

The effect of quantitative easing on interest rates

by Annette Vissing-Jorgensen and Arvind Krishnamurthy

Hanno Lustig

UC Berkeley Haas and UCLA Anderson

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Uncertainty

- did Fed reduce/create uncertainty in bond market during QEI/II?
 - large-scale experiment in monetary economics without precedent in U.S.
 - bond market participants face huge amount of model uncertainty in assessing likely impact of QE and other measures

'The long-term risks are enormous but difficult to estimate. They begin with the danger of a new surge of inflation, at least after the economy comes out of its current downturn. Beyond that, taxpayers will have to pick up the losses from loans that default or guarantees that have to be made good.'

Source: U.S. Details \$800 Billion Loan Plans, NYTimes, Nov 25, 2008.

Measuring Tail Risk

- cost of tail risk insurance for actively traded bond portfolios in option markets
- use volatility surface (OptionMetrics) for options on bond ETF's traded on CBOE
 1. SHY: iShares Barclays 1-3 Year Treasury Bond Fund
 2. TLT: iShares Barclays 20+ Year Treasury Bond Fund
 3. IEF: iShares Barclays 7-10 Year Treasury Bond Fund
 4. LQD: iShares iBoxx Top Investment Grade Corporate Bond Fund
 5. TIP: iShares Barclays US Treasury Inflation Protected Securities Fund

Tail Risk and Quantitative easing

- is the Fed reducing tail risk in the 10/20-year Treasury market?
- initial **increase** in **downside tail risk** (large increase in **nominal yields**) during QE1, but decreases in **upside tail risk** (large drop in nominal yields)
 1. Implied volatility from OTM **puts** on 360-day options for 10-year Treasury bonds increases by **10 percentage points** ; **15 percentage points** for 20-year Treasury bonds.
 2. Implied volatility from OTM **calls** on 360-day options for 10-year Treasury bonds **decreases**
 3. Implied volatility from OTM **puts** on 360-day options for TIPS **decreases**
- implied volatility on 10-year and 20-year Treasuries spikes during QE1 well **after** stock market vol spikes

Implied Vol in the Tails Increases During QEI

Figure : 360-day implied vol for 10-year Treasuries

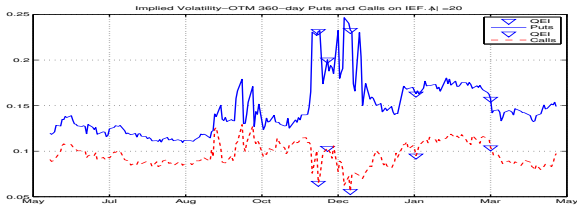
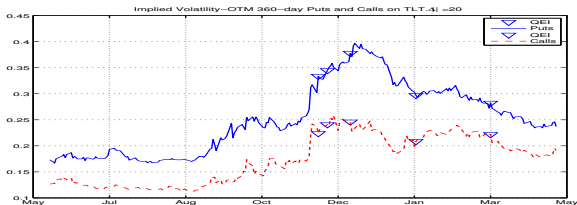


Figure : 360-day implied vol for 20-year Treasuries

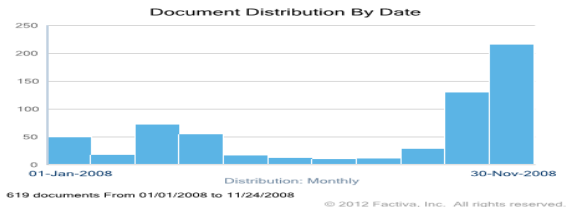


Puts and Calls with $|\Delta|$ of 20.

QE in the media

Figure : Quantitative easing in News Articles

160 (340) mentions of 'quantitative easing' in the week (month) prior to 11/24



Source: Factiva. Mentions of QE prior to 11/24/2008 in major news outlets.

Implied Vol in the Tails During QEI

Figure : 360-day implied vol for 10-year Treasuries

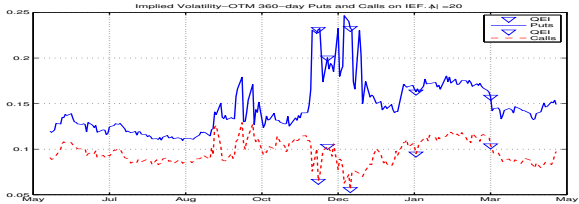
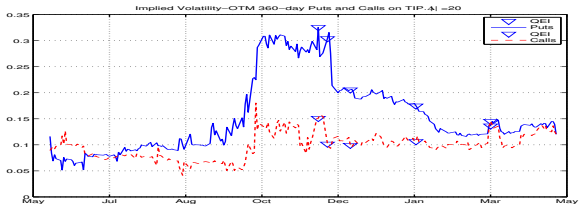


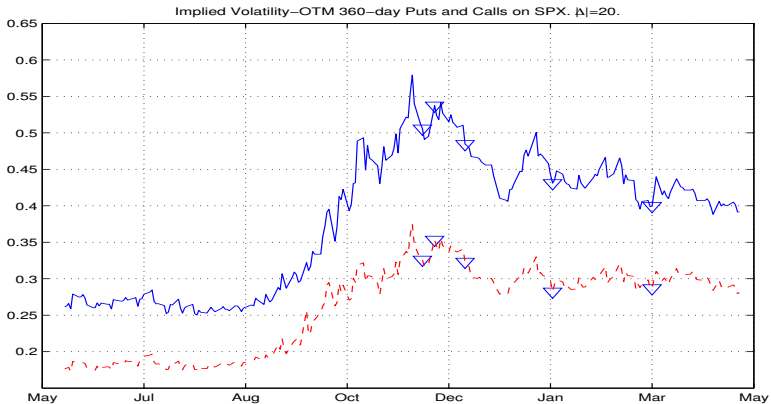
Figure : 360-day implied vol for TIPS



Puts and Calls with $|\Delta|$ of 20.

Implied Stock Market Vol in the Tails During QEI

Figure : 360-day implied vol for SPX



Puts and Calls with $|\Delta|$ of 20.

Tail Risk and Quantitative easing

- is the Fed mitigating downside tail risk in the Treasury market more than non-tail risk during QEI? evidence of a Bernanke put?
- increase in **downside risk (large increase in yields)** during QEI is **smaller** in the tails
 1. Implied volatility from OTM **puts** for 20-year Treasury bonds increases less than ATM implied vol
 2. Implied volatility from OTM **puts** for 10-year Treasury bonds increases less than ATM implied vol
 3. Implied volatility from OTM **puts** for 3-year Treasury bonds increases less than ATM implied vol
- during QEI, the Fed is steepening the inverse volatility skew for Treasuries, putting the Bernanke put in place
- during QEII, the inverse volatility skew remains steep: the Bernanke put is solidly in place

Steepening Volatility Skew during QE1 for Treasuries

Figure : 360-day Put implied vol for 20-year Treasuries

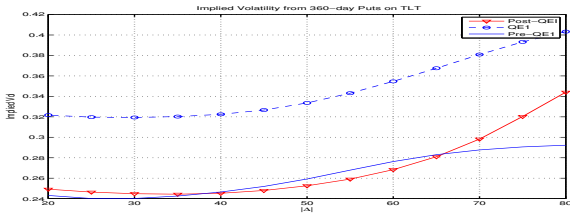
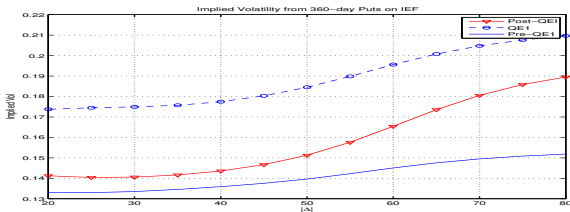


Figure : 360-day Put implied vol for 10-year Treasuries



pre-window: 25 days-5 days before 1st; post-window: 5-25 days after last.

Steepening Volatility Skew during QE1 for Treasuries

Figure : 360-day Put implied vol for 10-year Treasuries

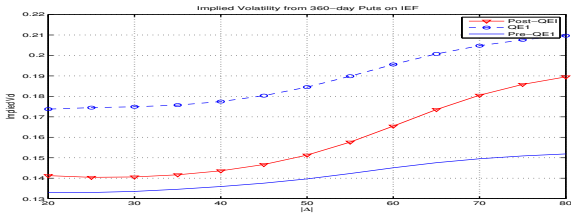
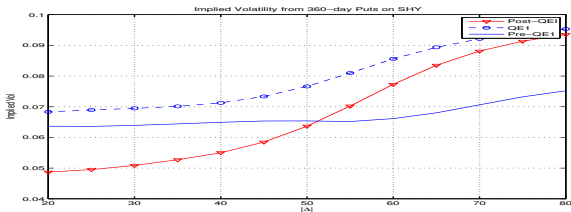


Figure : 360-day Put implied vol for 3-year Treasuries



pre-window: 25 days-5 days before 1st; post-window: 5-25 days after last.

Steep Volatility Skew before, during and after QEII

Figure : 360-day Put implied vol for 20-year Treasuries

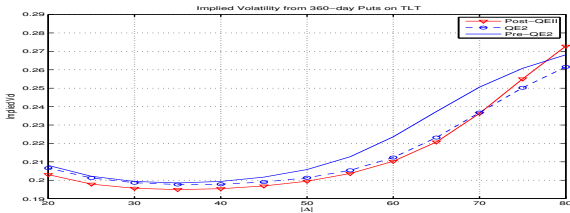
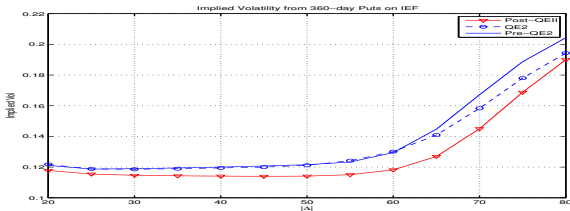


Figure : 360-day Put implied vol for 10-year Treasuries



pre-window: 25 days-5 days before 1st; post-window: 5-25 days after last.

Conclusion

- around start of QE1, inflation-driven uncertainty increases in bond market:
 - large increase in **downside** tail risk/uncertainty (risk of high nominal yields) in Treasury market
 - no similar increase in **upside** tail risk/uncertainty (risk of low nominal yields) in Treasury market
 - large decrease in **downside** tail risk/uncertainty (risk of high real yields) in TIPS market
- around the end of QE1, Fed manages to mitigate increases in downside tail risk relative to non-tail risk: the market prices in a Bernanke put
- no increase in bond market uncertainty around QEII