Effect of Fed's Credit Easing on U.S. Income

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Abstract

We develop a model of impulse function and analyze the short-term as well as long-term impact of U.S. credit easing on U.S. real income (output). Using the relevant data for years 1960-2014, we estimated our impulse function model. Our results show that while the short-term impact of U.S. credit easing on U.S. income is negative, its long-term impact on U.S. income is positive.

Key Words: Quantitative Easing, Credit Easing, Impulse Function

JEL Classification: C22, C32, C51, E64

I. Introduction

Following the beginning of the financial crisis in 2008, the Federal Reserve introduced a number of new policy tools that have altered both the size and composition of the Federal Reserve's balance sheet (see Clevelandfed.org). These policy tools are aimed at supporting the functioning of financial markets during the crisis and to help the economy recover from the recession. These non-traditional policy tools were thought to be necessary when traditional policy tool, such as, the federal funds rate target was already constrained near zero. The former chair of the Board of Governors named it the "credit easing," which is divided into three categories: (a) lending to financial institutions, (b) providing liquidity to key credit markets, and (c) purchasing longer-term securities. While lending to financial institutions and providing liquidity to key credit markets were aimed at lowering the short-term interest rate, the purpose of purchasing longer-term securities was to ease long-term lending rate. Lowering of short- and long-term interest rate would subsequently stimulate the consumption and investment demand, thereby, spurring the economic growth. The Bank of Japan (BOJ) implemented similar policy called "Quantitative easing" from March 2001 through March 2006. A study by Ugai (2006) found that the BOJ's policy did help stabilize the financial market. This study, however, did not study the policy's effect on Japan's real output. A similar study by Kurihara (2006) looked at the effect of BOJ's policy on stock prices in Japan and on the Japanese economy. Kurihara found that although the policy had been effective in overcoming recession and deflation in Japan it had no effect on stock prices, whatsoever. Eggertson and Woodford (2003) in their study on the effect of U.S. quantitative easing argue that such a non-traditional policy can have a beneficial effect in lowering long-term bond yields only if such policy signals a credible commitment by the central bank to keep interest rates low even after the economy recovers. Clouse, et. al. (2000) in their study, argue that such a signal is credible if the central bank purchases a large quantity of long duration assets in quantitative easing. A number of researchers, such as, Clarida and Gali (1994), Eichenbaum and Evans (1996), Faust and Rogers (2003), Scholl and Uhlig (2008), and Bouakez and Normandin (2010) studied the impact of U.S. monetary policy on the U.S. economy and concluded that the channel through which the monetary policy worked was via the movement in the value of dollar. Glick and Leduc (2013) studied the effect of unconventional and conventional U.S. monetary policy on the dollar using intra-daily data and concluded that the U.S. credit easing does have effect on the value of the dollar and has the same effect as that of

conventional U.S. monetary policy. Hudson (2010) takes a different view on the effect of Fed's credit easing. In his study he concludes that although intended to stabilize the U.S. financial market and stimulate the economy it is hurting the global economy by flooding the world market with U.S. keyboard money making the rest of the world's export more expensive and, thereby, making them lose the value of their U.S. dollar reserves. Other studies on the impact of recent U.S. unconventional monetary policy (credit easing) include those by Neeley (2010), Gagnon et al (2011), Krishnamurthy and Vissing-Jorgenson (2011), Hamilton and Wu (2012), and Li and Wei (2012). Our study is a net addition to the literature, in it, we develop a model of impulse function and analyze the short-term as well as long-term impact of U.S. credit easing on U.S. real income (output).

This paper has been organized as following: section II lays out the model, section III explains the methodology, section IV identifies the data source, section V reports the empirical findings, and finally, section VI concludes the study.

II. The Model

To analyze the effect of Fed's credit easing on U.S. economy we use the so-called intervention analysis. This analysis allows for a formal test of the change in mean of a time series following a policy action. We specify the intervention model as following:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 QE_t + \varepsilon_t \quad (1)$$

Where, y_t = real U.S. output in t^{th} year,

y_{t-1} = real U.S. output in $(t-1)^{th}$ year,

QE_t = credit easing (intervention) variable; it is a dummy variable that takes on a value of 1 for the year since the Fed implemented its credit easing policy (i.e. 2008) and a value of 0 otherwise,

$\mathcal{E}_t$ = a white-noise error term.

It means the U.S. real output for any particular year depends on its previous year value and on the monetary policy (credit easing) implemented by the Fed.

III. Methodology

To explain the nature of the model we rewrite equation (1) as following:

$$y_t - \alpha_1 y_{t-1} = \alpha_0 + \alpha_2 QE_t + \varepsilon_t$$

Using lag operator the above equation can be transformed as

$$y_t - \alpha_1 L y_t = \alpha_0 + \alpha_2 QE_t + \varepsilon_t \quad \text{or}$$

$$y_t(1 - \alpha_1 L) = \alpha_0 + \alpha_2 QE_t + \varepsilon_t \quad \text{or}$$

$$y_t = \frac{\alpha_0}{(1-\alpha_1 L)} + \frac{\alpha_2}{(1-\alpha_1 L)} QE_t + \frac{\varepsilon_t}{(1-\alpha_1 L)} \quad (2)$$

Since the variable, QE takes on a value of 1 for the years since quantitative easing was implemented (i.e. 2008) and a value of 0 otherwise,

For the years since 2008: $y_t = \frac{\alpha_0}{(1-\alpha_1 L)} + \frac{\alpha_2}{(1-\alpha_1 L)} + \frac{\varepsilon_t}{(1-\alpha_1 L)}$

For the years before 2008: $y_t = \frac{\alpha_0}{(1-\alpha_1 L)} + \frac{\varepsilon_t}{(1-\alpha_1 L)}$

Therefore,

For the years since 2008: $E(y_t) = \frac{\alpha_0}{(1-\alpha_1 L)} + \frac{\alpha_2}{(1-\alpha_1 L)}$

For the years before 2008: $E(y_t) = \frac{\alpha_0}{(1-\alpha_1 L)}$

Thus,

Long run mean of U.S. real output with credit easing = $\frac{\alpha_0}{(1-\alpha_1 L)} + \frac{\alpha_2}{(1-\alpha_1 L)}$

$= \frac{\alpha_0}{(1-\alpha_1)} + \frac{\alpha_2}{(1-\alpha_1)}$

Long run mean of U.S. real output without quantitative easing = $\frac{\alpha_0}{(1-\alpha_1 L)} = \frac{\alpha_0}{(1-\alpha_1)}$

Thus, the effect of Fed's quantitative easing on the long-run mean of U.S. real GDP is given by $\frac{\alpha_0}{(1-\alpha_1)} + \frac{\alpha_2}{(1-\alpha_1)} - \frac{\alpha_0}{(1-\alpha_1)} = \frac{\alpha_2}{(1-\alpha_1)}$

If, upon the estimation of equation (1), α_2 and α_1 are found to be statistically significant, and $\frac{\alpha_2}{(1-\alpha_1)}>0$, then we will conclude that the Fed's credit easing does have positive impact on U.S. real output. Also, the transitional effect of the Fed's credit easing on U.S. real output can be obtained from the impulse response function derived as following:

Equation (2) can be rewritten as,

$$y_t = \frac{\alpha_0}{(1-\alpha_1 L)} + \alpha_2 QE_t(1 + \alpha_1 L + \alpha_1^2 L^2 + \alpha_1^3 L^3 + \ldots\ldots) + \varepsilon_t(1 + \alpha_1 L + \alpha_1^2 L^2 + \alpha_1^3 L^3 + \ldots\ldots) \quad \text{or}$$

$$y_t = \frac{\alpha_0}{(1-\alpha_1)} + \alpha_2(QE_t + \alpha_1 QE_{t-1} + \alpha_1^2 QE_{t-2} + \alpha_1^3 QE_{t-3} + \ldots\ldots) + (\varepsilon_t + \alpha_1 \varepsilon_{t-1} + \alpha_1^2 \varepsilon_{t-2} + \alpha_1^3 \varepsilon_{t-3} + \ldots\ldots) \quad (3)$$

Differentiating y_{t+i} in equation (3) with respect to QE_{t-i} for $i = 0, 1, 2, 3, \ldots$ and updating by 0, 1, 2, 3, ….. period respectively yields,

$$\frac{dy_t}{dQE_t} = \alpha_2, \frac{dy_{t+1}}{dQE_t} = \alpha_2\alpha_1, \frac{dy_{t+2}}{dQE_t} = \alpha_2\alpha_1^2, \frac{dy_{t+3}}{dQE_t} = \alpha_2\alpha_1^3, \ldots\ldots\ldots\ldots$$

The cumulative impact of the credit easing is given by,

$$\sum_{j=0}^{\infty} \frac{dy_{t+j}}{dQE_t} = \alpha_2 + \alpha_2\alpha_1 + \alpha_2\alpha_1^2 + \alpha_2\alpha_1^3 + \cdots = \alpha_2(1 + \alpha_1 + \alpha_1^2 + \alpha_1^3 + \ldots) = \frac{\alpha_2}{1-\alpha_1}$$

Thus, $\frac{\alpha_2}{1-\alpha_1}$ measures the long-term impact of Fed's credit easing.

IV. Data

In our model, we use annual data on U.S. real output (Gross Domestic Product) from 1960 to 2014 obtained from the World Development Indicators, 2015.

V. Empirical Findings

We estimated equation (1) and obtained the following results (the detailed results are shown in the Appendix):

$$y_t = 0.054478 + 1.024661 y_{t-1} - 0.235553 QE_t + \varepsilon_t \quad (4)$$

(0.986934) (143.9702) (-3.074146)

The numbers in the parentheses are corresponding t-statistics. Since the coefficients associated with both independent variables: previous-year income (y_{t-1}) and credit easing (QE_t) – turned out to be statistically significant, we are now ready to evaluate the short- term and long-term impact of the Fed's credit easing on U.S. income as following:

Short-term impact of credit easing: $\alpha_2 = -0.235553$

Long-term impact of credit easing: $\frac{\alpha_2}{1-\alpha_1} = \frac{-0.235553}{1-1.024661} = \frac{-0.235553}{-0.024661} = 40.549856$

The above results imply that, while the sort-term impact of Fed's credit easing is to lower the U.S. real income by $0.235553 trillion, in the long run, however, the policy's impact is to increase the U.S. real income by $40.549856 trillion. This differing impact in the short run and in the long run of the credit easing on U.S. income seems puzzling. However, it has simple intuitive explanations. In the short run, a credit easing lowers the interest rate at home, causing a capital outflow, thereby, lowering the investment and the real output at home. In the long run, however, a credit easing lowers the value of the domestic currency making domestic exports cheaper to the foreigners, thereby, causing domestic exports to increase leading to a rise in domestic real output.

VI. Summary and Conclusion

Following the beginning of the financial crisis in 2008, the Federal Reserve introduced a number of new policy tools. These policy tools are aimed at supporting the functioning of financial markets during the crisis and to help the economy recover from the recession. These non-traditional policy tools were thought to be necessary when traditional policy tool, such as, the federal funds rate target was already constrained near zero. These policies, known as "credit easing" or "quantitative easing" are divided into three categories: (a) lending to financial institutions, (b) providing liquidity to key credit markets, and (c) purchasing longer-term securities. While lending to financial institutions and providing liquidity to key credit markets were aimed at lowering the short-term interest rate, the purpose of purchasing longer-term securities was to ease long-term lending rate. Lowering of short- and long-term interest rate would stimulate the consumption and investment demand, thereby, spurring the economic growth. There have been several studies on the impact of credit easing on U.S. economy, world economy, U.S. interest rate, the value of dollar, and the stock prices. Our study is a net addition to the literature, in it, we develop a model of impulse function and analyze the short-term as well as long-term impact of U.S. credit easing on U.S. real income (output). Using the relevant data for years 1960-2014, we estimated our impulse function model. Our results show that while the short-term impact of U.S. credit easing on U.S. income is negative, its long-term impact on U.S. income is positive. This differing impact in the short run and in the long run of the quantitative easing on U.S. income seems puzzling. However, it seems logical, because, in the short run, a credit easing lowers the interest rate at home causing a capital outflow, thereby, lowering the

investment and the real output at home. In the long run, on the contrary, a credit easing lowers the value of the domestic currency making domestic exports cheaper to the foreigners, thereby, causing home country's exports to increase leading to a rise in the domestic real output.

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Appendix

Dependent Variable: RGDP

Method: Least Squares

Date: 07/17/15 Time: 06:19

Sample (adjusted): 1961 2014

Included observations: 54 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.054478	0.055200	0.986934	0.3283
LAGRGDP	**1.024661**	0.007117	**143.9702**	0.0000
QE	**-0.235553**	0.076624	**-3.074146**	0.0034

R-squared	**0.998445**	Mean dependent var	8.218745
Adjusted R-squared	0.998384	S.D. dependent var	3.694207
S.E. of regression	0.148525	Akaike info criterion	-0.922175
Sum squared resid	1.125042	Schwarz criterion	-0.811676
Log likelihood	27.89873	Hannan-Quinn criter.	-0.879560
F-statistic	16368.68	Durbin-Watson stat	**1.494282**
Prob(F-statistic)	0.000000		

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