“On the Empirical (Ir)Relevance of the Zero Lower Bound Constraint: Comment”

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In 2008, for the first time since the Great Depression, the Federal Reserve encountered the zero lower bound (ZLB) on the nominal interest rate. The Fed’s target rate, the overnight federal funds rate, fell effectively to zero in the fall as the central bank’s emergency lending programs rapidly increased the supply of bank reserves. Then at its December 2008 meeting, the Federal Open Market Committee (FOMC), the Fed’s monetary policymaking body, formally set the target range for the funds rate at zero to 25 basis points—effectively zero. With the economy in freefall and little scope for additional rate cuts, the FOMC then turned to nonstandard policy tools, including forward guidance (communication about the likely or intended forward path of the policy rate) and large-scale asset purchases, also known as quantitative easing. Both tools were used actively during the Great Recession and the subsequent recovery.

Did the nonstandard tools work? The current consensus of central bankers and economists is that forward guidance and asset purchases eased financial conditions and supported the economy, with fewer adverse side effects than many predicted. Accordingly, these policies appear to have become permanent components of the monetary toolkit, both in the United States and abroad. However, the prevailing view also holds that the overall response of monetary policy was effectively constrained by the ZLB; that is, although nonstandard policies evidently mitigated the downturn, their use did not fully compensate for the inability of the Fed to cut short-term rates significantly further. This view, and the concern that in a world of low neutral interest rates future encounters with the ZLB may be frequent, has led the Fed and other central banks to actively consider new tools and new policy frameworks for dealing with the ZLB constraint.

In contrast to this prevailing view, however, a small literature has adduced indirect evidence to argue that the Fed’s response to the Great Depression was actually “normal,” despite the ZLB. In other words, according to this literature, by applying its nonstandard tools the FOMC was able to provide about the same amount of countercyclical stimulus as it would have if, hypothetically, the ZLB had not been binding. For example, Swanson and Williams (2014) find that two-year and five-year Treasury interest rates responded to economic data releases in a historically normal way during the ZLB period, especially prior to the FOMC’s strengthening of its forward guidance in August 2011. (At that meeting the FOMC announced its intention to hold rates at zero “through mid-2013,” implementing date-based forward guidance for the first time.) If the ZLB was effectively constraining the monetary policy response, these authors argue, the response of longer-term rates to economic news would instead have been attenuated. In another interesting paper, Wu and Xia (2015) infer the extent of monetary stimulus from the entire term structure rather than from the target funds rate alone. They use an affine term structure model to construct a “shadow” short-term interest rate, which can be negative, and find that, judging by the behavior of the shadow rate, U.S. monetary policy provided about the normal degree of stimulus despite the ZLB, especially later in the ZLB period (when the estimated shadow rate becomes significantly negative).
The present paper adds to the indirect evidence on the extent to which the ZLB limited the monetary response to the Great Recession. The authors perform several exercises comparing the volatility and dynamics of key macro variables during the recent ZLB episode to a non-ZLB period that includes the earlier “Great Moderation” era. Their intuition, confirmed in a simple model, is that, if the ZLB constrained monetary policy in the recent episode, then volatility should have increased, and macro dynamics changed, relative to the benchmark of the Great Moderation. Contrary to that prediction, they find that the behavior of key economic variables (including longer-term interest rates) did not change much in the ZLB period, implying that the ZLB was not an effective constraint on monetary policy. Needless to say, these findings are good news if true. If, even in the face of a very severe downturn, the Fed was able to overcome the ZLB and provide a normal degree of countercyclical stimulus, then concerns about future encounters with the ZLB may be overblown.

Before commenting on the paper’s results, I will add one suggestive result of my own. Figure 1 shows the pace of labor market recovery from recessions since 1960. The top panel of the figure shows the unemployment gap, the difference between the civilian unemployment rate and the Congressional Budget Office’s estimate of the natural rate of unemployment. Shaded lines show periods of recession. As the reader can observe, unemployment tends to lag the cycle, peaking later than output before declining.

![Figure 1](image1.png)

Panel A: Unemployment Gap

The bottom panel of Figure 1 shows the average quarterly change in the unemployment gap between the peak and the trough of the unemployment rate. As the figure shows, the pace of labor market recovery from the Great Recession was faster than in the previous two recessions and only modestly slower than the most severe prior postwar recessions, in 1973-75 and 1981-82. On this metric, then, the recovery from the Great Recession seems relatively normal, consistent with the conclusions of the present paper.
Fernald, Hall, Stock, and Watson (2017), who display a figure similar to my Figure 1, develop this point further.

Turning to the present paper, I consider two questions. First, the evidence presented by the authors, though interesting, is indirect and drawn from a single episode. How persuasive is it? Are there other plausible explanations for their findings? Second, the indirect evidence of this paper is silent about exactly how, and with what policies, the Fed overcame the ZLB constraint. It’s worth asking whether their findings are consistent with what we know about the effectiveness of nonstandard policies. Is it quantitatively plausible that, using forward guidance and asset purchases, the Fed was able fully to overcome the constraint posed by the ZLB?

On the first question, the paper’s comparison of the recent ZLB episode with the non-ZLB period is not a controlled experiment. It’s possible that the ZLB did constrain monetary policy, which all else equal would have led to the predicted changes in macro volatility and dynamics, but that other differences between the periods obscure the comparison. Here are some possible confounding factors: First, the Great Recession, which was caused by a severe financial crisis, may differ on important dimensions from previous postwar recessions (Ng and Wright, 2013). For example, consumption or investment may have been affected by adverse financial shocks in ways not typical in recession. Second, productivity growth was slow following the financial crisis; if the crisis suppressed variation in productivity as well, standard real-business-cycle arguments would suggest that cyclical dynamics would also be affected. Third, even if monetary policy was constrained by the ZLB, fiscal policy may have compensated, particularly early in the recovery. Finally, the authors’ finding that volatility was no higher in the ZLB episode than earlier could conceivably be the result of declining trends in volatility, unrelated to the ZLB or the Great Recession.

Table 1 below provides simple evidence on the first three of these possibilities. The table shows the ratio of standard errors of key macroeconomic variables during the ZLB episode (2009Q1-2015Q4) to the non-ZLB period (1984Q1-2018Q2 excluding the ZLB period and the Great Recession). The top five entries replicate (to a close approximation) the results of the authors’ Table 1, confirming their finding that these macroeconomic variables were less volatile during the ZLB episode than before, contrary to what we would expect if the ZLB had constrained monetary policy. The table shows the same comparison for five additional variables: personal consumption expenditures, nonresidential fixed investment, nonfarm business productivity, industrial production, and the full-employment federal deficit.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Ratio of standard errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>0.88</td>
</tr>
<tr>
<td>Hours</td>
<td>0.73</td>
</tr>
<tr>
<td>GDP deflator</td>
<td>0.89</td>
</tr>
<tr>
<td>Core CPI inflation</td>
<td>0.59</td>
</tr>
<tr>
<td>Core PCE inflation</td>
<td>0.49</td>
</tr>
<tr>
<td>PCE</td>
<td>0.71</td>
</tr>
<tr>
<td>Nonresidential fixed investment</td>
<td>0.85</td>
</tr>
<tr>
<td>Nonfarm business productivity</td>
<td>1.02</td>
</tr>
<tr>
<td>Industrial production</td>
<td>0.95</td>
</tr>
<tr>
<td>Full-employment federal deficit</td>
<td>1.34</td>
</tr>
</tbody>
</table>

Note: ZLB period is 2009Q1-2015Q4; non-ZLB period is 1984Q1-2018Q2 less ZLB period. The Great Recession, which covers the period
from 2008Q1-2009Q2, is excluded. All variables are in percent quarterly annualized growth rates with the following exceptions: Inflation rates are in percent levels and the full-employment deficit is a percent of potential GDP.

In brief, Table 1 does not provide evident support for the idea that unusual behavior of consumption or investment, arising perhaps from the unusual mix of shocks underlying this recession, can explain the relatively low volatility of the economy during the ZLB period. Rather, the volatility of consumption and nonresidential fixed investment behaved similarly to that of overall GDP. Nor is there evidence that differences in the behavior of productivity account for lower overall volatility, as the volatility of nonfarm business productivity growth is about the same in the ZLB period as in the non-ZLB period. There is, however, some evidence in Table 1 that fiscal policy was unusual during the recent episode: The standard error of the full-employment federal deficit (CBO) is 34 percent larger in the ZLB episode than during the non-ZLB period. A possible story is that expansionary fiscal policy, including major fiscal actions in 2009, compensated for constrained monetary policy early in the ZLB period. Later in the recovery fiscal policy became more restrictive, but monetary policy may also have been relatively more aggressive after say 2011, as suggested by the evidence in Swanson and Williamson (2014) and Wu and Xia (2015). In short, fiscal activism, rather than the irrelevance of the ZLB, may help explain why macroeconomic volatility did not increase.

Figure 2 below provides some evidence on the fourth possibility, that the relatively low volatility during the ZLB episode reflected longer-term volatility trends. The figure shows ten-year rolling standard deviations of annualized growth rates for five macro variables studied in the paper. Prior to 1994 the data include observations from before the Great Moderation and do exhibit a downward trend, but from 1994 on there is little evidence of a trend in volatility. The exception is core PCE inflation, whose volatility does decline over time, which may partially account for the low volatility of inflation variables in the ZLB episode. Otherwise, though, the authors’ result does not appear to be an artifact of longer-term volatility trends.

Figure 2
Ten-year rolling standard deviations of annualized growth rates
Continuing with an evaluation of the paper’s findings, I turn next to a basic prediction underlying the paper’s empirical test, that periods in which the ZLB constrains monetary policy will exhibit higher output and inflation volatility. The authors derive that prediction from a small calibrated macro model, under the assumption that monetary policy (if unconstrained) would follow a simple Taylor rule with an inertial interest-rate adjustment. To test the robustness of their analysis, in lieu of their small theoretical model, we used stochastic simulations of the Fed’s large-scale macro model, known as FRB/US. We conducted 500 simulations of the model using shocks drawn from the period 1970 – 2015. In each run the model was simulated for 200 quarters, with the first 100 quarters used to establish initial conditions, then discarded. For these simulations, agents were assumed to have model-consistent (essentially, rational) expectations. Importantly, the simulations also assume that the real neutral interest rate is 1 percent, so that the nominal neutral rate is about 3 percent. That assumption, common to recent studies of the effects of the ZLB, implies in these simulations that the ZLB is binding about one-third of the time. In contrast, the authors assume a 2 percent real neutral rate for their simulations, which in their model implies that the ZLB is binding only about 2 percent of the time. Our assumption seems the better one for studying the effects of the ZLB.

We performed the simulations for three alternative policy rules: 1) a standard Taylor rule with inertial rate adjustment; 2) the same Taylor rule, but in which the lagged interest rate is a shadow rate, allowed to be negative (the policy rate itself must be non-negative, however); and 3) a temporary price-level targeting (TPLT) rule with one-year lookback. Under the TPLT rule, the Fed is assumed to commit not to raise its target rate from zero until inflation over the past year is equal to or greater than the inflation target of 2 percent; away from the ZLB, policy is governed by an inertial Taylor rule. Bernanke, Kiley, and Roberts (2019) show that the TPLT rule with one-year lookback—essentially, an inflation threshold rule—performs well in FRB/US simulations when the neutral interest rate is low and the ZLB is, accordingly, a potential significant constraint. See that paper for more details on the simulation approach and the alternative policy rules.

Table 2 below shows the simulation results from FRB/US. For each policy rule, the table shows the relative volatility (ZLB versus non-ZLB periods) of the output gap and inflation, under assumptions to be specified in a moment. The last column shows the mean duration of ZLB episodes in the simulations under each policy assumption.

<table>
<thead>
<tr>
<th>Policy rule</th>
<th>Relative volatility (mean within-simulation)</th>
<th>Relative volatility (pooled simulation-periods)</th>
<th>Relative volatility (pooled simulation-periods, ZLB episodes of 24-32 quarters)</th>
<th>Mean ZLB duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Output Gap</td>
<td>Inflation</td>
<td>Output Gap</td>
<td>Inflation</td>
</tr>
<tr>
<td>Inertial Taylor</td>
<td>1.22</td>
<td>1.04</td>
<td>1.62</td>
<td>1.27</td>
</tr>
<tr>
<td>Inertial Taylor, w/ Shadow Rate</td>
<td>1.07</td>
<td>0.96</td>
<td>1.50</td>
<td>1.14</td>
</tr>
<tr>
<td>TPLT, 1-yr lookback</td>
<td>0.77</td>
<td>0.72</td>
<td>1.27</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Note: For each policy rule the table reports the ratio of the standard deviation of the output gap and demeaned inflation in ZLB periods to that in non-ZLB periods. The first two columns report the mean ratio across 500 simulations of 100 periods each. The second two columns report this ratio calculated for 50,000 pooled
simulation-periods. The next two columns report this ratio where the numerator is the standard deviation for the pool of ZLB periods in which the episode is between 24 and 32 quarters in length. Simulations assume agents have model-consistent expectations (MCE) and that $r^* = 1$ percent in real annual terms.

The first two columns of Table 2 calculate the relative volatilities by the same method as the authors do in their simulations. Specifically, we first calculate the relative volatilities of ZLB versus non-ZLB periods within each 100-period simulation, then average this ratio across the 500 simulations. For the baseline policy rule (inertial Taylor), the relative volatilities are lower than those found by the authors (compare their Table 3). For the Taylor rule with a lagged shadow rate, we find, like the authors, that volatility in ZLB and non-ZLB periods is about the same (see the authors’ Table 6). For the TPLT rule, volatilities are lower in the ZLB period.

The finding that, even under the baseline policy rule, simulated volatilities are not much greater during ZLB periods would appear to weaken a key premise of the paper. Indeed, for the baseline policy rule, we found that in more than half the simulations the observed relative volatilities for both inflation and the output gap were less than one, suggesting low power for tests based on these ratios. However, inspection of the simulation results also showed that the distribution of ZLB durations is highly skewed, with many episodes being very short; moreover, observed volatilities tend to be much higher for long ZLB episodes. These observations are illustrated by the third and fourth columns of Table 2, which show relative volatilities calculated by pooling the 500 simulations (yielding 50,000 simulation-periods). This means of aggregating effectively gives greater weight to longer ZLB episodes, leading to higher relative volatilities.

Since volatilities are correlated with the length of the ZLB episode, the right way to make an inference about the recent experience would seem to be to consider simulated episodes of similar length. The actual ZLB episode of the past decade was 28 quarters long, and so the fifth and sixth columns of Table 2 calculate volatilities, relative to all non-ZLB periods, of simulated ZLB episodes of between 24 and 32 quarters. We find that relative volatility of the output gap is well above one for all three policy rules, while inflation volatility is not much affected by the ZLB. These results seem qualitatively similar to those of the paper, except that the shadow-rate version of the Taylor rule does not reduce relative volatility of the output gap in our simulations as it does in those of the paper. We also find surprisingly high volatility of the output gap for the TPLT rule—surprising, because we know that that rule in general does a good job of overcoming the ZLB. One reason may be sample size: ZLB episodes in the range of 24-32 quarters are only about 3 percent of simulation-periods under the TPLT rule.

Overall, my investigation has not turned up any obvious reasons for the surprisingly low volatility of the ZLB period, other than the authors’ hypothesis that monetary policy was able to overcome much of the effect of the ZLB constraint. A possibility worthy of further investigation is that fiscal policy offset to some extent the effects of the ZLB on monetary policy. I also find in simulations that the duration and severity of ZLB episodes is highly skewed toward shorter and less-damaging episodes, which should be considered in assessing the power of this paper’s test.

My second broad question, which I’ll entertain here briefly, is whether the paper’s findings are consistent with the available direct evidence on the power of nonstandard monetary tools. There is something of a puzzle here. Consider for example the recent paper by Chung et al. (2019), which assesses the Fed’s current policy toolkit. Using the FRB/US model, this group of Federal Reserve authors examine the ability of forward guidance and asset purchases/QE, the Fed’s main nonstandard tools, to respond effectively to a deep recession scenario. Table 3 shows a few selected results from their paper.

| Table 3 |
| Simulation results from Chung et al. (2019) |
In their baseline scenario, Chung et al. (2019) assume that policy is described by an inertial Taylor (1999) rule, constrained by the ZLB. They calibrate the recessionary shocks so that, in their simulation of FRB/US, the unemployment rate peaks at 10 percent and inflation troughs at 0.75 percent (Table 3)—in other words, a deep recession broadly comparable to the Great Recession. They then calculate that, if short-term rates could go indefinitely negative (so the ZLB does not bind), the same shocks in FRB/US would produce a peak unemployment rate of about 8.5 percent and a trough inflation rate of about 1.5 percent. The differences from the baseline case—about 1.5 percentage points of unemployment and 0.75 percentage points of inflation at the extreme points—suggest that the costs of the ZLB constraint are high, at least in this simulation.

Can nonstandard policies overcome the ZLB constraint? Chung et al. (2019) examine this issue through simulations which incorporate such policies. Importantly, these authors assume that the nonstandard policies used are credible (they assume that agents in the model generally understand and believe the Fed’s policy promises), aggressive, and effective. For example, the results reported in Table 3 assume that the Fed can credibly promise to keep the short-term rate at zero at least until the unemployment rate falls to 3.5 percent. The quantitative easing program considered involves asset purchases of up to $85 billion per month, securities holdings that peak at 33 percent of GDP, and a reduction of the term premium on longer-term Treasuries by as much as 200 basis points. Overall, these assumptions are on the optimistic end of the conventional range of views about nonstandard policy effectiveness.

Do these policies make the ZLB irrelevant? As Table 3 suggests, in the Chung et al. (2019) simulations, forward guidance and asset purchases each reduce the simulated decline in inflation substantially, indicating that on this dimension perhaps a combination of the two policies would overcome the ZLB. However, for unemployment the outcome is not so good. Even added together, the two nonstandard policies appear able to reduce the peak unemployment rate by only about half of the effect of the ZLB (although they are collectively more effective at later stages of the recovery). The authors argue that lags in the effectiveness of nonstandard policies help explain their inability to fully offset the effects of the ZLB. In this regard, it’s interesting that the Wu and Xia (2015) estimate of the shadow rate does not fall much below zero for some time after the beginning of the ZLB period.

Of course, these results are specific to the FRB/US models and the choices the Fed authors use in their simulations. Still, to make more credible the present paper’s conclusion that the ZLB did not constrain monetary policy in the recent episode, future research will need to provide a more detailed accounting of the policies the Fed actually adopted during this period and how they could have plausibly offset the constraint imposed by the zero lower bound.
References


