**WHAT DOES MONETARY POLICY DO TO LONG-TERM INTEREST RATES AT THE ZERO LOWER BOUND?**

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1. **Introduction**

This article is about how the information from the Federal Open market committee (FOMC) affects the interest rate at the zero lower bound. The model that is used for this article is a structural vector autoregressive model (VAR). The idea behind this article is that we want to capture the days when the variance of monetary policy shocks was high when the interest rate was stuck at the zero lower bound. These are days we had FOMC meetings and other announcements that affected investor’s views on the monetary policy actions[[1]](#footnote-1).

1. **Data description**

The author used six different interest rate from November 2008 to December 2010. The interest rate that is used is described below.

* Two nominal Treasury zero-coupon yield
* Ten-year nominal Treasury zero-coupon yields
* Five-year TIPS breakeven
* Five-to-ten year forward TIPS breakeven
* Moody’s indices of BAA corporate bond yield
* Moody’s indices of AAA corporate bond yield

We had to change two of the interest rates for our paper because we could not find the exact same as the author used. The first interest rate we changed was the five-year TIPS breakeven into the difference between “five-year treasury bond yield” and “five-year treasury inflation”. Secondly, was the five-to-ten year forward TIPS breakeven into a five year forward inflation.

1. **OLS**

We aim to find that how do monetary shocks affect the six different interest rates. To do this in OLS, we made a little change on the control for “monetary shock”. Instead of using Monetary Policy announcement date, we used Federal Funds Rate. Basically, we just regress the FFR on these interest rate, respectively. All the coefficients are tabulated below. OLS result gave us significant coefficient, but does this result trustworthy? The result would be highly untenable for several reasons. First of all, all marginal effects will be biased due to the omitted variables. Second of all, the model will suffer “Autocorrelation” problem because of the sample type. Moreover, OLS cannot estimate the persistence of monetary shocks. Hence, a simple OLS regression will be inappropriate.



1. **Methodology in the paper**

Let’s first look at how did the article solve this problem by VAR model. The author assumed that the bond yields can be explained by a simple reduced form question, where is a vector of yields. is the forecast error, and it also can be represented as an underlying structural form equation. Where the is the variance of announcement days and on all other days. Dr. Wright suggested an identification approach through heteroscedasticity. Where are the estimates of the variance-covariance matric of the vech of and. and are the variance-covariance matrices of residuals on announcement days and no announcement days. Now the only question left is –what is the optimal ? To solve this question, a “minimum distance problem” would be helpful.

1. **VAR model replication**

To make the regression simple, what we did in our replication was using FFR as our monetary policy shock control. And to see what how do monetary policy shocks affect those different interest rates.

1. **Two-Year Treasury Bond**

VAR selection order criteria shows three lags would be optimal, based on the minimum AIC. However, some lags in the result were not significant. For the accuracy of the estimation, we decided to use one lag. And it also preserves the degree of freedom.

Model defined as:

1. **Ten-Year Treasury Bond**

VARSOC showed two-lag is optimal choice for the model. By checking the regression result, we kept one lag since the second lag is not significant.

Model defined as:

1. **Five-Year Breakeven**

VARSOC indicated that three-lag is the optimal choice for the model. Due to the insignificance of the third lag, we used two lags.

Model defined as:

1. **Five to Ten Year Inflation**

VAR selection order criteria shows three lags would be the optimal, based on the minimum AIC. However, the third lag in regression output was not significant. For the accuracy of the estimation, we decided to use two-lag.

Model defined as:

1. **AAA**

VARSOC indicated that three-lag is the optimal choice for the model. Due to the insignificance of the third lag, we used two lags.

Model defined as:

1. **BAA**

Same result as the “AAA” bond, VARSOC told us that three-lag is the optimal choice for the model. Due to the insignificance of the third lag, we used two lags.

Model defined as:

1. **Conclusion based on Impose Response Function**

* Two Year Treasury: A one deviation increase in Federal Funds Rate appears to have an insignificant impact on two-year treasury bond, temporarily. In a longer term, the impact becomes negative. However, since the zero line lies within the 95% CI, the response of two-year treasury to a shock to Federal Funds rate is zero.
* Ten Year Treasury: Same as the two-year treasury bond pattern. A one deviation increase in Federal Funds Rate appears to have an insignificant impact on two-year treasury bond, temporarily. In a longer term, the impact becomes negative. However, since the zero line lies within the 95% CI, the response of ten-year treasury to a shock to Federal Funds rate is zero.
* Five Year Breakeven: A one deviation increase in Federal Funds Rate will have a negative and significant impact on Five Year Breakeven. Moreover, we can see the impact lasts about three months.
* Five to Ten Year Inflation: A one deviation increase in Federal Funds Rate appears to have a positive, significant and temporary impact on five to ten years’ inflation. In the long term, the zero line lies within the 95% CI. Hence, the response of two-year treasury to a shock to Federal Funds rate is zero.
* AAA: A one deviation increase in Federal Funds Rate appears to have a positive, significant and temporary impact on Moody’s AAA bond. However, the impact only lasts about 10 days.
* BAA: Similar result we got, compared to the “AAA”. A one deviation increase in Federal Funds Rate appears to have a positive, significant and temporary impact on Moody’s AAA bond. However, the impact about 20 days, plus the impact range is wider than AAA.



1. **Limitations and Improvement**

The results will not be accurate based one some limitations. We estimated that how does monetary shock affect interest rate during a specific period, financial crisis. The sample size is 562 obs. The result will be biased due to the limited observations and omitted variables. To solve this issue, implementing “bootstrap” strategy would improve the accuracy of the estimation. Moreover, we would like to keep looking for some other important variables which can reflect monetary policy shock. Another problem is that our method is not able to distinguish the real monetary policy shock and random shock. Theatrically speaking, we could do some work on the restriction of the coefficients.

1. **Conclusion**

Unfortunately, we could not use “announcement day” to estimate the monetary policy shock. This was a groundbreaking idea in policy analysis area. Another paper Dr. Wright published in 2003—“ Identifying the effects of monetary policy shocks on exchange rates using high frequency data”, that was the first time he brought the idea that analyzing monetary policy effect by VAR model.

**From the paper:**

The founding that the author did was that over the period we estimated the effect of the meetings of FOMC when the interest rate was stuck at the zero lower bound was that the monetary policy shocks had a significant effect on the ten-year yields and long maturity corporate bonds yield but if faded off over the next months. The two-year Treasury yields effect was small. The effect on corporate bonds was a little more than the ten-year Treasury bond yields. This founding is important as we can see that the monetary policy shocks did not only affect Treasury securities but it also affected the private yields, which has a bigger impact on economic activity.

**From our model:** Monetary policy shock has relatively longer and greater impact on the ten-year treasury bond, compared to the pattern we got in two-year treasury bond, however both of them are insignificant. Moody’s AAA and BAA bonds appear to have more significant impacts, and the impact tends to last longer in “AAA” bonds. This finding matched the author’s result that monetary policy shocks affect more on private bonds. The reason could be that treasury bonds considered as “risk-free” premium, so public bonds would be more stable when some shocks occur in the economy. “Five year break even” (TIPS) was affected a lot by the monetary shocks. It is more likely to be the case that people/banks/firms trying to hedge their portfolios during a crisis. In the longer term, the monetary policy shocks reflect in inflation, five to ten year forward inflation, was not significant.

**Appendix**

1. Stationary Check



















Based on Dickey Fuller Test, among the original series, most of them are stationary. Only ten year treasury bond and five to ten year inflation are non-stationary, and integrated of order 1.

1. VAR Selection Order Criteria













To have a more accurate estimation, we only chose the significant lags.

1. Three-Month Forecast



1. Wright, Jonathan «WHAT DOES MONETARY POLICY DO TO LONG-TERM INTEREST RATES AT THE ZERO LOWER BOUND?” Cambridge. NATIONAL BUREAU OF ECONOMIC RESEARCH. 2001. Page 2 [↑](#footnote-ref-1)