

# Targeting Nominal Income under the Zero Lower Bound: The Case of the Bank of England

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**ABSTRACT:** The Bank of England, like other central banks that use an interest rate as their policy variable, faces practical problems for implementation of monetary policy when interest rates are constrained by their zero lower bound. The quantity of money, however, faces no such constraint and, for that reason, policies that emphasize control of the money supply may offer an alternative path toward achievement of a central bank's nominal objectives. A simple model rooted in Quantity Theory principles suggests this is possible if the quantity of money is measured properly and slow-moving trends in velocity can be accommodated in the policy's implementation.

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## **Targeting Nominal Income under the Zero Lower Bound: The Case of the Bank of England**

The Bank of England (BoE) pursues its objective of two percent inflation by setting a target value for its Bank Rate. After varying between 0.25 to 0.75 percent in the aftermath of the financial crisis of 2008-2009, the onset of the Covid pandemic pushed the Bank Rate still lower to its current value of 0.1 percent. At this level, however, the zero lower bound constraint implies that any further attempts at monetary stimulus would have to originate from an expanded use of quantitative easing or other “unconventional” policy tools.

In response perceived limits on the ability of the BoE to restore economic activity to a level consistent with full employment and maximum output, setting a target for nominal GDP (NGDP) has been suggested as an alternative. For example, Frenkel (2012) discusses “the death of inflation targeting” and the adoption of NGDP targeting in its place whereas Bean (2013) and Goodhart, et al. (2013) discuss some pitfalls of NGDP targeting for the BoE. If the BoE were to adopt a target for nominal GDP, however, a practical question would remain: How would this goal be achieved? In what follows we revisit a monetary policy strategy based on setting a path for the money supply rather than one that sets an interest rate target. Although setting targets for the money supply fell out of favor when abrupt shifts in velocity severed traditionally observed linkages between money and nominal magnitudes, evidence suggests that results rejecting a role for money in monetary policy could be attributed to errors associated with measurement of the money supply rather than any breakdown in the fundamental relationships suggested by economic theory.<sup>1</sup> If this conjecture is accurate, it may be possible for a central bank to resurrect a strategy of this type to achieve a nominal objective if money is measured in a coherent manner. In what follows, a simple analytical

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<sup>1</sup> Belongia (1996) and Hendrickson (2014) replicate widely-known studies that reported breakdowns in traditional relationships between money and aggregate activity and show that results like those reported in the 1960s and 1970s are maintained when money is measured as a Divisia index. See Barnett (1980) on the construction of Divisia aggregates and Barnett (2012) for a survey of problems that arise with the use of the official simple-sum monetary aggregates reported by central banks.

framework is adopted to examine whether setting a path for the money supply might allow the BoE to target nominal GDP.

### **The Analytical Framework**

The P-star model proposed by Hallman, et al. (1991) expressed the Equation of Exchange as:

$$(1) P^*_t = (M_t V^*_t) / Q^*_t.$$

where  $P^*_t$  is the long-run target value for the price level at time  $t$ ,  $M_t$  is the chosen measure of the money supply,  $V^*_t$  is the long-run equilibrium value for velocity, and  $Q^*_t$  is the value for potential real GDP at time  $t$ . Apart from errors in the measurement of the simple sum monetary variable, the P-star model soon failed because the original study ignored slow-moving trends in velocity that undermined any relationships based on (1).<sup>2</sup> Moreover, Orphanides and van Norden (2002) identified problems associated with estimating a value for potential GDP in real time and discussed how implementation of a policy rule with this term would be problematic. A finding of reverse causation between money and prices led Hall and Milne (1994) to reject the P-Star model for the UK because this invalidated the basic relationship underlying the model.

For purposes of nominal GDP targeting, the terms in (1) can be re-arranged as:

$$(2) Y^*_t = M_t V^*_t,$$

where  $(Y^*_t)$  is a long-run target value for nominal GDP that is related to the behavior of a monetary aggregate ( $M_t$ ) and an estimated value for that aggregate's trend velocity ( $V^*_t$ ). In this form, any issues associated with estimating potential output are avoided but questions about the choice of an appropriate monetary aggregate and the accommodation of any slow-moving trends in velocity remain. Nonetheless, if these two empirical issues can be dealt with, the

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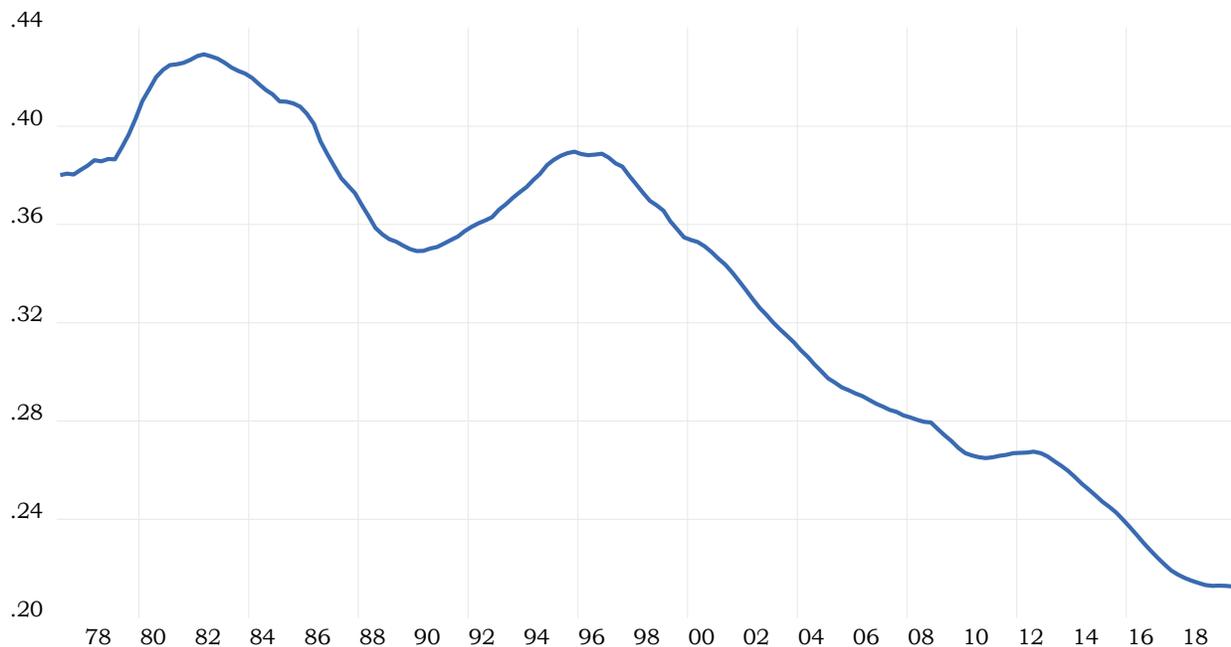
<sup>2</sup> Orphanides and Porter (2000) reported that the conclusions of Hallman, et al. (1991) for the original P-star model are restored when, instead of assuming velocity is constant, it is allowed to vary via estimation of a forecasting equation.

nominal GDP variant of the P-star model may offer a means by which the BoE could achieve a target value for nominal spending even when the zero lower bound constraint is binding. The viability of this approach is examined below.

### The Data

The monetary series used in equation (2) is a Divisia aggregate that encompasses the UK's Household and Private Non-Financial Corporation sectors (H-PnFC). The data are discussed by Berar (2013) and are available at the BoE website. This aggregate's trend velocity, calculated by the one-sided Hodrick-Prescott filter discussed by Stock and Watson (1999), is shown in Figure 1. In addition to its ability to capture any slow-moving trends in velocity, this version of the H-P filter requires no out-of-sample information and, as such, any policy rule that includes  $V^*$  can be implemented in real time. The velocity of this measure of the money supply displays a relatively smooth and declining trend since the late 1970s.

Figure 1. Trend Velocity: Divisia H-PnFC



## Evaluating the Performance of a Rule Based on Money

To examine whether a policy rule based on (2) will guide nominal spending toward a target path, we follow the strategy employed by Hallman, et al. (1991) and regress the change in nominal spending growth on four of its own lags and the lagged value of the nominal income gap. This gap is defined as the difference between the natural logarithms of the target ( $Y^*_t$ ) and actual ( $Y_t$ ) values for nominal spending. When expressed in logarithms, the target and actual values of nominal spending are represented by  $y^*_t$  and  $y_t$ .

The target value is determined by using a value of trend velocity ( $V^*_t$ ) generated by the one-sided H-P filter and the H-PnFC Divisia aggregate on the right-hand side of equation (2). A positive and significant coefficient for the gap variable indicates that the goal variable accelerates when its target value is greater than the actual value and, conversely, that nominal spending growth will tend to decline when the target value is below the actual value. Quarterly changes in nominal GDP growth are multiplied by 400 so that they are expressed in annualized percentage points. Values for the nominal GDP gap variable are multiplied by 100 so that they are measured in percentage points. In the interest of space, the regression's constant term is not reported.

When estimated over a 1978.3 through 2019.4 sample of quarterly data, the coefficients (t-statistics) are:

$$\begin{array}{cccccc} \Delta^2 y_t = & -0.754\Delta^2 y_{t-1} & -0.460\Delta^2 y_{t-2} & -0.241\Delta^2 y_{t-3} & -0.092\Delta^2 y_{t-4} & +0.591(y^*_{t-1} - y_{t-1}) \\ & (10.0) & (5.0) & (2.6) & (1.2) & (4.0) \end{array}$$

The large, positive, and significant coefficient for the lagged value of the nominal income gap indicates that nominal spending accelerates when the gap is positive and decelerates when the gap is negative. When the money supply is constructed from economic principles of aggregation and trend velocity is allowed to vary over time, the results imply that application of the P-star model and appropriate adjustments in the quantity of money will guide the actual value of nominal GDP to its long-run target as defined in (2). Belongia and Ireland (2015,

2021), using Divisia monetary aggregates and estimates of trend velocity from the Hodrick-Prescott filter, found similar results for the United States and Euro Area. When the change in the growth rate of NGDP for the UK is replaced with the change in the inflation rate, as in the original P-star model, the results indicate inflation will not converge to its target value.

### **Identifying a Target Path for Money**

To identify a path for money consistent with a goal for nominal income, the Equation of Exchange is re-arranged as:

$$(3) M^*_t = Y^{T_t}/V^*_t$$

where ( $Y^{T_t}$ ) is the target value for nominal GDP and  $V^*_t$  is the estimate of trend velocity. Thus, with values for trend velocity used earlier and a given target path for nominal spending in hand, a central bank should be able to calculate values for the money supply consistent with this target.

If the target value of NGDP in (3) is represented as its trend, the difference between the target path for the money supply implied by (3) and its actual value can be labelled as a money gap.<sup>3</sup> By illustrating how much the money supply has deviated from its target, the money gap allows inferences to be made about whether the stance of policy was too restrictive or expansionary relative to a value consistent with a target path for nominal spending.

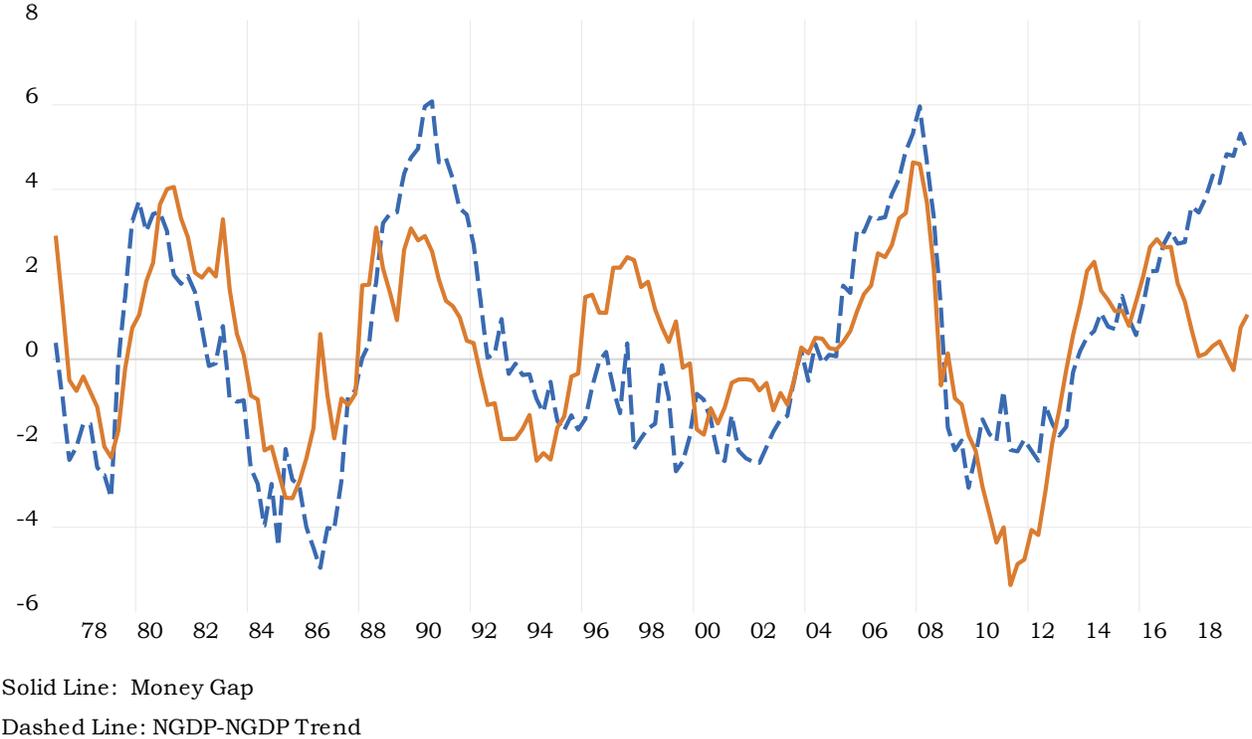
Figure 2 plots the percentage point differences between the actual and target values for the money supply and nominal spending. Although both series display considerable variation over time, the figure shows that changes in the stance of monetary policy, as represented by deviations of money from its target, move closely with deviations of nominal GDP from its target (correlation = 0.68). Tests of Granger causality also indicate causation running from the money gap to variations in the difference between actual and target values on nominal GDP.

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<sup>3</sup> The trend was determined by regressing nominal GDP on a constant, a time trend, time squared and time cubed over a period spanning 1977.1 through 2015.4 and then extrapolated through 2019.4.

Beyond merely achieving a target value for NGDP, it appears as if a smoother path for the money supply could reduce the volatility of NGDP as well.

Figure 2. Deviations of NGDP from Target and Money Gap



**Conclusion**

The evidence presented suggests the BoE could use the quantity of money to stabilize nominal GDP around a target path were it to adopt that goal in lieu of its current objective of two percent inflation. Crucially, the potential success of such a policy depends on the ability to track variations in trend velocity and measure the money supply in a manner consistent with the principles of monetary aggregation developed by Barnett (1980).

## References

Barnett, William A. "Economic Monetary Aggregates: An Application of Index Number and Aggregation Theory." Journal of Econometrics 14 (September 1980): 11-48.

Barnett, William A. Getting It Wrong: How Faulty Monetary Statistics Undermine the Fed, the Financial System, and the Economy. Cambridge: MIT Press, 2012.

Bean, Charlie. "Nominal Income Targets: Old Wine in a New Bottle." Speech Delivered at the Institute for Economic Affairs Conference on the State of the Economy, London 27 February 2013. <https://www.bankofengland.co.uk/-/media/boe/files/speech/2013/nominal-income-targets-an-old-wine-in-a-new-bottle.pdf>

Belongia, Michael T. "Measurement Matters: Recent Results from Monetary Economics Reexamined." Journal of Political Economy 104 (October 1996): 1065-1083.

Belongia, Michael T. and Peter N. Ireland. "A 'Working' Solution to the Question of Nominal GDP Targeting." Macroeconomic Dynamics 19 (April 2015): 508-534.

Belongia, Michael T. and Peter N. Ireland. "Strengthening the Second Pillar: A Greater Role for Money in the ECB's Strategy." Applied Economics (forthcoming) 2021.

Berar, Raiveer. "Improvements to Divisia Money Series." Bank of England. 30 August 2013.

Frenkel, Jeffrey. "The Death of Inflation Targeting." VoxEU/CEPR. 19 June 2012. <https://voxeu.org/article/inflation-targeting-dead-long-live-nominal-gdp-targeting>

Goodhart, Charles, Melanie Baker and Jonathan Ashworth. "Monetary Targetry: Might Carney Make a Difference?" VoxEU/CEPR 22 January 2013. <https://voxeu.org/article/monetary-targetry-might-carney-make-difference>

Hall, Stephen G. and Alistair Milne. "The Relevance of P-Star Analysis to UK Monetary Policy." The Economic Journal 104 (May 1994): 597 – 604.

Hallman, Jeffrey J., Richard D. Porter and David H. Small. "Is the Price Level Tied to the M2 Monetary Aggregate in the Long Run?" American Economic Review 81 (September 1991): 841-858.

Hendrickson, Joshua R. "Redundancy or Mismeasurement? A Reappraisal of Money." Macroeconomic Dynamics 18 (October 2014): 1437-1465.

Orphanides, Athanasios, and Richard Porter. "P\* Revisited: Money-Based Inflation Forecasts with a Changing Equilibrium Velocity." Journal of Economics and Business 52 (January-April 2000): 87-100.

Orphanides, Athanasios and Simon van Norden. "The Unreliability of Output-Gap Estimates in Real Time." Review of Economics and Statistics 84 (November 2002): 569-583.

Stock, James H. and Mark W. Watson. "Forecasting Inflation." Journal of Monetary Economics 44 (October 1999): 293-335.