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Relationship Between Quantitative Easing and Monetary Stability in USA: An Econometric Study

العلاقة بين التيسير الكمي والاستقرار النقدي في الولايات المتحدة الأمريكية: دراسة قياسية

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Abstract

The study aimed to identify the causal relationship between the quantitative easing and the monetary stability in USA. We used the data of Federal Reserve Bank for the period comprises between the third quarter of 2008 and the final quarter of 2018. First, we applied different statistical tools to analyze the obtained data. We carried out normality test and found that both time series are non-normally distributed. Then we concluded through unit root test that both series are stationary at the level form. Furthermore, we found a positive weak correlation between the two time series and through Granger causal test we found that there is a bidirectional relationship between the quantitative easing and the monetary stability at 5% level of significance.

Keywords : Quantitative Easing, Monetary Stability, Normality Test, Unit Root Test, Correlation, Granger Causality Test.

ملخص

هدفت الدراسة إلى التعرف على العلاقة السببية بين التيسير الكمي والاستقرار النقدي في الولايات المتحدة الأمريكية. أخذنا بيانات بنك الاحتياطي الفيدرالي للفترة الممتدة من الربع الثالث من عام 2008 إلى الربع الأخير من عام 2018. ومن أجل تحليلها اعتمدنا على أدوات إحصائية مختلفة. في البداية قمنا بإجراء اختبار التوزيع الطبيعي ووجدنا أن توزيع السلسلتين الزمنيتين ليس طبيعيا. ثم استنتجنا من خلال اختبار جذر الوحدة أن السلسلتين مستقرتين في المستوى. علاوة على ذلك، وجدنا ارتباطًا إيجابيًا ضعيفًا بين السلسلتين وتحققنا من خلال اختبار السببية من وجود علاقة ثنائية الاتجاه بين التيسير الكمي والاستقرار النقدي عند مستوى معنوية 5٪.

الكلمات المفتاحية: التيسير الكمي، الاستقرار النقدي، اختبار التوزيع الطبيعي، اختبار جذر الوحدة، الارتباط، اختبار السببية لجرانجر.

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1. INTRODUCTION AND LITERATURE REVIEW

Quantitative easing (QE) is a monetary policy to increase the money supply by injecting liquidity into the economy by buying government assets back from the market. It increases the capital within the financial sector, and therefore, increases the amount which banks lend to consumers and small businesses, in an effort to promote economic growth. However, it is usually done when interest rates are already extremely low and there are no other measures which can be taken. Through the purchase of long-term government bonds, the central bank decreases yields and, consequently, overall financial costs. QE also impacts the economy by devaluing the home currency hence making export goods more competitive. Therefore it is believed that the increase in government expenditure will lead to increased consumption, which will further increase the demand for goods and services, thus fostering job creation and, ultimately, creating economic vitality. (Magavi, 2012, p. 3)

The phrase was first applied to Japan as it dealt with the bursting of a real estate bubble and the deflationary pressures that followed in the 1990s. The central banks of the US, the Euro area and the UK have all followed Japan in adopting policies that have led to substantial increases in their balance sheets, although there are significant differences both amongst themselves and with Japan in terms of how they have implemented QE and other unconventional policies. (Joyce, Miles, Scott, & Vayanos, 2012, p. 274)

Fed has bought US Treasuries but also large quantities of agency debt and agency-backed mortgage backed securities. The first quantitative easing was announced on November 25, 2008, that the Fed would purchase $500 billion in mortgage-backed securities and up to $100 billion in agency debt of Fannie Mae, Freddie Mac, Ginnie Mae, and Federal Home Loan Banks. Furthermore, in March 2009, the Fed expanded the mortgage buying program with additional purchase of $750 billion more in mortgage-backed securities. Overall, when this first round of LSAP ended on March 31, 2010, it purchased a total of $1.25 trillion in mortgage-back securities and $175 billion in agency debt. The main purpose of this action was to reduce the cost and increase the availability of credit for the purchase of houses, which in turn should support housing markets and foster improved conditions in financial markets more generally. The second quantitative easing was announced on August 10, 2010 Federal Open Market Committee will keep constant the Federal Reserve's holdings of securities at their current level by reinvesting principal payments from agency debt and agency mortgage-backed securities in longer-term Treasury securities. Additionally, the Fed started purchasing $600 billion of longer-term securities. It was intended to promote a stronger pace of economic recovery. The third quantitative easing was announced on September 13, 2012 that the Fed was committing to an open-ended purchase of $40 billion in agency MBS per month until the labor market improves substantially. On December 12, 2012, the Fed decided to continue and magnify the attempt of the third round of quantitative easing by increasing the amount of open-ended purchase from $40 billion to $85 billion per month. (Joanne, 2015, p. 2) The monthly purchase consisted of $45 billion of U.S. Treasury securities and $40 billion of mortgage-backed securities. (Williamson, 2017, p. 10)

The implications of all of these programs for the Fed's balance sheet can be observed in Fig.1. From December 2007 to October 2014, the Fed's total assets increased from $882 billion to $4.5 trillion — five times its pre-crisis size. By the end of the quantitative easing program, it will gradually decline to about $4.1 trillion in December 2018.

The vast majority of studies on the Fed's QE address its impact on financial markets, long-term interest rates and other macroeconomic variables. Fuster and Willen (Fuster & Willen, 2010) studied the effect of MBS purchase on the mortgage market and found that the purchase of MBS under QE improved the mortgage market via boosting mortgage refinancing activity rather than house purchase as intended by the Fed, and the benefit of QE is disproportionately skewed towards borrowers with high creditworthiness. Krishmamurthy and Vissing-Jorgensen (Krishnamurthy & Vissing-Jorgensen, 2011) using the interaction of different characteristics of assets purchased, showed that QE1 and QE2 lowered the nominal interest rates on Treasuries, Agencies, corporate bonds and MBS through the portfolio balance and signaling channels, but the effect is heterogeneous, as the purchase of US Treasuries has stronger effect on long-term safe assets while lower-rate corporate bonds are more influenced by MBS purchase. Williamson (Williamson, 2014) constructed a model of money, credit and banking, and showed that QE done with US Treasuries lowers inflation through the liquidity channel, which goes against the intention of the Fed. Woodford (Woodford, 2016) compared three alternative dimensions of central bank policy — conventional interest-rate policy, increases in the central bank's supply of safe liabilities, and macroprudential policy — and concluded that quantitative easing policies increase financial stability risk (in the absence of an offsetting tightening of macroprudential policy), but they actually increase such risk less than either of the other two policies, relative to the magnitude of aggregate demand stimulus; and a combination of expansion of the central bank's balance sheet with a suitable tightening of macroprudential policy can have a net expansionary effect on aggregate demand with no increased risk to financial stability. Shogbuyi and Steeley (Shogbuyi & Steeley, 2017) examined the impact on the variance-covariance structure of UK and US equity markets of the QE operations implemented by the Bank of England (BoE) and the Federal Reserve (Fed), and they found that while QE operations in general reduced equity volatility, day to day operations generated spikes in volatility in UK equities and they also found that BoE operations increased the covariance between the UK and US equity markets. Ronkainen and Sorsa (Ronkainen & Sorsa, 2017) suggested that the Fed has legitimated the QE programmes somewhat successfully, Fed has been able to conduct the large-scale purchases, and their legitimation have been imitated by other central banks. But many social institutions influencing Fed’s activities have not been aligned with the formal institutions of finance-led growth regimes. Moreover, the asset class limitations of Fed’s legal constraints make it difficult to conduct QE consistently. Reisenbichler (Reisenbichler, 2019) showed that QE programmes have supported private housing markets to different degrees as part of these balance sheet expansions. While the Fed has bought close to $2 trillion in mortgage debt, the ECB has purchased housing-related bonds much less extensively. He also showed that growth models, and the role of housing within them, explain these monetary policy differences in the United States and the eurozone. Labonte (Labonte, 2019) provided an overview of how the Fed’s monetary policy works and recent developments, and showed that the increase in the Fed’s balance sheet has the potential to be inflationary because bank reserves are a component of the portion of the money supply controlled by the Fed (called the monetary base), which grew at an unprecedented pace during QE, but in practice, overall measures of the money supply have not grown as quickly as the monetary base, and inflation has remained below the Fed's goal of 2% for most of the period since 2008. The growth in the monetary base has not translated into higher inflation because bank reserves have mostly remained deposited at the Fed and have not led to increased lending or asset purchases by banks.

In this paper we try to analyze the causal relationship between the quantitative easing and the monetary stability in USA. We take the data of period comprises from the third quarter of 2008 to the final quarter of 2018.

2. DATA AND METHODOLOGY

In this article, we study the relationship between the quantitative easing (QE) and the monetary stability (MS). We prefer to work with quarterly data, because it is more accurate than annual data and can capture better results between QE and MS. The time span of current study is from the third quarter of 2008 to the final quarter of 2018. And data consists of two variables, the ratio of quantitative easing to the total assets of the Federal Reserve (QER) and the monetary stability coefficient in USA (MSC). Data has been taken from Federal Reserve's website.

After reviewing the existing literature and to get the objective of current study, following hypothesis have been formulated:

Hypothesis 1: QER and MSC are normally distributed;

Hypothesis 2: QER and MSC are stationary (absence of unit root);

Hypothesis 3: There is a correlation between QER and MSC;

Hypothesis 4: There is a cause and effect relationship between QER and MSC.

To check the above mentioned hypothesis we run different statistical tools and tests on EViews software version 9. To analyze the relationship between QER and MSC we took following tests:

2.1 Normality Test

We use the Jarque-Bera (JB) test to check the normality of data. This test first computes the skewness and kurtosis measures of the OLS residuals and uses the following test statistic: (Gujarati, 2003, p. 148)

$$\mathbf{JB} = \boldsymbol{n}\,[\boldsymbol{S}^2/6 + (\boldsymbol{K}-3)2/24] \qquad (1)$$

where n = sample size, S = skewness coefficient, and K = kurtosis coefficient. For a normally distributed variable, $S = 0$ and $K = 3$. Therefore, the JB test of normality is a test of the joint hypothesis that S and K are 0 and 3, respectively. In that case the value of the JB statistic is expected to be 0. Under the null hypothesis that the residuals are normally distributed, Jarque and Bera showed that asymptotically (i.e., in large samples) the JB statistic given in (1) follows the chi-square distribution with 2 df. If the computed p value of the JB statistic in an application is sufficiently low, which will happen if the value of the statistic is very different from 0, one can reject the hypothesis that the residuals are normally distributed. But if the p value is reasonably high, which will happen if the value of the statistic is close to zero, we do not reject the normality assumption.

2.2 Unit Root Test

To check whether a time series is stationary or non-stationary we use unit root tests. Any data series is said to be stationary if its mean and variance remain constant over a period of time. After under taking unit root we further confirms stationary of QER and MSC by carrying out ADF test.

2.3 Augmented Dickey–Fuller (ADF) Test

Augmented Dickey-Fuller test is a modified version of Dickey Fuller Test. In order to statistically check whether our time series variables are stationary or not we used Augmented Dickey Fuller test. In this test we compare the t-Statistic with the critical values of studied variable to determine if your data is stationary or not.

2.4 Correlation Test

We will need to carry out correlation test through EViews software version 9 in order to check whether there is any correlation, positive or negative, weaker or stronger exists between QER and MSC or not.

2.5 Granger Causality Test

After presence of correlation we wanted to check whether any causal relationship exists between QER and MSC or not. To check the causal relationship we carried out Granger causality test by using EViews software. According to the concept of Granger's causality test (Granger, 1969), a time series x is said to be causing y when past values of x can predict future values of y. In this case we can say that x granger causing y. All of the possible permutations of the two variables are:

- Unidirectional Granger causality from variables x to variables y;
- Unidirectional Granger causality from variables y to variables x;
- Bi-directional casualty;
- No causality.

In all possible cases, a common assumption is that the data are stationary.

3. EMPIRICAL ANALYSIS

As we discussed five steps in Methodology, the empirical analysis of carried out tests are follows:

First of all we checked our variables for normality test. This test was conducted with the help of Jarque-Bera concept. We individually compute descriptive statistics of both variables by using EViews version 9. In our case skewness values of QER and MSC are -2.799657 and 0.946615 respectively whereas kurtosis values of tested variables are 9.806063 and 14.55559 respectively and the Jarque-Bera statistic rejects the null hypothesis of normality for the two series at the 5% significance level. Descriptive statistics of the two variables are given below under Table 1. Hence, we can conclude that our variables QER and MSC are non-normally distributed.

After affirming the non-normal distribution of our variables, we wanted to know if our both time series are stationary or not. There are two ways by which we checked stationarity of time series. The first and simplest method to check stationarity of any time series is to draw conclusion from its graph. In this case we plotted values of QER and MSC on line plot graph by using EViews version 9. By visual conclusion we can say that our time series are stationary, because we observe same trend in mean and variance of variables. The graphs for both the variables are shown in Fig.2 and Fig.3. As we can see there is not much fluctuations shown in graphs so we can say that both the series are stationary at level.

After confirming through simple graph method, we also checked stationarity of our time series data through augmented Dickey-Fuller test. We individually run augmented Dickey-Fuller test for QER and MSC by using EViews software version 9. The results of ADF test are shown in Table 2 in Appendices. Our null hypothesis for this test is that unit root exists in QER and MSC series, but if we compare results of test, our T-Stats for QER and MSC series are -3.2065 and -5.2892 which are considerably less than critical values -2.9350 and -1.9491 respectively at significant level of 5%. So we can reject our null hypothesis and conclude that our time series are stationary at level.

Next it comes the step of correlation between QER and MSC series. Correlation result is given under Table 3, which shows a positive correlation between two variables having value 0.3785. This is obviously a weak positive relationship between QER and MSC. Now, it comes the question of casual relationship between the two time series. To check the direction of this relationship we carried out Granger causal test. The output of Granger causality test is given in Table 4. We can easily reject our both hypothesis because the obtained p-values 0.0026 and 0.0310 are less than 0.05. We can conclude that there is a two way cause and effect relationship between QER and MSC. So the causality is bidirectional at 5% level of significance.

4. CONCLUSION

We empirically examine the dynamics between QER and MSC in terms of their relationship and causality between them. First of all we checked the normality of data by using Jarque-Bera test. After confirming the non-normal distribution of data, we went for stationary or non-stationary time series. For checking and confirming stationarity, we used simple graph method and then Augmented Dicket-Fuller Test. Both test showed stationarity of time series data at level at 5% level of significance. The results of coefficient of correlations tells us that there is a positive weak relationship exists between QER and MSC. After affirming the existence of a correlation between the two variables, we examined the cause-and-effect relationship between QER and MSC by implementing Granger Causality Test which proved bidirectional causal relationship between QER and MSC at 5% level of significance.

Our results indicate that the quantitative easing policy has a weak positive impact on the monetary stability in the United States, although that the quantitative easing eases financial conditions by reducing the spread between the required return on risky investments and the return on safe assets. And this reduces the incentive for private issuance of safe liabilities and favors financing of investment through issuance of non-safe liabilities, which is desirable on monetary and financial stability grounds. But this does not imply the creation of conditions under which it should be more tempting for banks to take on greater risk.

Based on these results, the study recommends that the quantitative easing policy should not be overstated. In addition, taking into consideration the importance of developing the stock market, as well as attracting more domestic and foreign investment.

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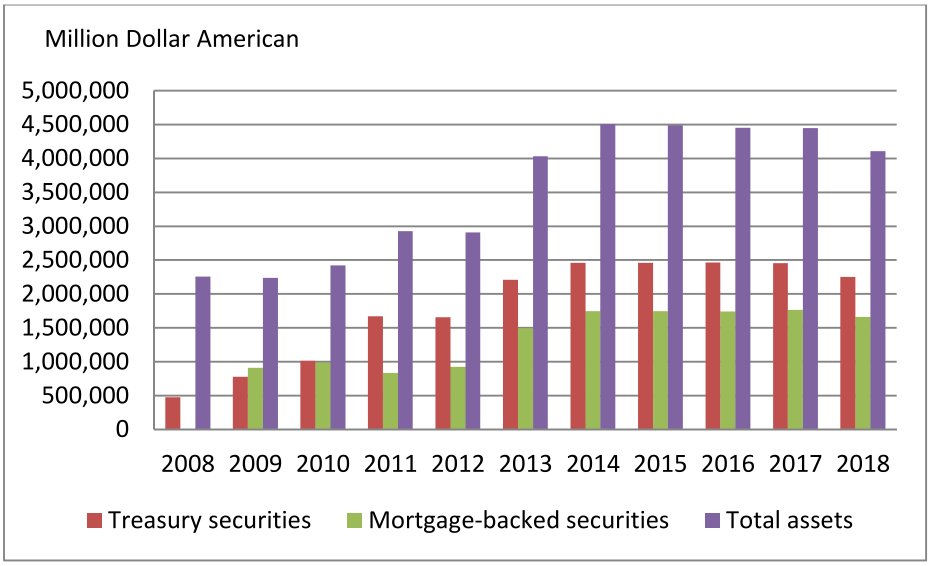
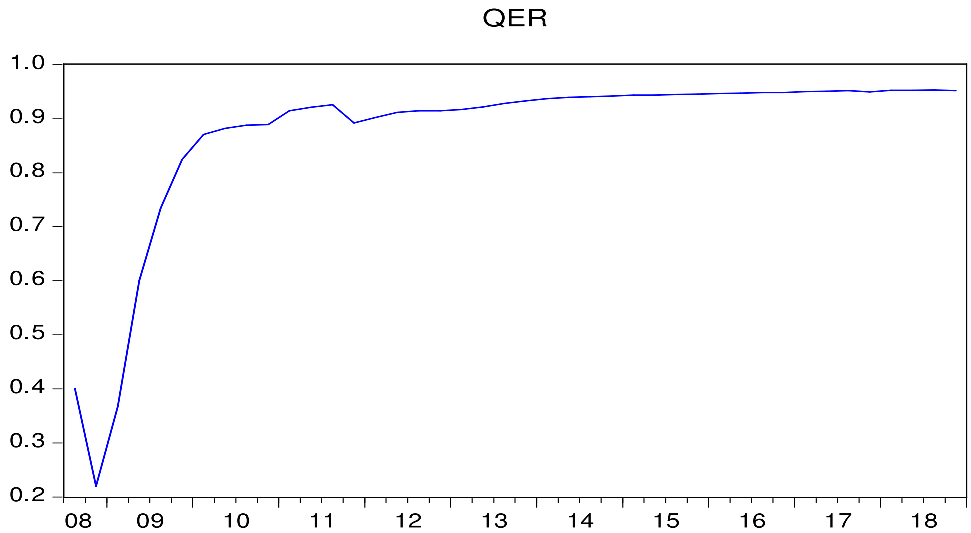
6. Appendices

Fig.1. Federal Reserve assets during the period 2008-2018



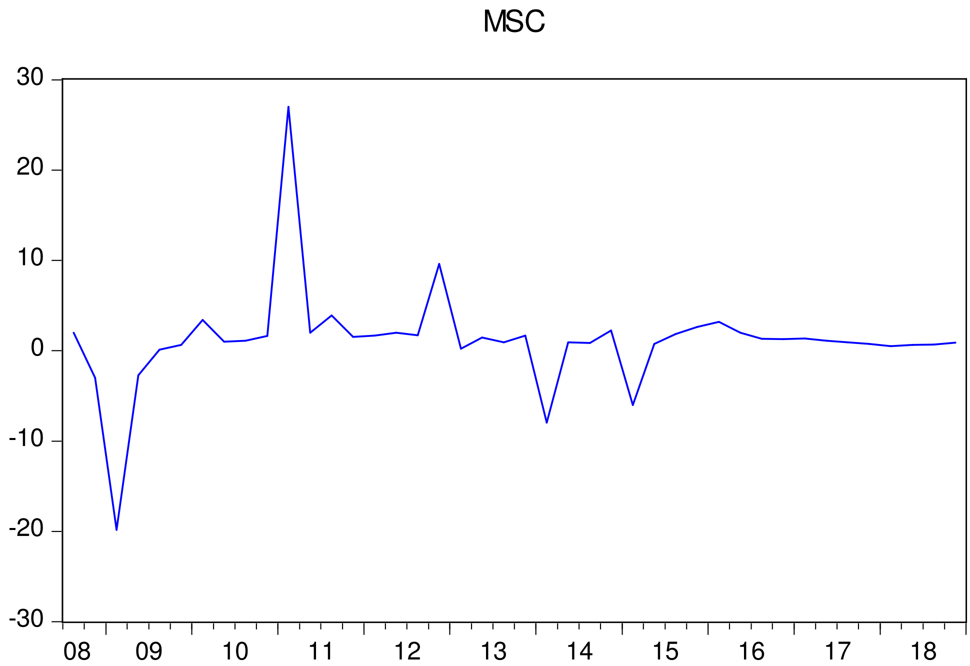
Source: Prepared by researchers, based on Fed reports.

Fig.2. Line Plot of QER



Source: Prepared by researchers, based on EViews 9 software.

Fig.3. Line Plot of MSC



Source: Prepared by researchers, based on EViews 9 software.

Table 1. Descriptive Statistics for QER and MSC series

	QER	MSC
Mean	1.145446	0.871844
Median	1.198286	0.930908
Maximum	27.00739	0.953367
Minimum	-19.83145	0.219986
Std. Dev.	5.79346	0.166432
Skewness	0.946615	-2.799657
Kurtosis	14.55559	9.806063
Jarque-Bera	239.9531	135.9309
Probability	0.00000	0.00000
Sum	48.10874	36.61746
Sum Sq. Dev.	1376.131	1.135689
Observations	42	42

Source: Prepared by researchers, based on EViews 9 software.

Table 2. ADF Test for QER and MSC series

Null Hypothesis: the variable has a unit root
Lag Length: Automatic - based on SIC, maxlag=9

Model	ADF test	QER			SMC		
		Trend	C	H0	Trend	C	H0
Constant	Lags	0			0		
	t-Stat	-	3.4615	-3.2065	-	1.0216	-5.3897
	Prob.	-	0.0013	0.0267	-	0.3133	0.0001
Constant & Trend	Lags	0			0		
	t-Stat	-0.0383	3.1680	-2.3981	0.2630	0.2764	-5.3314
	Prob.	0.9696	0.0030	0.3751	0.7940	0.7837	0.0005
None	Lags	5			0		
	t-Stat	-	-	1.0174	-	-	-5.2892
	Prob.	-	-	0.9155	-	-	0.0000

Source: Prepared by researchers, based on EViews 9 software.

Table 3. Correlation Test between QER and MSC series

Covariance Analysis: Ordinary
Date: 08/30/19 Time: 07:13
Sample: 2008Q3 2018Q4
Included observations: 42

		QER	MSC
QER	Correlation	1	0.378483
	t-Statistic	-	2.586123
	Probability	-	0.0135
	Observations	42	42
MSC	Correlation	0.378483	1
	t-Statistic	2.586123	-
	Probability	0.0135	-
	Observations	42	42

Source: Prepared by researchers, based on EViews 9 software.

Table 4. Granger Causality Test

Pairwise Granger Causality Tests
Date: 08/30/19 Time: 07:30
Sample: 2008Q3 2018Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
QER does not Granger Cause SMC	40	7.11639	0.0026
SMC does not Granger Cause QER		3.84131	0.0310

Source: Prepared by researchers, based on EViews 9 software.