BOARD OF GOVERNORS
OF THE FEDERAL RESERVE SYSTEM

MEMO

TO: Thomas Laubach DATE: October 26, 2015

FROM: Robert Tetlow[1]

SUBJECT: Implications of a Large, Temporary Appreciation of the Dollar, in Terms of r*

This memo is in response to a request for additional information about the quantitative implications for monetary policy of an appreciation of the foreign exchange value of the dollar. In light of the r* memos that were delivered to participants for the October 2015 meeting, and the associated questions that are being asked of participants, we study a large, persistent appreciation of the dollar for its implications for the path of r*. We focus here on two of the notions of r*. One is a short-run concept of r* defined as the rate at which policymakers would have to set the real policy rate, period by period, in order to completely offset the effects of the shock on the unemployment rate.[2,3] The second concept is a medium- or long-term one: the intercept shift in the Taylor rule that policymakers would choose in order to offset the medium- and longer-term implications of the shock to unemployment and inflation.[4] The short-run r* exercise encompasses all the policy actions that policymakers would ideally undertake, if they were concerned solely with offsetting the unemployment effects of the shock, and provided they thought they could convince the public of the path they would commit themselves to follow. By contrast, the medium-term concept used here is best thought of in terms of augmentations to a pre-existing regime governed by the Taylor (1999) rule. In this instance, policymakers who were already believed by the public to be following the Taylor (1999) rule would find, based on their knowledge of the large magnitude and duration of the exchange rate shock, that adhering to the

[1] James Trevino provided technical assistance in carrying out these simulations. Etienne Gagnon and Ed Herbst also helped.

[2] In what we do here, this corresponds to an optimal control policy where the loss function includes the usual quadratic penalty on the deviation of unemployment from the natural rate, and a minimal penalty on the change in the federal funds rate, but no penalty at all on inflation. This delivers a path for the real rate that differs from the optimal discretionary policy described in the memo delivered to the FOMC by Lopez-Salido, Gust, Johannsen and Tetlow in two respects: first, it closes the unemployment gap rather than the output gap, and second, it is a policy under commitment rather than discretion. We know that the former assumption makes no material difference to our results and have reason to believe that the latter makes only a small difference, at least in this instance.

[3] Of course, truly optimal policy would not take the Tealbook baseline as given and not, therefore, return a prescribed path for the real policy rate that would return the economy to baseline but would rather attempt to achieve a closed unemployment gap in every period. In order to isolate the effect of the shock of interest and thereby keep the experiment clean, we need to have policy do its best to return economic outcomes to baseline values, not ideal values.

[4] A memo by Gust, Lopez-Salido, Johannsen and Tetlow delivered to the FOMC for the October meeting and a memo on balance sheet reinvestment policies delivered to the FOMC for the September meeting by Erceg, Klee and Tetlow, both covered the magnitude of intercept shifts to a Taylor rule that would be necessary to offset certain shocks. The procedure here follows what was done in constructing Figure 2 in Erceg *et al.*

rule would be deficient in some way. Accordingly, they would promise to alter their policy, perturbing the Taylor rule by shifting its intercept by a nearly constant amount for a lengthy period of time, something that arguably would be relatively easy to communicate to the public.

The details of the simulations are as follows. We use the FRB/US model, with the same expectations assumptions that are employed in constructing the simple rules exhibits in the Monetary Policy Strategies (MPS) section of Tealbook B.[5] Except where otherwise noted, policy is assumed to be governed by the non-inertial Taylor (1999) rule, with either the fixed value for the intercept used in the Tealbook or one that shifts as described below. We use the October 2015 Tealbook staff forecast and policy path, including the balance sheet policies embedded therein, which we take to be fixed, as the baseline. The shock is a roughly 10-percent appreciation of the foreign exchange value of the U.S. dollar over 2 quarters, which fades out slowing following its onset in 2015:Q4. (The upper panel of Figure A, attached, shows the implications of the shock on the real exchange rate. We will turn to the lower panel shortly.)[6]

The results of the simulations are shown in Figure B. The black solid line is the Tealbook baseline. First, observe the red dashed lines, which show the results when policy follows the Taylor (1999) rule with a fixed intercept. As can be seen, while the Taylor rule responds in a broadly appropriate fashion to the shock—easing significantly—it nevertheless does not do a particularly good job of offsetting a shock that is this large and persistent. The baseline path for the unemployment rate cannot be seen as it is buried beneath the green line, but at its peak, the unemployment rate under the fixed-intercept Taylor rule is about 0.4 percentage point higher than in the baseline. The reason for this result is straightforward: Simple rules like the Taylor rule are designed to be effective for average or typical shocks, rather than being "customized" for any given shock. In particular, the output and inflation gap terms are designed and calibrated for shocks at business cycle frequencies.

The blue dotted lines show the implications of responding to the shock using the Taylor (1999) rule augmented by allowing the intercept term to shift downward by an almost-constant amount. (The shift in the intercept—or medium-run r* if you will—is shown in the bottom panel of Figure A.) This intercept adjustment, which is almost 60 basis points, has a salutary effect on the economy, offsetting the unemployment effects of the shock almost entirely. The intercept adjustment has this effect primarily because private agents understand that it defers liftoff, which generates somewhat higher expected (and actual) inflation, which in turn produces somewhat lower long-term real interest rates.

[5] That is, we assume that private agents' asset prices are model consistent as is wage-and-price setting. Expectations in other segments of the economy—consumption, investment and income—are assumed to be governed by a small-scale vector-autoregressive model (so-called "VAR-based expectations"). In our experience, having VAR-based expectations in these blocks is typically not very important for results for monetary policy experiments.

[6] An appreciation of the exchange rate such as this—one that is unaccompanied by shocks to other variables—is best thought of as an increase in the country risk premium, which encourages investors to favor the holding of dollar denominated assets. Results would differ for exchange rate shocks that were thought to originate from other sources.

Finally, the green solid lines shows the results when policymakers adjust the federal funds rate such that the real rate is equal to short-run r*, period by period. This is, as we noted, the optimal policy for policymakers who are concerned solely with the real-activity implications of the shock. This policy does not defer liftoff for as long as the intercept-adjusted Taylor rule, but it keeps the nominal funds rate lower for considerably longer than any of the alternatives. The accommodation provided is, however, largely a matter of timing as can be seen by the fact that for the first several years of the simulation this policy renders almost exactly the same real 10-year Treasury yield as does the intercept-adjusted Taylor rule.

To recap, a large and persistent shock to the exchange value of the U.S. dollar, something that would not be all that unusual by historical standards, can present challenges to policymakers that might induce them to depart from the policy reactions that might be regarded as normal for typical disturbances. We presented two alternative approaches, one based on short-run r*, which generates a path for the real rate of interest that is the optimal policy response, given certain preferences, and the other based on an idea of medium- or long-run r*--or more specifically a long-lasting shift in the intercept term of a Taylor rule. These two policy responses, to the extent that they are feasible and can be communicated clearly, improve on the results of following the Taylor (1999) rule without an intercept adjustment.

References:

Erceg, Christopher; Elizabeth Klee, Bernd Schlusche and Robert Tetlow (2015) "Alternative Approaches to Ending Reinvestment" memo distributed to the FOMC, September 8.

Gust, Christopher; David Lopez-Salido, Benjamin K. Johannsen and Robert Tetlow (2015) "r*: Concepts, Measures and Uses" memo distributed to the FOMC, October 13.

Lopez-Salido, David; Christopher Gust, Benjamin K. Johannsen and Robert Tetlow (2015) "Monetary Policy at the Lower Bound with Imperfect Information about r*" memo distributed to the FOMC, October 13.

Taylor, John B. (1999) "An Historical Analysis of Monetary Policy Rules" in John Taylor (ed.) *Monetary Policy Rules* (Chicago: University of Chicago Press): 319-347.

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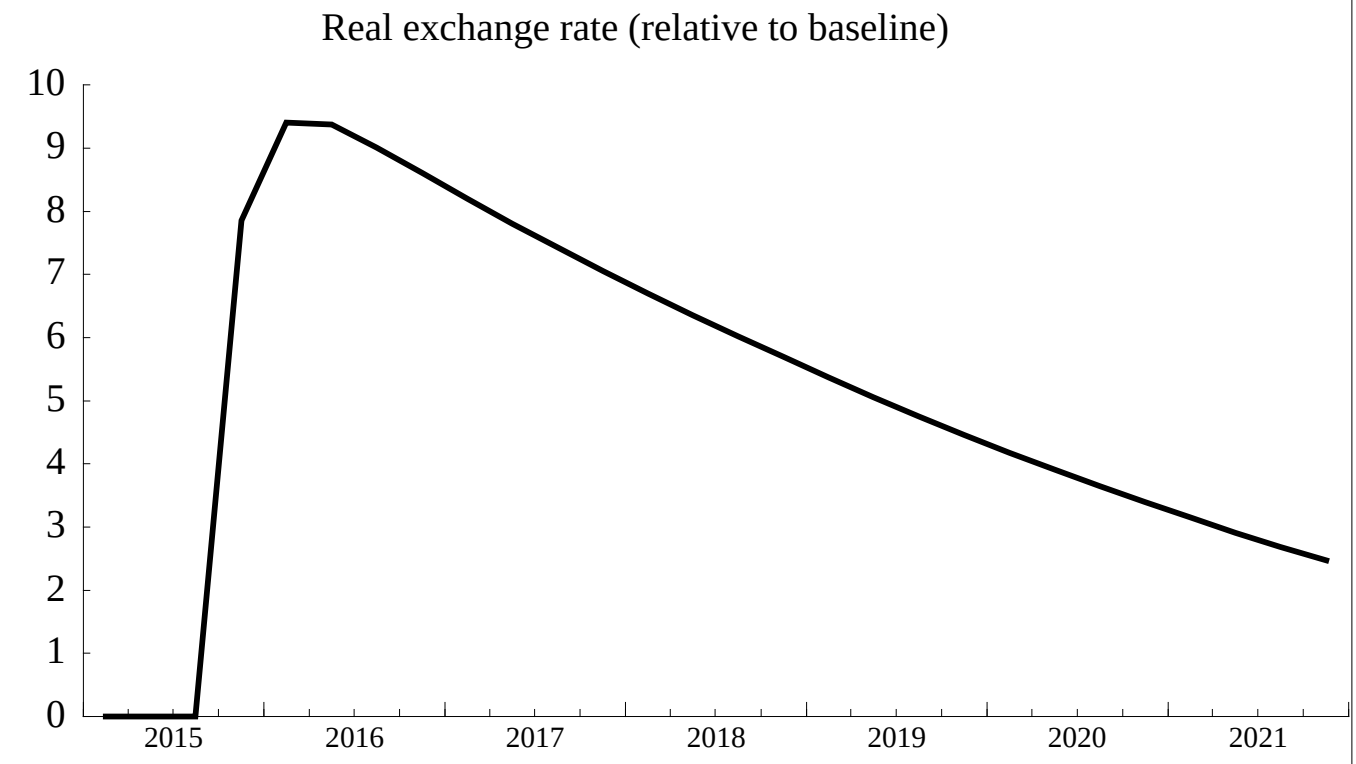
Figure A

The Exchange Rate Shock
(Real Terms)



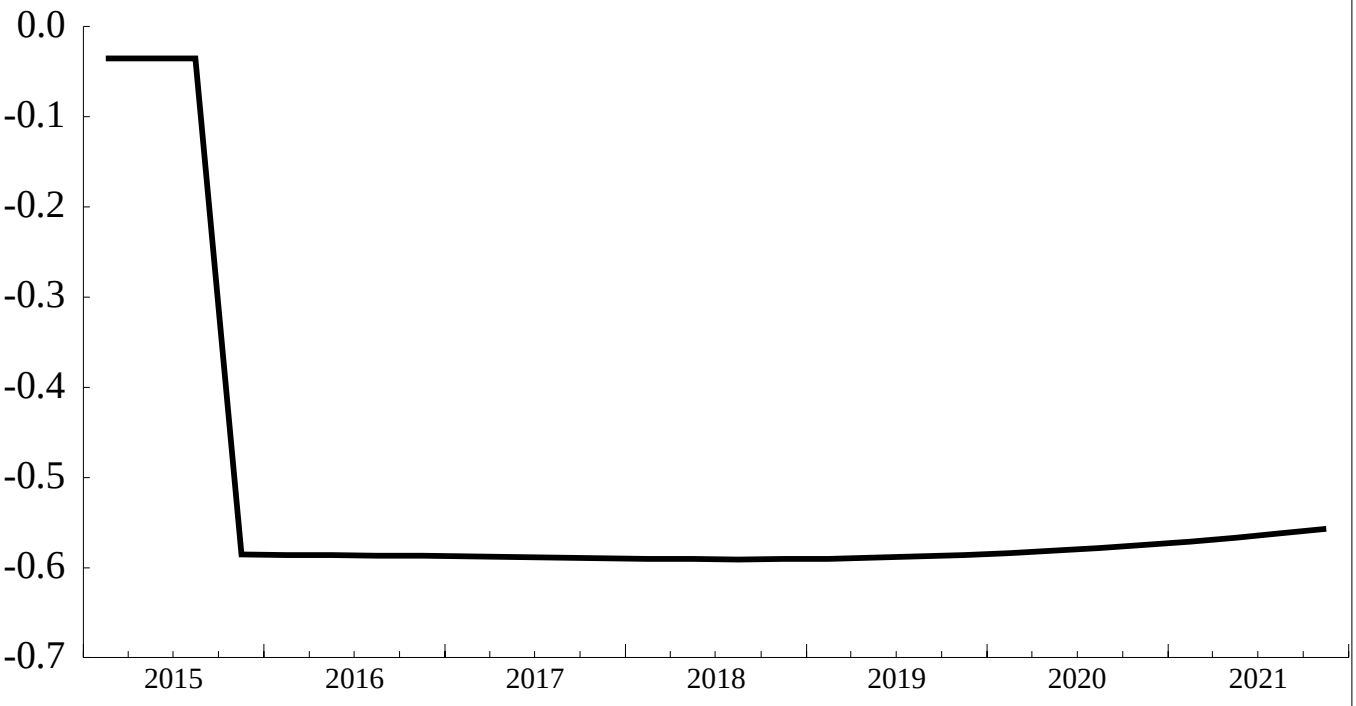


Figure B
Effects of a Temporary 10-Percent Exchange Rate Appreciation