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The effects of quantitative easing on the volatility of the gilt-edged market☆

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ABSTRACT

We model the effects of quantitative easing on the volatility of returns to individual gilts, examining both the effects of QE overall and of the specific days of asset purchases. The action of QE successfully neutralized the six fold increase in volatility that had been experienced by gilts since the start of the financial crisis. The volatility of longer term bonds reduced more quickly than the volatility of short to medium term bonds. The reversion of the volatility of shorter term bonds to pre-crisis levels was found to be more sensitive to the specific operational actions of QE, particularly where they experienced relatively greater purchase activity.

1. Introduction

The gilt-edged market, the market for UK government bonds, has been the main instrument through which the Bank of England has operated its policy of quantitative easing, a program of expansionary monetary policy through asset purchases funded by electronic money creation. While there have been a number of studies of the effects of quantitative easing on the UK bond market, these have focussed exclusively on determining the success or otherwise of this unconventional form of monetary policy.[1] However, the gilt-market is also a major vehicle for those seeking long term fixed interest investments, for example pension funds and life insurance companies. This study examines the effects of quantitative easing from a bond investor's viewpoint and looks in particular at whether the volatility in the market has been affected by the asset purchase operations. This is important because if investors perceive volatility to have risen, they may require a greater premium for holding longer term gilts, raising the cost of financing government expenditure, and worsening the very economic outlook that the quantitative easing is designed to improve. Moreover, the costs to financial institutions and others using fixed income derivatives for hedging purposes will be directly affected by significant changes in the volatility of the underlying bonds.

The quantitative easing program in the UK can be divided into three phases of activity. The first phase, QE1, between March 2009 and January 2010, saw £200 billion spent to purchase assets, mostly gilts. By the end of QE1 40% of the stock outstanding of 3–10 year maturity bonds were purchased, 50% of the 10–25 year maturity bonds, and 15% of the more than 25 year maturity bonds were purchased. The purchases were conducted using a reverse auction process, whereby counterparties submitted prices at which they offered to sell specific quantities of individual gilts. Non-competitive (quantity only) bids were also permitted, with successful bids paying the average accepted competitive price. Other assets such as commercial paper and corporate bonds were also purchased by the Bank but in significantly smaller quantities, and these were being sold back into the market by December 2009. At the meeting of the Monetary Policy Committee held on the 4th of February 2010, the members decided not to increase the limit for asset purchases further. In October 2011 the second round of quantitative easing began (QE2) after the members of the Monetary Policy Committee voted to increase the limit of asset purchases further by £75 billion. A further increase of £50 billion

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[1] For example, Meier (2009), Joyce, Lasaosa, Stevens, and Tong (2011), Glick and Leduc (2012), Meaning and Zhu (2011), Joyce and Tong (2012) and Breedon, Chadha, and Waters (2012). These together with studies looking at the US experience and the wider economic effects of QE are surveyed in Joyce, McLaren, and Young (2012) and Martin and Milas (2012).

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was announced in February 2012 and the purchases were accomplished by the 2nd of May 2012. After only a two-month gap the QE asset purchase facility was restarted again. On the 5th of July 2012, the MPC announced a further £50 billion of gilt purchases, to be completed by November 2012, this phase being identified as QE3.[2]

In an efficient financial market, macroeconomic news should be fully and instantaneously reflected in market prices (and returns). Ross (1989) used a no-arbitrage martingale theoretical asset pricing framework to establish that asset price volatility represents the rate of information flow into an efficient market. Higher volatility implies a higher rate of flow of information into prices and thus a more efficient market. The relationship between financial market volatility and macroeconomic news, in particular, is developed in the theoretical work of Veronesi (1999). In this model, if the uncertainty surrounding macroeconomic fundamentals is high, then news causes asset prices to move much more than when this uncertainty is lower.

Empirical investigation of the link between information flow, specifically macroeconomic news, and bond market return volatility commenced with the study by Jones, Lamont, and Lumsdaine (1998).[3] The authors use high frequency data and apply a GARCH model to analyze the effect of macroeconomic news announcements on bond market volatility in the US. They find that Treasury bond returns and volatility are significantly higher on the announcement days of US macroeconomic data such as the unemployment statistics and the producer price index. However, they also show that the news effect is short-lived, so that the impact on volatility disappears soon after the announcement. De Goeij and Marquering (2006) also examine daily returns on US Treasury bonds, between 1982 and 2004, but use a GARCH model that includes a threshold variable to distinguish the effects of positive and negative news announcements. They find negative news tends to have a greater impact on volatility. Arnold and Vrugt (2010) study the relationship between macroeconomic uncertainty, measured by the log sum of absolute residuals from an AR(1) process applied to several different macroeconomic variables, and bond volatility measured by the quarterly standard deviation of returns. They find much stronger links between uncertainty and volatility than in the previous studies, also providing strong support for the theoretical framework of Veronesi (1999). Huang and Lu (2008) use a principal components analysis to decompose macroeconomic variables into real and monetary factors. They find that while real factors influence volatility across the maturity spectrum, monetary variables influence only the volatility of short and medium term bonds. Nowak, Andritzky, Jobst, and Tamirisa (2011) show that the response of volatility to macroeconomic news is considerably slower in the bond markets of emerging countries relative to those of more mature economies. Abad and Chulia (2013) find that the volatility of European bond markets increases following monetary policy surprises. Won, Yun, and Kim (2013) examine the effect of unanticipated changes in a country's credit spread on the volatility in its bond market, looking in particular at the markets in Brazil, Russia, China and Turkey. They document an asymmetry in the relation wherein increases in credit spreads have a greater impact on volatility than decreases in credit spreads. They also identified a feedback effect from volatility to credit spreads, but only during the financial crisis, indicating that credit spreads and bond market volatility could interact to generate further market instability.

While there have been no studies looking directly at the effect of QE on bond market volatility, there have been some studies that have considered the effect of QE on equity market volatility. Tan and Kohli (2011) examine the volatility of the US stock market over the period 2008 to 2011, which encompasses the US QE1 and QE2 phases. They examine three models of volatility, an AR(1) process and a modified constant elasticity of variance model, both applied to the VIX measure of implied volatility for the S&P500 index, and the conditional volatility from a GARCH(1,1) model applied to the returns to the S&P500 index. They find that the onset of QE led to a significant drop in stock index volatility that then reverted to previous levels following the ending of a phase of QE. Joyce et al. (2011) examine the behavior of the option-implied volatility of the FTSE100 index between January 2009 and June 2010, a period encompassing the UK QE1 phase. They found that the twelve-month implied volatility fell by around 40% during 2009. They also constructed an option-implied probability distribution for the FTSE100 returns and found that it narrowed between February 2009 and February 2010, with the (lower) tail risk falling considerably.

The earliest study of the conditional volatility of UK government bonds is Steeley (1992) who applied the time varying volatility model of Taylor (1986) and Taylor and Kingsman (1979) to the returns of individual gilts around the time of the 1986 Big Bang deregulation of the UK financial markets. This model uses an exponentially-weighted average of the absolute value of the deviation of returns from their average to create a sequence of conditional volatility forecasts. He showed that the volatility of gilts declined in the aftermath of the deregulation. Longer term historical perspectives are provided by both Anderson and Breedon (2000) and Johnson and Young (2002) who studied the periods 1946–1995 and 1957 to 2000, respectively. Both studies document a significant increase in UK bond market volatility between 1972 and 1975, and a gradual downward trend thereafter. Steeley and Ahmad (2002) focus on the effects of the flight to quality following the Asian crisis and the dot.com boom and bust in equity markets around the end of the last millennium. They find a significant decrease in the volatility of the UK bond market at this time as the market enjoyed "safe-haven" status.

This paper contributes to and extends these existing literatures in several ways. First, it is the first study to directly consider the impact of QE on the volatility of the UK bond market. Second, by focussing on the experience of individual bonds, it examines QE from the perspective of bond market investors. Third, by contrast to most prior studies of the effects of QE in the UK that consider only the first round of QE, between 2009 and 2010, this study additionally considers the more recent second and third rounds. Fourth, there have been very few studies of the volatility of the UK bond market, and none considering the time interval since 2001, and so this study provides further and more current evidence of the behavior of volatility in this market.

The key findings of this paper are the following. Using a GARCH based model of conditional return volatility, we document a significant increase in bond market volatility prior to the commencement of QE. This appears to begin at the point that the Bank of England offered special liquidity support to the Northern Rock bank in September 2007. This increase in volatility was as much as 600% for longer term government bonds. The first phase of QE led to a gradual reduction in bond market volatility, back to pre-crisis levels for ultra-short and long term bonds, but to levels still significantly above the pre-crisis levels for short and medium maturity bonds. The subsequent phases of QE led to further significant reductions in volatility, so that all bonds had volatility back at the pre-crisis levels or lower. Using an event study methodology, we also uncover a pre-announcement drift downwards in the volatility of gilts across the month ahead of the Bank of England's first announcement relating to QE, its intention to establish an asset purchase facility. Using cross section regressions, we find that bonds that experienced relatively more purchase auction activity saw relatively less reduction in volatility during the first phase of QE. However, this effect diminishes through the later QE periods, and can be counteracted

[2] Although the QE2 and QE3 phases have been separately distinguished in some recent survey papers, Joyce et al. (2012) and Martin and Milas (2012), the short gap between them may mean that this distinction is not preserved in the future.

[3] While we confine this review to studies of macroeconomic news and bond market volatility, there are longer established parallel literatures examining the effects of conventional monetary policy surprises and other macroeconomic news on returns in stock and bond markets and volatility in stock markets both within and across countries, for example, Balduzzi, Elton, & Green, 2001, Bomfim, 2003, Ederington & Lee, 1993, Graham, Nikkinen, & Sahlström, 2003, Kearney & Lombra, 2004, Nikkinen & Sahlström, 2001, 2004a, 2004b, Nikkinen, Omran, Sahlstrom and Aijo, 2006.