

The Effects of QE2 on Long-term Interest Rates

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The Federal Reserve has considered purchasing a large quantity of long-term Treasuries in what is being called “QE2.” Market participants expect a purchase around \$500bn.³ The objective of this policy paper is to evaluate the likely impact of QE2 on various long-term rates given two pieces of information: (a) Knowledge about the relevant features of long and short-term Treasuries from the analysis by Krishnamurthy and Vissing-Jorgensen (2010) (hereafter, KVJ). (b) Analysis of the effects of long-term asset purchases by the Federal Reserve in the late-2008 to 2009 period (“QE1”), interpreted in the light of this knowledge.

The stated objective of QE2 is to reduce long-term interest rates in order to spur economic activity.⁴ The QE2 strategy involves purchasing long-term Treasuries and paying by increasing reserve balances. Interest bearing reserve balances can be thought of as overnight government debt. Thus, a \$500bn QE2 decreases long-term Treasury supply by \$500bn and increases overnight debt supply by \$500bn. The common argument for how this policy may affect interest rates is based on portfolio balance: The Fed reduces the portfolio of long-term versus short-term bonds in the hands of investors and thereby lowers long-rates relative to short-rates.

Our analysis in KVJ offers two important points for appraising these issues: (1) We show that it is important to ask which interest rate (i.e. Treasury, Agency, MBS, Baa, etc.) will be affected by the policy move; and (2) We show that the asset purchased (i.e. Treasuries, Agency, MBS, etc.) in the policy matters for outcomes.

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³ See <http://blogs.wsj.com/economics/2010/10/15/bernanke-induces-economists-to-bet-on-bond-buying-sizes/>

⁴ <http://www.newyorkfed.org/newsevents/speeches/2010/dud101001.html>

In our framework, changes in the overall supply of Treasuries affect interest rates through a *liquidity* channel and through a *safety* channel. Investors have a unique demand for liquid and safe assets and thus place a premium on these assets, above and beyond what they would be willing to pay according to standard CCAPM models.⁵ Altering the supply of Treasuries changes the supply of liquid and safe assets in the hands of investors, changing the liquidity and safety premium, and thereby changing interest rates. These effects are only present in safe and/or liquid bonds (e.g. Treasuries, Agencies, and highly rated corporate bonds). This is important for thinking about QE2 because, while there is considerable evidence for supply effects, most of the evidence comes from examining the behavior of Treasury interest rates, or other near safe/liquid substitutes. But, even if a policy affects Treasury interest rates, such rates may not be policy relevant. Most economic activity is funded by debt that is not as free of credit risk as Treasuries, Agencies, Aaas. For example, only a small fraction of corporate bonds are rated Aaa or Aa, with the majority of corporate debt being A, Baa, or lower. If the objective of QE2 is to reduce interest rates paid by the majority of corporations and households which may then spur spending and economic growth, then examining supply effects on Treasury rates will be misleading.⁶ Indeed, looking at the effect of supply on Baa rates is the most relevant benchmark. (KVJ focus on Baa rated bonds as the benchmark, as opposed to A or C rated bonds, because the yield on Baa corporate bonds is available back to 1919. Longstaff, Mithal and Neis (2006) use credit default swap data from December 2000 to October 2001 to show that the non-default component of yields is about 50 bps for Aaa and Aa rated bonds, and about 70 bps for lower-rated bonds, suggesting that the cutoff for bonds whose yields are not affected by liquidity or safety premia is somewhere around the A rating.).

In theory, supply can affect even Baa rates through a *duration-risk* channel. By purchasing long-term Treasuries, policy can reduce the duration risk in the hands of investors and thereby affect

⁵ A simply way to think about investor willingness to pay extra for assets with very low default risk is to plot the price against the expected default rate. KVJ argue that this curve is very steep for low default rates, with a slope that flattens as the supply of Treasuries increases.

⁶ A good example to illustrate this point is to consider the behavior of Treasury Bill rates in the fall 2008 period. Such rates were close to zero and substantially below most of other corporate borrowing rates. It would have been incorrect to look at the low Treasury Bill rate and conclude that credit was easy – the low rates reflect an extremely high investor preference for liquid and safe assets.

the term premium (i.e. the risk premium between long-term bonds and short-term bonds). The KVJ analysis does not account for any effects on the duration risk premium. This is because the evidence in KVJ is based on examining the effects of Treasury supply on *maturity-matched* spreads between non-Treasury (i.e. corporate) bonds and Treasury bonds. Greenwood and Vayanos (2010) offer evidence for how a change in the supply of Treasuries affects the spread between long-term and short-term Treasury bonds. Their demonstrated effect has been interpreted by some as working through a duration risk channel (see Gagnon, Raskin, Remache, and Sack, 2010). However, it is important to note that the Greenwood-Vayanos evidence is based on Treasury rates, which are affected by liquidity/safety effects. Thus, their analysis also does not conclusively pin down a duration risk channel for the broad bond market.

As we show below, re-examining the evidence on the effects of QE1 in this light suggests that while the effects on Treasury yields are substantial, the effect on Baa rates is roughly one-third of the Treasury effects. This leads us to conclude that QE2 will have smaller effects on broad bond-market interest rates and therefore limited effects on economic activity through an interest rate channel. (Note: There may be other channels through which QE2 may be beneficial. We do not address such channels.)

The yield on Agency MBS (i.e government backed MBS) is another policy relevant rate. If QE2 is successful in reducing these rates, such a reduction may feed into lower financing costs for households. Agency MBS have low credit risk because of the government guarantee, but they carry prepayment risk and are therefore not safe in the same sense as Treasuries, which offer an almost sure nominal repayment. Furthermore, agency MBS are less liquid than Treasuries. In empirically analyzing Agency MBS rates (not reported here) we have found no effects of Treasury supply on the spreads between Baa rates and Agency MBS, which leads us to conclude that purchasing Treasuries in QE2 will also have little effect on mortgage rates. On the other hand, there is research that shows MBS rates may be affected by large-scale asset purchases because of market segmentation (see Gabaix, Krishnamurthy and Vigneron, 2007). But this research suggests that it is more relevant to purchase Agency MBS than Treasuries if the goal is

to lower mortgage rates. This is consistent with the evidence from QE1 which involved purchases of agency MBS and which did affect the yield on these assets.

This note first reexamines the effects of QE1 on bond market interest rates. The data is largely taken from the event study of Gagnon, Raskin, Remache and Sack (2010), but reinterpreted from the vantage of KVJ, and with additional evidence from credit default swaps. We then analyze the likely impact of QE2 given the evidence from QE1 and the fact that QE2 will only involve Treasuries.

EVENT STUDY: 11/08 to 3/09, "QE1"

Gagnon, et. al., (2010) provide an event study of QE1 based on the announcements of long-term asset purchases by the Federal Reserve in the late-2008 to 2009 period ("QE1") (for simplicity we focus on the main event dates here, leaving out three event dates on which only small yield changes occurred). These policies included purchase of mortgage-backed securities, Treasury securities and Agency securities. The table below reproduces the main event-study dates, spanning a period from 11/25/08 to 3/18/09. The Gagnon, et. al., paper includes some other dates which we exclude because the effects are negligible. The paper also includes other interest rates (swaps, etc.), which are largely in line with the effects in the table below. The second-to-last column is based on our own computations. The IG 10yr CDS refers to the CDX North America Investment-Grade 10-year index which tracks changes in credit risk on investment grade bonds over the event dates.

<u>Date</u>	<u>Event</u>	<u>10yr Treas</u>	<u>10yr Agency</u>	<u>Baa</u>	<u>Agency MBS</u>	<u>IG 10yr Credit Default Swaps</u>
11/25/08	Initial LSAP Announcement	-22bps	-58bps	-18bps	-44bps	-14bps
12/1/08	Chairman Speech	-19	-39	-12	-15	+23
12/16/08	FOMC Statement	-26	-29	-11	-37	-22
1/28/09	FOMC Statement	+14	+14	+2	11	-5
3/18/09	FOMC Statement	-47	-52	-29	-31	-9
Total for event dates		-100	-164	-68	-116	-27

Over the November 2008 to March 2009 period it became evident from Fed announcements that the government intended to purchase a large quantity of long-term securities. Interest rates fell across the board on long-term bonds, consistent with a contraction of supply effect. Now consider the channels through which the supply effect may have worked. As we have argued a purchase of long-term securities in exchange for bank reserves has three possible effects:

- (1) Safety channel: In KVJ we show that investors have a unique demand for long-term safe assets, which is satisfied by Treasuries (as well as agencies and almost-safe Aaa private sector assets). As QE1 involves a purchase of Treasuries and Agencies from the private sector, investors have to make do with less long-term safe assets. The resulting scarcity drives up the safety premium in the price, thus reducing yields.
- (2) Liquidity channel: Since long-term Treasuries are less liquid than bank reserves, QE1 expands the supply of liquid assets and thus reduces liquidity premia in the market. Since Treasuries and other very liquid assets have low interest rates partly because they carry a liquidity premium, the reduction in the liquidity premium will increase interest rates on such assets. It is important to note that this effect runs counter to the intended strategy which is to bring down long-term interest rates.

- (3) Duration channel: Since QE1 decreases the supply of long duration assets in the hands of investors, it reduces duration risk premia.

The Baa bond possesses neither a safety nor a liquidity convenience yield. Thus the fall in Baa yields can help to isolate the duration risk premium effect. However, note that over this period credit risk also fell dramatically. The credit default swap (CDS) column in the table tracks the changes in investment-grade CDS over the event dates. The total fall in the CDS is 27 bps. Netting this against the Baa fall, we have a duration risk effect of at most 41 bps. This number is an upper bound however because it is likely that the Baa credit risk fell more than investment-grade (which includes Aaa, Aa, A, and Baa bonds) credit risk.

The Agency bonds will be particularly sensitive to the safety effect. These bonds are not as liquid as the Treasury bonds, but do have almost the same safety as Treasuries (especially since the government placed FNMA and FHLMC into conservatorship in September 2008). The fall in Agency yields is 164 bps. Of this, if we say that 41 bps was due to a decrease in the duration risk premium then the safety channel must have reduced rates by at least 123 bps. We say “at least” because the 41 bps is an over-estimate and effect (2) may have also worked against the safety effect.

The Treasury bonds, which are the most liquid and safe securities, see their yields fall by 100 bps. Comparing this to the 164 bps drop in the Agency securities, we surmise that the liquidity effect must have raised interest rates by 64 bps.

Agency MBS yields fall by 116 bps. There are two ways to interpret this evidence. It is possible that this is due to a safety effect – the government guarantee behind these MBS may be worth a lot to investors so that these securities carry a safety premium. The safety premium then rises, as with the Agency bonds, decreasing Agency MBS yields. On the other hand, the Agency MBS carry significant prepayment risk and are unlikely to be viewed as safe in the same way as Agency bonds or Treasuries (where safety connotes the almost certainty of nominal

repayment). In empirically analyzing Agency MBS rates as well as the rate on 30-year conventional household mortgages (not reported here) we have found no effects of Treasury supply on the spreads between Baa rates and Agency MBS, which leads us to conclude that Agency MBS rates, like Baa rates, do not carry safety or liquidity premia.

Yet, Agency MBS fall more than Agency bonds. We think that a more likely explanation is market segmentation effects. Gabaix, Krishnamurthy and Vigneron (2007) provide evidence that MBS rates are affected by market segmentation effects. In their analysis, changes in supply/demand conditions in the Agency MBS market can drive yields through changes in the amount of prepayment risk borne by MBS investors. Since QE1 involved a substantial purchase of Agency MBS, it is likely that Agency MBS yields fell directly due to such a purchase.

Our read on the event study from QE1 is thus more nuanced than the Gagnon, et. al. (2010) analysis which sees the effect on interest rates as through the duration risk channel. Most of the fall in interest rates is due to a safety effect. The liquidity effect has an opposing effect and works to raise rates. There is a duration effect that is roughly one-third of the safety effect, but works in the same direction to decrease rates.

Finally, note that these effects – safety, liquidity, duration – are all sizable and probably much more than we should expect in QE2. This is because the November 2008 to March 2009 period is an unusual financial-crisis period in which the demand for safe and liquid assets was heightened. In such an environment, supply changes should be expected to have a large effect on interest rates. We should not expect as large effects going forward because these demand conditions no longer exist.

ANALYSIS OF QE2

We next analyze the QE2 purchase of \$500bn of Treasuries, funded by a \$500bn increase in bank reserves, on interest rates through the liquidity channel, safety channel and duration risk channel.

First, we think that the liquidity effect is likely to be small. To quantitatively evaluate this effect, we need to compute the relative liquidities of long-Treasuries and bank reserves, and examine the effect of the increase in the aggregate stock of liquid assets on the liquidity premium. There are reasons to think that the current elasticity of the liquidity premium with respect to supply is close to zero, so that even without going through the computation of the effect of QE2 on the stock of liquid assets we can conclude that the liquidity effect is negligible. Liquidity premia are exceptionally low currently. Consider the following data (on 10/22/2010):

	<u>Treasury Bill</u>	<u>Tier 1 Non-Financial CP</u>
1 week	10bps	19bps
1 month	12	21
3 month	12	23

The premium on the more liquid 1 week bill relative to the 3 month bill is only 2 basis points. The premium on the more liquid 3 month bill relative to 3 month CP is only 11 basis points. The latter premium also reflects some credit risk and tax effects. Given how low these numbers are, any increase in the supply of liquid assets can at most increase yields by a few basis points. Second, part of the reason why liquidity premia are so low is that given recent government policy there is currently a large supply of liquid assets in the hands of the private sector. Consider that the Fed has already increased bank reserves substantially. In June 2007, reserve balances totaled \$44bn. As of September 2010, reserve balances totaled close to \$1,040bn. Furthermore, the government has increased the supply of Treasury bills from \$865bn to \$1783bn over this same period. These arguments suggest that the effects on liquidity premia

will be negligible so that the liquidity channel will not result in a substantial rise in long-term rates.

Next, consider the safety effect. With a \$500bn decrease in Treasury supply, investors will have to make do with less long-term safe assets, and hence drive up the safety premium. Table III, column (2) of KVJ estimates the size of this safety effect. The regression is,

$$\text{Baa-Aaa spread} = \text{controls} + \beta \log(\text{Debt} > 10\text{yr Maturity})$$

where, $\log(\text{Debt} > 10\text{yr Maturity})$ is instrumented by (Debt/GDP) , $(\text{Debt}/\text{GDP})^2$, and $(\text{Debt}/\text{GDP})^3$.

The Baa-Aaa spread is the spread between two similarly liquid (or illiquid) assets, but with a large difference in relative safety. Baas have approximately a 10% probability of default over 10 years, while Aaas have a 1% probability of default. The regressor is long-term Treasury supply instrumented by the total supply of Treasuries. As we explain in our paper, it is important to instrument the long-term Treasury supply to provide an accurate estimate of β because the maturity structure of government debt may be endogenous.

The β estimate, based on annual data from 1926 to 2008, is 0.31 (*t-stat* = -2.40). As of September 2010, there was \$847bn of long-term Treasury bonds outstanding. If the Fed purchases \$500bn of these securities, there will be \$347bn left in the hands of the private sector. Evaluating this change based on the β estimate gives an expected fall in Aaa rates of 27 basis points. Both Agency bonds and Treasury bonds are safer than Aaa corporate bonds. Thus, we expect that the fall in these rates will be somewhat higher than the 27 basis points. How much more? As a lower bound, if we extrapolate from the fact the difference in default probabilities between the Baa and Aaa bonds of 9% is responsible for 27 basis points of safety premium, then we compute that the fall in a bond with zero default risk will be 31 basis points. This is probably an underestimate because we think the effects are non-linear near zero default risk.

Note also that it is unlikely that the elasticity of the safety premium is currently close to zero (as we argue for the liquidity premium). The spread between Baa rates and Aaa rates is 104 bps (10/22/2010). The spread between Aaa rates and the 30 year Treasury bond is 81 basis points. These premia are large and similar to historical averages. In addition, long-term Treasury bonds (bonds with maturities greater than 10 years) totaled \$547bn in June 2007 and \$847bn in September 2010. Thus, the supply increase in long-term safe assets is modest. Indeed, if one considers that the number of Aaa credits has also fallen over the last 3 years, it is possible that the supply of long-term safe assets is largely unchanged.

Thus, with small liquidity effects, we expect that QE2 will lower both Aaa and Treasury rates by over 31 basis points. As for agency MBS, our evidence suggests that historically agency MBS behave like Baa bonds in response to changes in Treasury supply, suggesting small effects of QE2 on MBS yields.

Last consider the duration risk effect. In QE1, we estimated that the duration risk effect totaled 41 basis points. As noted above, we expect this effect to be dampened in QE2 given that we are no longer in a period of heightened risk aversion. Here is a rough estimate of how much less: We noted that the safety effect, which is also driven by an aversion to risky assets, drove a 123 basis point effect during QE1 – roughly 3X more than the duration effect. We compute that the safety effect based on average conditions is 31 basis points. If the duration effect is one-third of this effect, then we estimate that the duration effect will drive a 10 basis point fall in all long-term bond yields.

CONCLUSION

We predict that QE2 policy of purchasing long-term Treasuries will have a 10 basis point effect on Baa rates which are the rates most relevant for corporate borrowing. We do not expect much effect on Agency MBS rates or household mortgage rates (roughly the same 10 basis

points as Baas). These rates will only fall substantially with a policy that targets purchases of Agency MBS. We expect that there will be a significant lowering of the interest rates on the safest assets, including Treasuries and Agency bonds. We thus conclude that the Treasuries-only policy in QE2 will have a limited effect on interest rates relevant for most households and corporations, and will primarily benefit the safest borrowers such as Aaa corporations. There may be other benefits of policy, working through inflation or other effects, but the channel of lower long-term rates benefitting borrowers emphasized by Fed officials⁷ will likely play a limited role.

⁷ See, e.g., William Dudley, <http://www.newyorkfed.org/newsevents/speeches/2010/dud101001.html>.

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