fall owing to supply disruptions, causing prices to rise. In response, in an inflation rate targeting regime, a restrictive policy is pursued to lower the inflation rate to the target. In a price-level path targeting regime, an even more restrictive policy is pursued to correct the price level overshoot relative to the original target path. Both policies worsen the negative impact of the shock on output. The negative supply shock induces a recession, a deeper recession results from an inflation rate target, and an even deeper recession results from a price-level target.[5]

What would be the results of NGDP path targeting in light of a temporary negative supply shock, one where output falls and prices rise? Consider initially a special case in which the rise in the price level exactly offsets the fall in output so that NGDP is unchanged. Unlike with inflation or price-level path targeting, there is no need to pursue a restrictive monetary policy, so policy would not deepen the recession. If the price level rises by more relative to the fall in output, and if NGDP rises above its target path, a restrictive policy would also result in NGDP falling under the target. However, since the price level increase is partially offset by declining output, compared with inflation or price-level targets, monetary policy is less restrictive. And if the fall in output outweighs the rise in the price level and NGDP declines, monetary policy is expansionary, lessening the recessionary impact of the supply shock. Thus, for temporary aggregate supply shocks, an advantage of NGDP targeting is automaticity—the response is to the change in NGDP; the source of the shock doesn't need to be determined for NGDP targeting to be stabilizing relative to inflation or price-level targeting.

While supply shocks such as those caused by oil prices or natural disasters may dissipate, permanent shocks, such as those caused by excessive regulation, reduce the rate of productivity growth and hence the long-run rate of economic growth. Under either inflation or price-level path targeting, neither the inflation target nor the price-level target would need to be altered, and the central bank would adjust the stance of monetary policy to achieve its targets. However, with NGDP growth targeting, given the inflation rate that conditioned the NGDP growth target before the

permanent shock, the target rate of growth in NGDP would need to be reduced to be consistent with the slower long-run rate of growth of output, and with NGDP level targeting, the target path for the level of NGDP would need to be adjusted downward. With a fall in real GDP growth owing to a negative, permanent supply shock, attempting to maintain NGDP along the pre-supply-shock path would raise the inflation rate above the desired rate and hence would eventually raise the expected inflation rate.

In summary, it is important for a central bank that is targeting either the inflation rate or the price level to be able to differentiate between aggregate demand shocks and temporary aggregate supply shocks in real time, something that is difficult to do in practice. Discerning the source of shocks is less critical for an NGDP-targeting central bank. But with productivity shocks that affect the growth rate of output in the long run, an NGDP-targeting central bank would need to adjust its NGDP path target accordingly to avoid either inflationary or disinflationary policy, whereas a price-level-targeting or an inflation-targeting central bank could achieve its long-run goals without changing the price-level path target or the inflation rate target. Since economies are hit by a variety of shocks, ultimately the relative usefulness of NGDP targeting compared with either price-level or inflation targeting is an empirical question.

AN EMPIRICAL COMPARISON OF PRICE-LEVEL AND NGDP-LEVEL TARGETING

Next we summarize the results of an empirical comparison of a policy pursuing a path target for the price level with one pursuing a path target for NGDP.[6] Specifically, we estimate a model over the period Q4 1979–Q4 2003 (a period in which the economy was buffeted by substantial demand and supply shocks) and then simulate the estimated model over the period Q1 2004– Q4 2006.[7] The analysis is conducted by finding the values for the federal funds rate consistent with the selected target path for either the price level or NGDP. To make the simulations more realistic, for a given target variable and its associated path, we implement policy settings that attain the target path on average over a moving 12-quarter period rather than on a period-by-period basis. In addition, in recognition that there is slippage in the link between the policy instrument and the policy target, we do not insist upon attaining the policy target precisely but rather seek to keep the target variable within specified tolerance bands around the desired path. This approach, applied to our path targets, roughly reflects recent policy statements to the effect that the 2 percent inflation target is "symmetric," allowing actual inflation to be either somewhat above or below target over the medium term.

Our statistical model includes real GDP, the GDP deflator, a commodity price index, a measure of the money stock, the federal funds rate, and a credit spread (which measures the difference between the yield on corporate securities and the yield on government securities of similar maturity) that is informative in explaining movements in economic activity.[8] The responses of the model variables to monetary policy actions over the estimation period are as expected based on monetary theory and previous empirical studies: contractionary monetary policy (i.e., an increase

in the federal funds rate) has a negative but transitory effect on real GDP, a delayed but then persistent effect on the GDP deflator, and a transitory increase in the credit market's assessment of corporate credit risk.

For price-level targeting, we specify a target path that allows the price level to rise at a 2 percent annual rate using the price level in Q4 2003 as the base from which the target path is computed. For the simulations in which we target the level of NGDP, our base case specifies a path that grows at a 4.5 percent rate (2 percent for prices and 2.5 percent for real GDP). We then determine the settings for the federal funds rate needed to maintain the targeted variable within a tolerance band centered on the target path. We set tolerance bands of either ±1 percent or ±2 percent around these specified target paths and only require that the outcomes fall within these bands over rolling 12-quarter horizons. For comparison, we also evaluate a policy that is a continuation of the implicit FIT that characterized the Q1 1979–Q4 2003 estimation period for our model. In evaluating the FIT policy, we use values of the federal funds rate characteristic of the estimation period. The target paths for real GDP and the price level used in evaluating the FIT policy are the same as those employed in the NGDP target path.

Our conclusion regarding the superiority of NGDP path targeting for our simulation period is based upon several experiments. In each experiment, we evaluate macroeconomic variability by computing loss functions. These loss functions reflect the Fed's dual mandate and are simply weighted averages of the variability of output and the price level around their target values.[9] As is common, we use real GDP as a proxy for employment. Using the measures of variability of output and the price level, for each policy strategy, we compute three versions of the loss function that use the alternative weights described in the next paragraph. Since volatility is undesirable in macroeconomic variables, our preference for the NGDP path target derives from the fact that it minimizes the loss function. However, for both the simulated price-level and NGDP policies, while the interest rate settings are within historical bounds over the estimation period, policy changes are often larger than the usual 25 basis point moves that have characterized interest rate policy over the past several decades. Given that our simulation period begins with the federal funds rate at 1 percent, we also investigate whether our conclusions depended on setting the interest rate less than zero. Violation of the zero lower bound is not an issue in our results.

The Federal Reserve Act does not specify the relative importance of each goal, so weights applied to output and prices in computing the values of the loss function are governed by the preferences of policymakers. Representing policymakers assigning equal importance to real GDP and price-level variability, our first loss function equally weights the variabilities of real GDP and the price level. In the absence of congressionally specified weights, we refer to the loss function with these weights as the dual mandate loss function. Our second loss function recognizes that policymaker preferences may tend toward assigning more importance to real GDP stability (and implicitly assign more importance to labor market stability) than to price-level stability. These

policymakers are willing to tolerate somewhat poorer inflation outcomes in support of improved output and employment results. Policymakers with these preferences are referred to as having Keynesian preferences. The Keynesian weights are 0.75 for real GDP variability and 0.25 for price-level variability. Our third loss function represents the results for policymakers who are relatively concerned with maintaining the price level at its target. A loss function with weights of 0.25 on the variability of real GDP and 0.75 on the variability of the price level reflects such preferences, and we call these preferences Classical.

We present the main results of the various experiments in table 1, with the results of each reported for the alternative loss functions. Although the focus of our analysis is targeting paths for the price level and NGDP, we also include results from the continuation policy associated with the FIT approach being pursued at the time.

For each weighting scheme, we report two price-level experiments—both with an objective for the price level to grow from its Q4 2003 value at a pace of 2 percent—with alternative tolerance bands around this rate of growth in the price level. Since 2 percent has been the formal inflation objective since 2012 and the informal objective before that, we restrict our attention to the case where the price level grows at that pace. We also report, for each weighting scheme, results for the NGDP target path from its Q4 2003 value and alternative tolerance bands. In this experiment, the target NGDP path grows at 4.5 percent (2 percent for inflation and 2.5 percent for real GDP).[10]

The results are clear: regardless of the relative weights on real GDP and the price level used in computing the loss functions, targeting the NGDP path always dominates targeting the price-level

Table 1. Loss Functions

TYPE LOSS FUNCTION/POLICY OBJECTIVE	% RATE OF CHANGE[A]	LOSS FUNCTION VALUE[B]		
		TOLERANCE BAND WIDTH		FIT-CONSISTENT POLICY
		±1%	±2%	
A. DUAL MANDATE WEIGHTS				
1. Price Level	2.0	3.33	2.18	1.76
2. Level NGDP	4.5	1.45	1.67	
B. KEYNESIAN WEIGHTS				
1. Price Level	2.0	4.50	2.31	1.67
2. Level NGDP	4.5	1.48	1.57	
C. CLASSICAL WEIGHTS				
1. Price Level	2.0	2.15	2.06	1.86
2. Level NGDP	4.5	1.42	1.77	

[A] The desired rate of change employed in computing the target path of the level of the variable over Q1 2004–Q4 2006. The target paths for real GDP and the price level used in evaluating the FIT policy are 2 percent for prices and 2.5 percent for real GDP. The Q4 2003 value is projected forward as the target value at the indicated rate of change.
[B] All values are multiplied by e–04.

path. Targeting the NGDP path also always dominates the FIT-consistent policy. Across the various experiments, the loss value is minimized with the Classical weights for NGDP targets and the narrow confidence band.

The results in table 1 are conditional on the values of the federal funds rate needed to attain the assumed objectives for growth in the paths of the price level and NGDP. In order to consider whether frameworks such as the path targets for the price level or NGDP should be considered as viable policy alternatives, an assessment of the behavior of the federal funds rate is needed. After all, if the federal funds rate is highly variable (i.e., exhibits what is called "instrument instability"), then the usefulness of the alternatives examined here would be moot.[11]

For purposes of comparison, during the period under investigation, the federal funds rate rose from 1 percent in Q1 2004 (where it remained during Q2 2004) and then rose in a sequence of 25 basis point increases to 5.25 percent in Q4 2006. By contrast, for both the price-level and NGDP path targets, the pattern of the federal funds rate underlying the results in table 1 is to rise immediately and substantially in Q1 2004, rise more moderately for another quarter or two, and then gradually fall to about 2.5 percent by the end of 2006. Specifically, the policy rate for the NGDP target initially jumps to about 5 percent (relative to the actual 1 percent rate in Q4 2003) and initially to about 7 percent for the price-level target. The explanation is that the specified target paths for both the price level and NGDP, consistent with trends at the end of 2003, tend to be less than the actual paths followed by the target variables. A policymaker active over the 2004–2006 period and following the alternative strategies discussed here would have needed to undertake relatively restrictive policies at the outset to restrain the target variable within the tolerance bands. Further investigation of whether the policy rate changes needed at the outset in our experiments would be viewed by policymakers as introducing too much interest rate volatility is likely warranted.[12]

CONCLUSION

Our evaluation of NGDP and price-level targeting over the Q1 2004–Q4 2006 period suggests better outcomes under NGDP targeting than under either price-level targeting or a continuation of the monetary policy that characterized the estimation period (Q4 1979–Q4 2003) for our model. Julio Garín, Robert Lester, and Eric Sims, using a very different model, find that NGDP targeting outperforms inflation targeting;[13] Jonathan Benchimol and André Fourçans, again using a very different model, find that policy rules targeting the level of NGDP generally outperform rules that target NGDP growth or policy implemented using variants of the Taylor rule.[14] Further, David Beckworth and Joshua R. Hendrickson,[15] using a New Keynesian model, suggest that NGDP targeting is preferred to a Taylor rule. The accumulating empirical evidence from a variety of macroeconomic models in support of NGDP targeting suggests that the Federal Reserve should seriously consider NGDP targeting as a monetary policy strategy in its upcoming review of its monetary policy framework in late 2019.

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NOTES

1. Since moderate interest rates follow from stable prices, there are essentially two goals. In addition, it is common in many discussions to substitute for the unemployment goal the objective of output being at potential, an approach employed here as well.

2. As an illustration, consider a simple numerical example. Suppose that in the base year, t–1, the price level was 100 with a 2 percent inflation target. If actual inflation is also 2 percent, in year t the price level will rise along the target path to a value of 102. If actual inflation continues at the target rate, both will rise to 104.04 in year t+1, and so on. But if for some reason the actual inflation rate is 1 percent, the actual price level in year t would rise only to 101, below the desired value of 102. Under the FIT policy, policy does not correct for inflation "misses" relative to the implied original path. If inflation is too low in period t, but in year t+1 returns to its desired rate, the price level rises to 103.02, below the 104.04 value along the original price path. Under a path target, policy temporarily raises the inflation rate above 2 percent to return the price level to the target path.

3. While the FIT policy in principle attempts to attain the target inflation rate, in practice this has not been consistently achieved. As noted earlier, for about a decade, inflation has been persistently below target.

4. Although more variable rates of inflation are often associated with heightened macroeconomic uncertainty (which in turn is associated with disruptions to private spending), if the central bank consistently hits its price level target and hence establishes credibility for doing so, more variable inflation rates under price-level targeting will not raise the level of uncertainty.

5. With a temporary negative supply shock and flexible implementation of either inflation targeting or price-level targeting, in practice the central bank may choose to move to its target more slowly than with an aggregate demand shock in order to allow the negative supply shock to unwind, thereby limiting any policy-induced declines in output at the cost of a longer departure from inflation targets or the price level.

6. For a complete analysis and description of the simulation technique, see James S. Fackler and W. Douglas McMillin, *Nominal GDP versus Price Level Targeting: An Empirical Evaluation* (Lexington, KY: Institute for the Study of Free Enterprise, 2019).

7. Since much of the recovery period after the recent recession was characterized by short-term interest rates at values close to zero, and since rates today remain well below precrisis levels, our simulation period reflects price-level and NGDP path targeting starting in a period of near-zero rates. Specifically, we begin our simulation period at a time when the federal funds rate was at a then historically low value of 1 percent.

8. A vector autoregressive model is estimated using logarithms of the first four variables and the levels of the interest rate and credit spread. Estimating with the logs of real GDP and the GDP deflator is key to our comparison since the sum of the logs of these two variables is equivalent to the log of the product of the two, with the product being NGDP. Thus, in our simulations we can use the federal funds rate to target either the log of the price level alone or the sum of the log of the price level and the log of real GDP. Following Edward Nelson, "The Future of Monetary Aggregates in Monetary Policy Analysis," *Journal of Monetary Economics* 50 (2003): 1029–59, and in the spirit of Milton Friedman, Karl Brunner, and Allan Meltzer, money is included as a proxy for substitution effects generated by monetary policy actions that are not entirely captured by a short-term interest rate. We use

the MZM (money zero maturity) measure of money. For the credit spread, we use the Gilchrist-Zakrajsek corporate bond market spread that measures credit market sentiment toward the general level of corporate credit risk.

9. Specifically, the loss functions account for squared deviations of outcomes of the price level and real GDP from their target paths. The presumption is that there are costs borne by the economy when such deviations occur. Specifically, we compute the mean squared deviation (MSD) of both real GDP and the price level around the specified path targets. The MSD considers the average of the squared deviations of actual outcomes from the path target value. The deviations are squared in part so that negative deviations don't offset positive ones and understate the costs of policy "misses" and in part to emphasize that large deviations (when squared) are more costly than small ones. The loss function value is the weighted average of the MSD for both the price level and real output with the weights described in the next paragraph of the text.

10. Although real GDP growth had averaged a bit over 3 percent annually from 1960 to 2006, in light of current projections of lower real GDP growth in the future, we use a more modest growth rate of 2.5 percent. However, additional results are reported in Fackler and McMillin, *Nominal GDP versus Price Level Targeting*, for higher rates of growth of the NGDP path assuming 3 percent and 3.5 percent growth in real GDP. None of the conclusions noted here are affected.

11. Instrument instability reflects not only highly variable changes in the policy instrument, but also increasingly large changes. In our results with the ± 2% bands, the variability in the federal funds rate needed to achieve the targets is approximately equal to that in the actual data. For the ± 1% band for NGDP, the variability in the federal funds rate needed to achieve the targets is marginally higher than the actual data.

12. Further statistical testing suggested that the variability in the federal funds rate in the simulations was not sufficiently different from the variability in the federal funds rate over the estimation period to invalidate use of the model in comparing price level targeting, NGDP targeting, and FIT targeting. For details, see Fackler and McMillin, *Nominal GDP versus Price Level Targeting*.

13. Julio Garín, Robert Lester, and Eric Sims, "On the Desirability of Nominal GDP Targeting," *Journal of Economic Dynamics and Control* 69 (2016): 21–44.

14. The Taylor rule is a widely discussed guide for monetary policymakers that assumes a dual mandate such as the Fed's. The rule suggests that policymakers should set the value of the nominal policy rate equal to the equilibrium real policy rate plus the inflation rate over the past year plus a weighted average of the output gap and the deviation of the inflation rate from target. Different formulations of the Taylor rule employ different weights on the output gap and the inflation gap. See Jonathan Benchimol and André Fourçans, "Central Bank Losses and Monetary Policy Rules: A DSGE Investigation," *International Review of Economics and Finance* 61 (2019): 289–303.

15. David Beckworth and Joshua R. Hendrickson, "Nominal GDP Targeting and the Taylor Rule on an Even Playing Field," *Journal of Money, Credit, and Banking* (forthcoming).