Nominal GDP as a Practical Guide to the Stance of Monetary Policy

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I. Introduction

Nominal GDP (NGDP) targeting has received a lot of attention over the past decade. This note provides a brief review of the key arguments for NGDP targeting and then presents some practical ways to use NGDP in conduct of U.S. monetary policy. Specifically, this note shows how to construct benchmark growth paths for NGDP that can help the Fed assess the stance of monetary policy. The note then demonstrates how these measures can be used to create a Taylor rule and a McCallum rule that do not require knowledge of unobservable variables like the natural interest rate or the output gap. These NGDP-based measures are shown to provide reasonable monetary policy prescriptions over the past few decades and suggest they could serve as a useful cross check on other monetary policy metrics that require natural rate estimates.

Summary of Arguments for NGDP Targeting

What should be the target of monetary policy? A growing number of observers over the past decade have been making the case that it should be NGDP level targeting (NGDPLT). Some see it as the next step in the evolution of monetary policy regimes since it avoids much of the confusion inherent to inflation targeting (Frankel, 2012; Beckworth, 2014; Sumner, 2014; Garin et al., 2016).[1] Others have made the case for NGDPLT based on the desirable commitment properties its creates in the face of a zero lower bound (ZLB) environment (Woodford, 2012; Summers, 2018). NGDPLT can similarly be seen as a velocity-adjusted money supply target that is effective in escaping the ZLB (Belongia and Ireland, 2015; 2017). Others view NGDPLT as way to improve risk-sharing between debtors and creditors and thereby improve financial stability (Koenig, 2013; Sheedy, 2014; Bullard, 2018). Finally, some see NGDPLT as a workaround to the knowledge problem in monetary policy. There is no need to have real-time knowledge of natural-rate variables such as the output gap in this framework (McCallum, 2011; Beckworth, 2017a; Beckworth and Hendrickson, 2018)[2].

The knowledge problem argument for NGDPLT is especially topical given the Phillis curve confusion over the past few years created by the simultaneous appearance of low inflation rates and low unemployment rates. As noted by Fed Chair Jay Powell (2018), the key "navigating stars" used by the FOMC—the natural real interest rate (r*) and the natural rate of unemployment (u*)—seem to be highly uncertain and hard to pin down in recent years. NGDPLT, on the other hand, only requires monetary policy to guide the level of nominal expenditures along its targeted growth path. There is no need to know potential GDP or any

[1] Along these lines, Sumner (2011) and Beckworth and Ponnuru (2016a, 2016b) argue the Fed inadvertently tightened policy during 2008 because of misguided inflation concerns. Likewise, Beckworth (2017b) contends the ECB tightened for the same reasons. Had the Fed and ECB been doing NGDPLT, these policy mistakes could have been avoided.

[2] Other, slightly older, papers in this vein include McCallum and Nelson (1998) and McCallum (1999).

other of the navigating stars in real time.[3] Moreover, data revisions need not be a major problem for NGDPLT as current NGDP estimates are not necessary to implement this monetary regime as shown later.

This note, however, is not about implementing NGDPLT per se. Rather, it shows how NGDP can be operationalized to help assess the stance of monetary even if NGDP is not being directly targeted. The measures constructed in this note provide useful cross-checks on other monetary policy metrics that require natural rate estimates. In sections that follows, these measures are explained and derived.

II. Estimating Benchmark Growth Paths for NGDP

To operationalize total dollar spending as a practical tool for monetary policy, this section estimates two benchmark growth paths for NGDP. These benchmark paths can be viewed as the neutral-dollar level of NGDP. Consequently, deviations of actual NGDP around these benchmark paths provides a measure of the stance of monetary policy. For robustness sake, the two benchmark paths are estimated from very different motivations.

The first benchmark growth path for NGDP is motivated from a "sticky forecast" perspective. The idea here is that the public makes many economic decisions based on a forecast of their nominal incomes. For example, households may take out a 30-year mortgage based on an implicit forecast of their nominal income over this horizon. The actual realization of nominal income may turn out to be very different than expected, but the households may not be able to quickly adjust their plans given sticky debt contracts and other commitments that constrain them. Consequently, the consequences of previous forecasts are often binding on them and slow to change. To capture this "sticky forecast" characteristic, a five-year forecast is created that only gradually changes as time progresses. Five years are chosen since it assumed that all constraints created by decisions based on the forecast can be reconfigured within five years.

The second benchmark path for NGDP is based on the idea that there is a full-employment level of NGDP. It takes the average output gap from multiple sources and uses it in a rolling regression to estimate a full-employment measure of NGDP. This measure, therefore, is motivated from a natural-rate perspective. Since the point of this note is to operationalize NGDP without relying on unobservable natural rate variables like output gaps, this benchmark path is created as a robustness check against the sticky forecast benchmark path. If the sticky forecast measure is reliable, it should at least be consistent with a full-employment measure of NGDP.

Estimating the Sticky Forecast Benchmark Path

To estimate the sticky forecast dollar benchmark path for NGDP, this note uses a weighted forecast of NGDP. Specifically, this measure is constructed using the Philadelphia Federal Reserve's *Quarterly Survey of Professional Forecasters* (SPF) and is constructed in the following steps.

First, for every quarter beginning in 1992 a five-year growth forecast (20 quarters) is created

[3] Contrary to some claims, this is a feature not a bug of NGDPLT (Beckworth, 2018).

using the short-run NGDP growth forecasts as well as the implicit long-run NGDP growth forecasts in the SPF. The short-run growth forecasts are provided for the first five quarters (t+1 to t+5) in the survey. The 10-year CPI inflation and 10-year real GDP growth SPF forecasts are combined into a long-run NGDP growth forecast from which is extracted an annual average NGDP growth forecast. This annual average forecast is then used for all the remaining 15 quarters (t+6 to t+20). Together, these series provide 20 quarters of forecasted NGDP growth as outlined in the table below.[4]

Forecast	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9	t+10
Source	SPF SR	SPF SR	SPF SR	SPF SR	SPF SR	SPF LR	SPF LR	SPF LR	SPF LR	SPF LR

Forecast	t+11	t+12	t+13	t+14	t+15	t+16	t+17	t+18	t+19	t+20
Source	SPF LR	SPF LR	SPF LR	SPF LR	SPF LR	SPF LR	SPF LR	SPF LR	SPF LR	SPF LR

Second, for a given starting period, these NGDP growth forecasts are then used to create a 20-quarter forecasted path of the dollar level of NGDP. For example, using the 1991Q4 NGDP value of $6.264 trillion as the starting value, the next 20 quarters (i.e. 1992Q1-1996Q4) of NGDP in dollars are forecasted. Then, using the actual 1992Q1 value of $6.363 trillion, the next twenty quarters (i.e. 1992Q2-1997Q1) NGDP in dollars are forecasted. These forecasts are created for every period up to the present.

Third, the next step is to recognize that starting with 1996Q4 there are 20 overlapping dollar NGDP forecasts for every quarter forecasted. To capture the "sticky forecast" idea, this note takes all of these 20 forecasts and averages them into a weighted dollar forecast. This averaging is repeated for every forecasted period so that a new weighted dollar NGDP forecast time series is created. This new time series is used as the sticky forecast benchmark path. Formally, it can be stated as follows:

$$NGDP_t^{weighted\ forecast} = \frac{\sum_{i=1}^{20} NGDP_{t-i}^{SPF\ forecast\ (t)}}{20}. \quad (1)$$

As noted above, the reason for averaging the overlapping dollar forecasts for a particular period is that even though forecasts get updated every quarter, their effects do not get updated so quickly. For example, someone purchasing a home in 1992Q1 took out a 30-year mortgage based on a forecast of his nominal income over this horizon. His nominal income may turn out to be very different than expected, say in the case of a job loss, but he may not be able to quickly sell his house or move because of family commitments. Consequently, by averaging over a five-year period we are capturing the lingering effects of past nominal income forecasts along with those of more recent forecasts. After five years, it is assumed there are no more lingering effects of past forecasts. Put differently, after five years any shocks to expected nominal income are assumed to be worked out.

Estimating the Full Employment Benchmark Path

The second NGDP benchmark path is an estimated full-employment level of NGDP or $NGDP_t^{FE}$. It is based on the notion that the output gap—the difference between the actual and full-

[4] The sample starts in 1992Q1 because that is the first quarter that the long-term CPI and real GDP forecasts are available in the SPF. Consequently, this benchmark NGDP measure only begins in 1997:Q1.

employment level of economic activity—is a consequence of there being too much or too little aggregate demand. Since NGDP is a measure of aggregate demand, we can state this relationship as follows:

$$\ln(NGDP_t) - \ln(NGDP_t^{FE}) = \pi_t output\ gap_t, \quad (2)$$

where $NGDP_t^{FE}$ is the full employment measure of NGDP and π_t is a time-varying parameter. Equation (2) says the output gap is related to the NGDP Gap at time *t* via the parameter π_t. Note that equation (2) can be rearranged into the following:

$$\ln(NGDP_t) = \ln(NGDP_t^{FE}) + \pi_t output\ gap_t. \quad (3)$$

Since $NGDP_t^{FE}$ is time-varying, we can estimate it in a rolling regression of the form

$$\ln(NGDP_t) = B_{0,t} + B_{1,t} time_t + B_{2,t} time^2{}_t + B_{3,t} output\ gap_t, \quad (4)$$

where the term $(B_{0,t} + B_{1,t} time_t + B_{2,t} time^2{}_t)$ equals $NGDP_t^{FE}$. This approach allows $NGDP_t^{FE}$ to be time-varying and non-linear. The rolling regression is estimated using quarterly data with a rolling window of 40 observations.

The average of the the IMF's output gap, the OECD's output gap, the CBO's output gap, the Blanchard-Quah output gap, and the Hodrick-Prescott filtered output gap measures are taken to get a consensus output gap estimate.[5] This average output gap is included with the natural log of NGDP and the two time variables in the rolling regression outlined above. The resulting $B_{0,t}$, $B_{1,t}$, and $B_{2,t}$ parameters can then be used to construct $NGDP_t^{FE}$.

Estimated Benchmark Path Results

Figure 1 below shows the results for the estimated benchmark paths. The top panel shows the benchmark paths in dollar levels while the lower panel shows the implied percent deviations. The percent deviations can be viewed as a "NGDP gap".

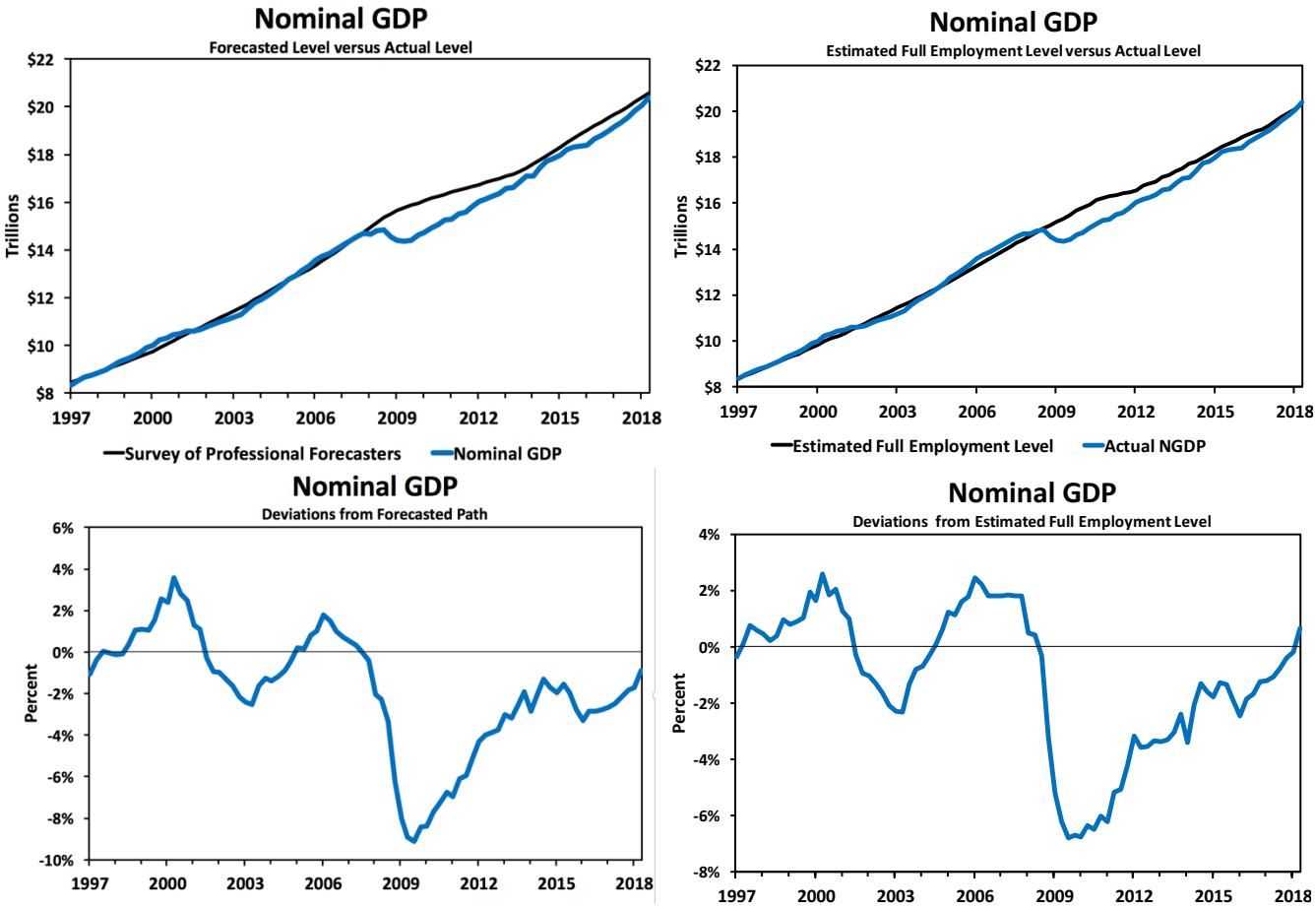
The figure reveals that the benchmark paths, though not identical, are very similar. Both indicate the stance of monetary policy was somewhat loose in the late 1990s and early-to-mid 2000s. It then turned relatively tight in 2008 and has slowly returned to neutral levels. The sticky forecast benchmark path, specifically, indicates there is still a little bit of tightness left in monetary policy, while the full employment benchmark suggests monetary policy is a little bit loose. Both, however, indicate monetary policy is close to neutral.[6]

That these results are so similar but come from very different approaches suggest there is something important being captured here. Moreover, that these results tell a reasonable story suggest these benchmark paths of NGDP provide valuable insight into the stance of Fed policy.

[5] The HP filter uses a standard 1600 weight for the quarterly frequency. The IMF and OECD output gaps are on annual basis and have to be interpolated. Finally, the Blanchard-Quah estimate of potential real GDP is estimated in a vector autoregression using 5 lags over the period 1949Q1 to the present.

[6] That both measures show that U.S. monetary policy has been effectively too tight for most of the past decade is consistent with Beckworth and Ramesh (2018) who shows that the NGDP growth rate has undergone a trend change since 2009.

Figure 1: NGDP Benchmark Paths



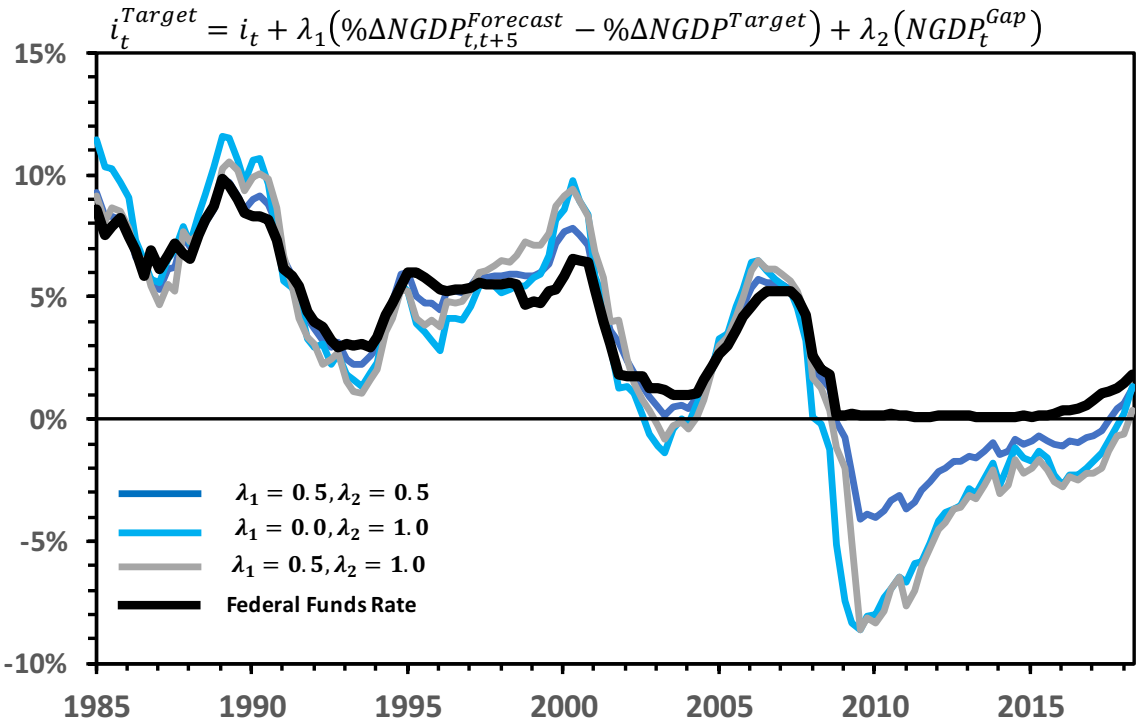
III. A Practical NGDP-Based Taylor Rule

The above analysis indicates the sticky forecast path for NGDP and its implied NGDP gap, which do not depend on any natural rate estimate, are informative measures that could be useful for Fed policymaking. These measures can be further utilized in a Taylor-like rule that targets NGDP growth and aims to close the NGDP gap. The proposed rule is as follows:

$$i_t^{Target} = i_t + \lambda_1\left(\%\Delta NGDP_{t,t+5}^{Forecast} - \%\Delta NGDP^{Target}\right) + \lambda_2\left(NGDP_t^{Gap}\right), \qquad (5)$$

where i_t^{Target} is the interest rate target the Fed sets, i_t is a market interest rate, $\Delta\%NGDP_{t,t+5}^{Forecast}$ is the forecasted NGDP growth over the next year, $\Delta\%NGDP^{Target}$ is the NGDPLT growth rate, and $NGDP_t^{Gap}$ is the percent deviation between the actual and sticky forecast benchmark NGDP path seen in the bottom panel of Figure 1. Like the sticky forecast measure, the $\Delta\%NGDP_{t+5}^{Forecast}$ comes from the *Survey of Professional Forecasters.* The 1-year treasury yield is used for i_t. The $\Delta\%NGDP^{Target}$ is set to 5.5 percent for 1985-2008 and 4 percent for 2009-2018 to reflect the actual trend NGDP growth rates allowed by the Fed.

Figure 2: A NGDP-Based Rule for Monetary Policy



Note that this monetary policy rule *does not require* any natural rate estimates or any current measures of NGDP that are subject to revision. There are no guessing games about the natural rate of interest or the output gap. Figure 2 above shows the implied interest rate target from this rule using different weights for λ_1 and λ_2.

This rule, which focuses on potential future misses from target and on past non-neutral misses in the NGDP growth path, puts the Fed's targeted interest rate not too far from other standard Taylor rules.[7] Depending on what weights are used for λ_1 and λ_2, this rule says U.S. monetary policy has set its target interest rate either just about right or slightly too high.

The big difference, though, between this and other rules is that this one only requires the 1-year treasury yield and the quarterly data from the *Survey of Professional Forecasters*. Again, no need for natural rate estimates. Moreover, if desired, this rule could be calculated on a monthly frequency by the Fed as there are monthly estimates of both NGDP and monthly NGDP forecasts.

IV. A Practical McCallum Rule

Another application of the NGDP benchmark path is McCallum's (1984, 1987) widely-cited nominal income targeting rule.

[7] See, for examples, the monetary policy rules posted at the Federal Reserve Board of Governor's website: https://www.federalreserve.gov/monetarypolicy/policy-rules-and-how-policymakers-use-them.htm.

$$\%\Delta b = \%\Delta NGDP^{Target} - \%\Delta V_t^{Forecast} - \lambda_1\left(NGDP_t^{Gap}\right), \quad (6)$$

where $\%\Delta b$ is the growth rate of the monetary base, $\%\Delta NGDP^{Target}$ is as before, and $\%\Delta V_t^{Forecast}$ is the average annualized growth rate of the monetary base velocity over the past four years. This latter measure is used as a forecast for the current period's velocity growth. This rule, then, has the monetary base growing at the rate of the NGDPLT target plus additional growth to offset both expected velocity growth and non-neutral deviations of NGDP from its sticky forecast benchmark path. This rule received a lot attention in the past when the U.S. monetary base was simpler, but has received less notice over the past decade given the large expansion of the Fed's balance sheet and the introduction of interest on excess reserves. These innovations lead to a very distorted view of the stance of monetary policy if one plugs in the headline monetary base and its velocity to this rule.

There is, however, a way to operationalize the McCallum rule if one distinguishes between permanent and temporary increases in the monetary base. The Fed signaled from the beginning of its large-scale asset purchase programs that the expansion of its balance sheet was temporary. The Fed is still committed to an eventual wind down that will put its balance sheet roughly in line with the sum of the secular growth in currency demand and some relatively small but unknown amount of reserves. (Bonis et al., 2017). As shown in Beckworth (2017c), this distinction between monetary base injections expected to be permanent and those expected to be temporary is important in determining the level of nominal demand.

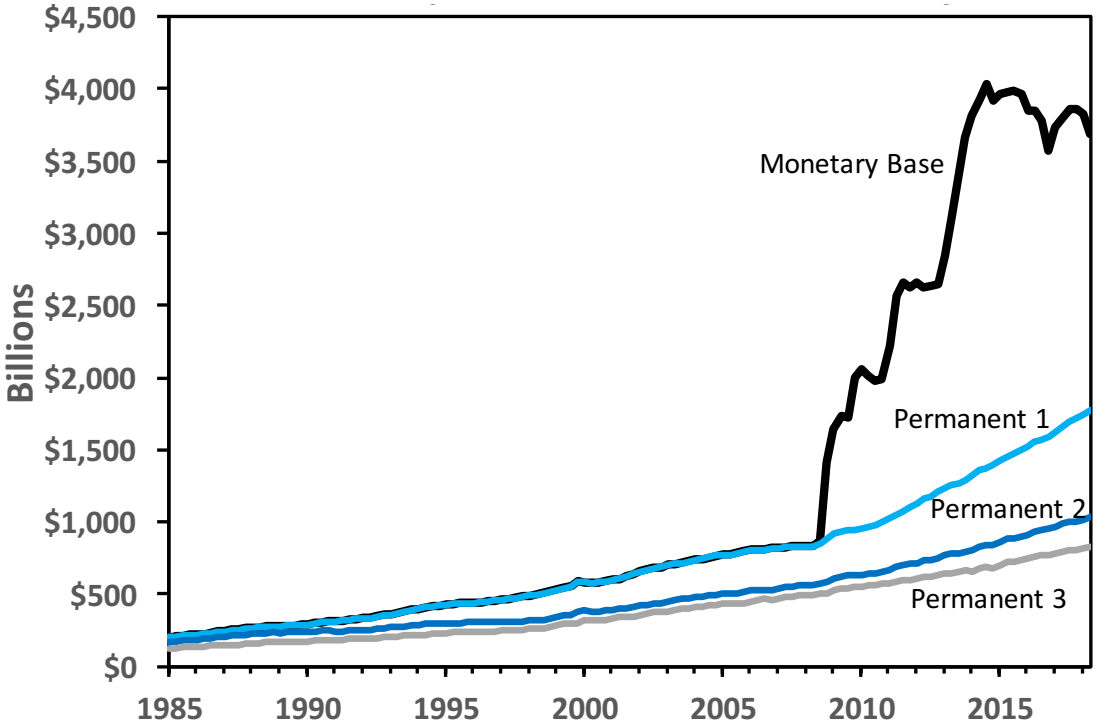
The implications for a McCallum rule that targets the level of NGDP is that one should look at permanent changes to the monetary base when quantifying this rule. The permanent portion is measured three ways in this note: (1) the monetary base less excess reserves, (2) the monetary base less excess reserves less currency held abroad, and (3) total currency less currency held abroad. All three measures are depicted in Figure 3. These first measure eliminates what is supposed to be a temporary component over the long run—excess reserves—but keeps required reserves. The second measure narrows the first one down by eliminating U.S. dollars abroad as measured by *U.S. Financial Accounts*. Finally, the third measure looks just at the domestic currency portion of the monetary base. All of these arguably provide some approximation to the permanent portion of the monetary base.

The McCallum Rule is constructed separately using each of these three measures. Like before, the $\Delta\%NGDP^{Target}$ is set to 5.5 percent for 1985-2008 and 4 percent for 2009-2018. The average prescribed growth that comes out of these three versions of the McCallum Rule is then taken for three different values of λ_1: 0.25, 0.50, 1.00. These averages are then subtracted from the average of the actual annualized average growth rates of the three monetary base measures.[8] The resulting "McCallum Rule gap" shows whether the permanent portion of the monetary base is gap is growing too slow (a negative value) or too fast (a positive value).

The results of this exercise are reported below in Figure 4. This figure shows that per the McCallum Rule the stance of monetary policy rather loose in the late 1990s, marginally loose in

[8] The growth rates are annualized quarter over quarter rates. Also, the five-center moving average is used to smooth the average growth rate.

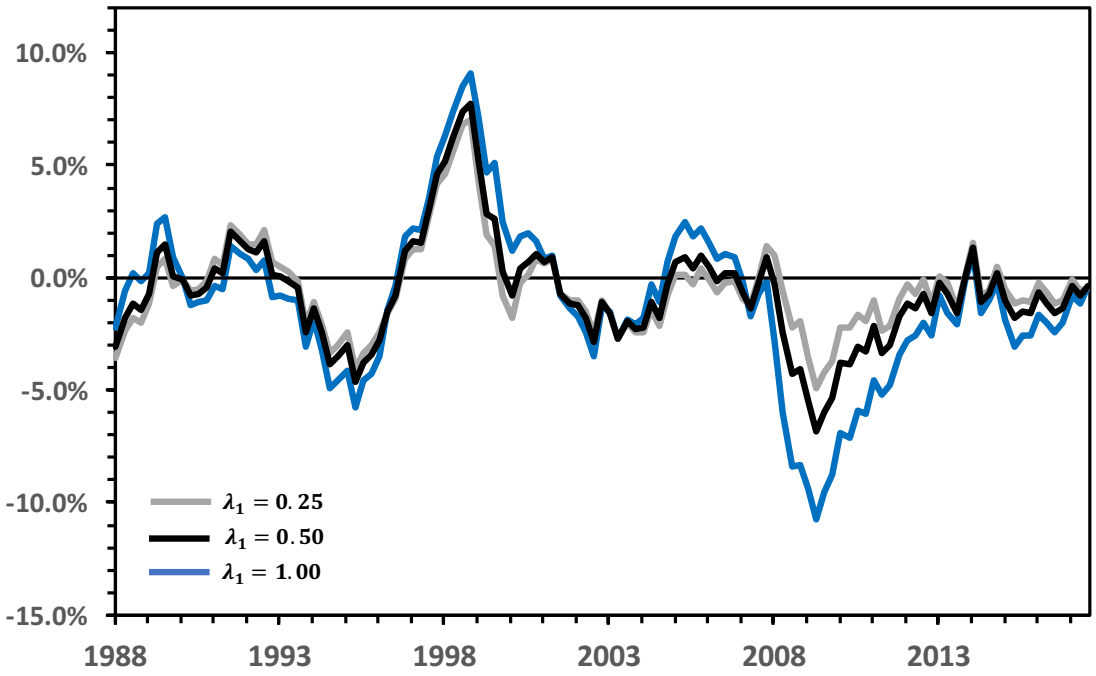
Figure 3: The Permanent Component of the Monetary Base



Permanent 1: Monetary Base minus Excess Reserves
Permanent 2: Monetary Base minus Excess Reserves minus Currency Abroad
Permanent 3: Total Currency minus Currency Abroad (i.e. domestic currency)

Figure 4: The McCallum Rule Gap

Actual minus McCallum Rule Growth Rate for the Monetary Base



the early-to-mid 2000s, and very tight from 2008-2012. Monetary conditions have slowly improved since then and now is close to neutral. This historical interpretation of the stance of monetary policy is reasonable and indicates the McCallum Rule properly quantified with the permanent portion of the monetary base can still be a useful metric for monetary policy.

V. Conclusion

This brief note has provided three practical ways to use NGDP to gauge the stance of monetary policy that does not require the use of any natural rate estimates. The metrics are the benchmark growth paths for NGDP, the NGDP-based Taylor Rule, and the McCallum Rule. These measures also are fairly robust to data revisions for several reasons. First, there is no use of current NGDP in any of the metrics. Second, if there are any definitional changes to NGDP that affect the entire time series they should affect the forecasted benchmark path proportionally since they are based off of forecasted growth rates.

These measures give the Fed additional tools for assessing the stance of monetary policy that are both easy to implement and appear robust over time. They should provide a useful cross check on other metrics that require natural rate estimates such as Phillips curves and traditional Taylor rules.

While this note has focused on three NGDP-based metrics, there have been other non-Phillips curve approaches to monetary policy that have been suggested recently: Sumner (2013) has called for NGDP futures targeting, Belongia and Ireland (2015, 2017) have made the case for the Fed to use the Divisia monetary aggregates as an intermediate indicator, and Hendrickson (2018) has argued for a labor standard. These approaches and those outlined in this note show that monetary officials like Fed Chair Jay Powell can still successfully guide monetary policy even if the traditional “navigating stars” are becoming harder to discern.

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