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The Impact of Monetary Policy on Banks' Risk-taking: Evidence from the Post Crisis Data

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Introduction

THIS study investigates the impact of unconventional monetary policy (UMP)¹ actions on the risk taking behavior of banks. Recent studies such as Paligorova and Santos (2012), Dellis et al. (2012), and Angeloni et al. (2015) argue that the prolonged period of low interest rate in the aftermath of the dot-com recession has encouraged banks to take excessive risk. According to these studies, there is a significant positive relationship between expansionary monetary policy measures and the amount of risk that the banks take. However, this positive relationship may not hold for the post-crisis period because of the following reasons.

First, the financial crisis caused liquidity problems among the banks, which led to the credit crunch phenomenon². Because of the resulting shortage of capital, the banks became risk averse about lending to businesses and individuals as well as to other banks (Lowth et al., 2010). Secondly, when the central bank repeats the same actions in the same circumstances, agents in the economy learn to respond in a particular way. However, when the policy rule changes, there will be a period when households and firms learn how to respond to the new rules of the game. The 2007 financial crisis caused one such period of adaptation as the Federal Reserve (FED) switched to unconventional policy actions after the funds rate reached the zero lower bound³ (Farmer, 2012). This might cause a different response of risk taking by the banks. Third, the sluggish recovery of the economy signals that future economic conditions are worse than expected (Haitsma et al., 2015). Such pessimism might cause banks to hesitate to take any risks.

From the policy perspective, one of the channels through which UMPs affect banks' risk taking is through the wealth effect. By increasing asset prices, the policy actions increase collateral values and lower delinquency⁴ and default rates, encouraging banks to take more risk in lending to borrowers. In this regard, Araujo et al. (2013) shows that asset purchases by the FED may not necessarily increase asset prices in all circumstances. In their general equilibrium model, if there exists a sufficient level of collateral for household's collateral constraint not to bind in equilibrium, central bank asset purchases will have no effect on equilibrium asset prices.

Based on these arguments, the study tests the hypothesis that instead of monetary policy, factors related to the aforementioned reasons are the main drivers of risk taking by the banks in the post-crisis period. These factors include credit crunch as measured by credit growth and expectation about future economic conditions. The new monetary policy regime is represented by using the FED's total asset as a measure of monetary policy. After the fed funds reached the zero lower bound in December 2008, the FED switched to unconventional policy tools, namely quantitative easing. Under this new policy regime, the FED's balance sheet is used as the main policy tool as the FED has directly engaged in large-scale asset purchase programs (LSAP). The LSAP involves the purchase of mortgage backed securities and other assets, leading to a massive expansion of its total asset holdings. Because of this the total asset holdings of the FED represent the (unconventional) monetary policy instrument for the post-crisis period. This is in line with Gambacorta et al. (2013) and Khatiwada (2017). Moreover, industrial production is used as a control for the level of economic activity. Following Delis et al. (2012), this paper measures the risk taking by the banks using the total risky assets owned.

In order to achieve its goal, this paper employs a time series regression where the risk taking measure is expressed as a function of credit growth, expected economic condition, and FED's total asset. The empirical findings show that monetary policy has been an insignificant factor during the post-crisis period while credit crunch and expectation about future economic condition are found to be significant factors affecting the risk taking decision of banks. These findings imply that the risk taking channel of monetary policy has been ineffective after the fed funds rate reached the zero lower bound.

The remainder of the study is organized as follows. The next section presents a review of previous empirical studies in the area. Following is a discussion of the empirical model to be estimated. The next section describes the dataset used in the study. Then the paper presents and discusses the empirical findings. Finally, the paper concludes by providing some policy implications.

Literature Review

Considerable effort has been made in the empirical literature to study the impacts of monetary policy on the risk taking behavior of banks. Virtually all studies use short-term interest rate as the measure of monetary policy. Dellis et al. (2012) estimates the risk taking impacts of monetary policy using micro level datasets. Their study makes two significant contributions. First, the authors distinguish between risk taking on new and existing loans. Their second contribution lies in the endogeneity problem that concerns the potential joint identification of monetary policy and bank risk. They argue that bank risk could influence the stance of monetary policy and that both of these variables are affected by the general macroeconomic conditions. To solve this problem of identification, the authors use the strategy developed by Romer and Romer (2004). Using risky assets owned and Z-index⁵ for each bank in their sample, the authors found that lowering the interest rate significantly increases risk taking by the banks.

On the other hand, Angelon et al. (2015) uses macro data and employs a VAR model to see the risk taking impacts of monetary policy in the U.S. Their major contribution is in the differentiation they make between two forms of risk: risk taking in the funding structure and overall risk taking. Their study uses data from January 1980 to September 2011. The major finding of their work is that a positive monetary policy shock increases the amount of funding risk taken by the banks while its effect on overall risk taking is insignificant. Similar results are also found by Abbate and Thaler (2014) using macro data. By identifying a Bayesian VAR through sign restrictions, the authors find evidence suggesting that expansionary monetary policy shock causes a persistent increase in proxies for bank risk taking behavior.

Few studies have also attempted to examine the risk taking effects of monetary policy in Europe. Altunbas et al. (2010) tests the hypothesis that low level interest rate is the contributing factor to the recent banking problem in Europe and the U.S. using a comprehensive database of quarterly balance sheet information and risk measures. In order to disentangle the effects of monetary policy from other factors, the authors make control for bank-specific characteristics such as size, liquidity, capitalization, lending portfolios, and profitability. The main result of their study is that, even controlling for the above factors, low levels of short-term interest rates over an extended period of time contributed to an increase in bank risk.

Similar results are also found by other researchers using micro level data. Jimenez et al. (2014) use micro data of the Spanish Credit Register from 1984 to 2006 to find that lower interest rates have a double-sided effect on the default probability of bank loans. This default probability falls in the short term, as the cost of interest payments decreases, but rises in the long run, as a result of banks lending money to riskier borrowers in exchange for a higher yield. This indicates increased risk taking by the banks through reaching for yield behavior.

This paper contributes to the accumulating empirical literature in two ways. First, in evaluating the impacts of monetary policy shocks, the study uses the FED's total asset as the main policy tool, instead of the commonly held approach of using interest rate or money supply. Secondly, in addition to testing the significance of monetary policy, the study attempts to point out the factors that have been the major drivers of risk taking during the post-crisis period.

Methodology

The empirical approach to test for the risk taking effects of UMPs relies on a time series regression. The econometric model is given by:

$$A_t = \alpha_0 + \beta MP_t + \alpha Ey_t + \delta Cg_t + \gamma Fd_t + u_t \quad (1)$$

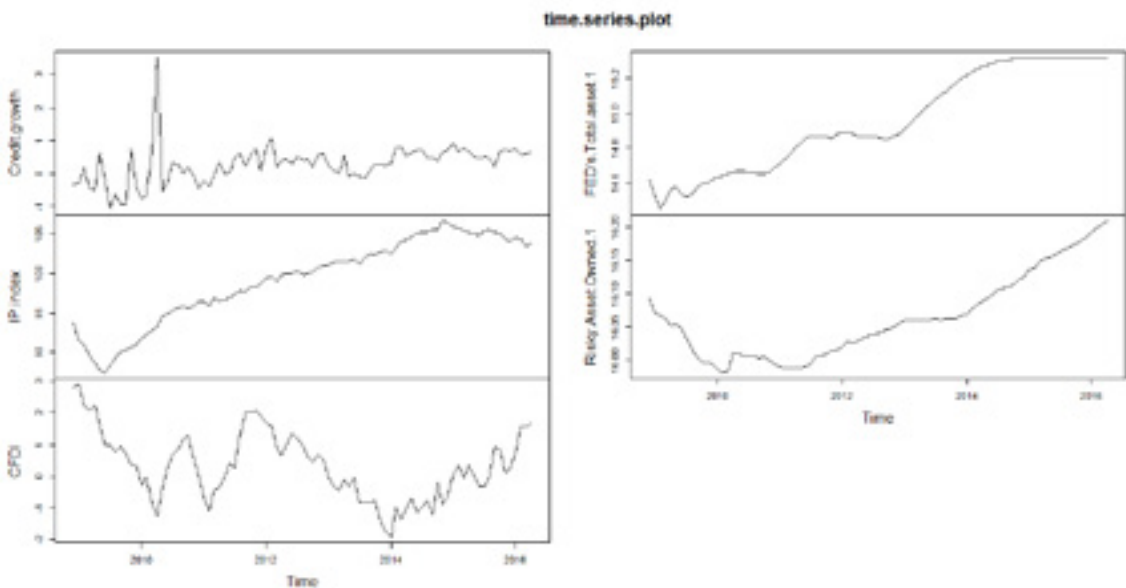
Where A is the risky assets owned, is credit growth rate representing credit crunch, and is the monetary policy measured by FED's total asset. financial market distress as measured by Cleveland Financial Distress Index, and it is the control for uncertainty shocks that have been the major drivers of financial market dynamics over the crisis period (Gambacorta et al., 2013). $denotes$ expected economic condition. It is given by the predicted values from an out-

put equation estimated in the spirit of Tolo (2011). The results of this estimation are provided in the appendix. FED's total asset and banks' risky assets enter the model in natural log while the rest of the variables enter in level. The main hypothesis in the estimation of Equation 1 is that the coefficients of credit growth and expected economic condition are jointly significant while that of monetary policy measure is insignificant.

Data

The dataset used in the study is monthly data from December 2008 to April 2016, the last month with the complete dataset. A total of 89 observations are used for estimation purposes. It encompasses data on the following variables: FED's total asset as a measure of monetary policy, industrial production, Cleveland Financial Stress Index, and credit growth. The data are obtained from the Federal Reserve Bank of St. Louis. Data on the total risky assets owned are obtained from the Federal Reserve Board of Governors website. All the data are seasonally adjusted. The time series plot of each variable is provided below and the descriptive statistics are available in the appendix section.

Figure 1: Time series plots; First row: Credit Growth, FED's total asset
Second Row: Industrial Production, Risky assets owned
Third Row: Cleveland Financial Distress Index



Estimation Results

In this section, the regression result from estimation of Equation 1 is discussed. From the initial regression, the results indicate the presence of a significant level of autocorrelation in the residuals. In order to correct for that, the Cochrane-Orcutt transformation is applied. This transformation requires the transformation of the regression model, given by Equation 1, to a form in which the OLS procedure is applicable. Rewriting Equation 1 for the period $t-1$, we arrive at:

$$A_{t-1} = \alpha_0 + \beta MP_{t-1} + \alpha Ey_{t-1} + \delta Cg_{t-1} + \gamma Fd_{t-1} + u_{t-1} \quad (2)$$

Then, multiplying Equation 2 term by term by ρ and subtracting from Equation 1 results in:

$$A_t - A_{t-1} = \beta (MP_t - \rho MP_{t-1}) + \alpha (Ey_t - \rho Ey_{t-1}) + \delta (Cg_t - \rho Cg_{t-1}) + \gamma (Fd_t - \rho Fd_{t-1}) + (u_t - \rho u_{t-1}) \quad (3)$$

Where ρ is obtained from the AR(1) modeling of first stage regression residuals ut:

$$u_t = \rho u_{t-1} + \varepsilon_t \quad (4)$$

Equation 3 can be rewritten using the residuals from Equation 4:

$$A_t - A_{t-1} = \beta (MP_t - \rho MP_{t-1}) + \alpha (Ey_t - \rho Ey_{t-1}) + \delta (Cg_t - \rho Cg_{t-1}) + \gamma (Fd_t - \rho Fd_{t-1}) + \varepsilon_t \quad (5)$$

By construction, the residuals in Equation 5 are white noise.

Table 2 in the appendix presents the result of an estimation of Equation 5. This result indicates that monetary policy is found to have an insignificant effect on the amount of risk that the banks take as expected. Thus, it can be concluded that unconventional monetary policy actions have different impact on the risk taking behavior of banks than the short-term interest rate. On the other hand, the phenomenon of the credit crunch as measured by credit growth has significant impact. A one percent decrease in the credit growth leads to a decrease in the amount of risk taken by the banks by 0.4%. Moreover, the joint significance test of the coefficients of credit growth and expected economic conditions has a p-value of 0.0238. This implies that credit crunch and expectation have been significant factors affecting the banks' risk taking decision.

In order to show that these results are robust, I consider a model in which risk taking is expressed as a function of only the financial distress index and FED's total asset. If credit crunch and expectation about future economic conditions cause the effect of monetary policy to disappear, then in the regression without these two variables the monetary policy measure should have a significant coefficient. The result of this regression is presented in Table 3 in the appendix section, and is found to be similar to the previous case. The coefficient FED's total asset remains insignificant. This indicates

that in addition to the credit crunch and expectation about future economic conditions, there might be other factors that cause the effect of monetary policy to disappear.

Conclusion

This paper re-investigates the impact of monetary policy on the risk taking behavior of banks after the fed funds rate reached the zero lower bound. Previous studies that use short-term interest rate as the measure of monetary policy found that expansionary policy actions lead to an increase in the amount of risk taken by the banks. However, whether this finding holds in the post-crisis period is questionable. This is because the banks have suffered from liquidity problems, and recovery from the crisis has been one of the slowest in history. The study contributes to the ongoing literature by considering a different measure of monetary policy given by FED's total asset. Moreover, it also proposes the possible factors that affect risk taking in the post-crisis period.

The results of the study provide no evidence of any impact by monetary policy on the risk taking behavior of banks. Instead, credit crunch as measured by credit growth and expectation about future economic condition are found to be the two major factors affecting risk taking. In terms of implication for the FED, our results suggest that more attention should be given to the capital constraint that the banks suffer from in order to have a prudent macro supervision. This can be attained by altering the total reserve that the banks have through a change in the required reserve ratio or by tapering the large-scale asset purchase program and resorting to the conventional higher short-term interest rate policy in the event that excessive risk taking is a threat to the economy.



Notes

1UMP is a term used to refer to monetary policy actions implemented after the short-term interest rate is stuck at the zero lower bound.

2Credit crunch is a sudden reduction in the availability of credit from banks.

3The zero lower bound is when the short-term interest rate (fed funds rate) becomes zero.

4Delinquency refers to a failure to pay an outstanding debt.

5Z-index captures the probability of default of a country's banking system.

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Appendix A

A1. Descriptive Statistics

Table 1: Summary statistics of the variables in the model

Variable	Observation	Mean	Std	Min	Max
Asset Risk	89	9476816	608285.8	8714822	1.10e+07
Credit Growth	89	0.277313	0.5855085	-1.073507	0.533819
CFDI	89	0.3124719	1.071473	-1.92	2.89
FED's total Asset	89	3236128	916481.6	1881629	4507150
Industrial Production	89	99.22468	5.372032	87.4125	106.6868

A2. Estimation Result of Equation 5

Table 2: Estimation result for equation. ***indicates significance at 5% and ** indicates significance at 10%

Variable	Coefficient	P-value
Intercept	113.9	0.0288 ***
Credit growth	0.004	6.46e-05 ***
Financial Distress index	0.003	0.0688**
Expected Output	0.63	0.3363
FED's total asset	0.012	0.9552

A3. Regression Result Without Expected Output and Credit Growth

Table 3: ***indicates significance at 5%

Variable	Coefficient	P-value
Intercept	113.9	0.0288 ***
Credit growth	0.004	6.46e-05 ***
Financial Distress index	0.003	0.0688**
FED's total asset	0.012	0.9552

A4. Regression Result for predicting expected economic condition

Table 4: Estimation Equation for Industrial Production

Variable	Coefficient	P-value
Intercept	-0.5447	0.2984
Inflation	2.0800	0.0604***
Capacity Utilization	1.1967	6.18e-14***
Export of Manufactured Goods	0.0001	0.6855