

# The impact of heterogeneous unconventional monetary policies on the expectations of markets crashes

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In periods of crisis, financial markets experience bouts of high volatility during which economic agents' perceptions of the probability of extremely adverse macro-financial events increases significantly. During these episodes, this substantial uncertainty may lead to adverse feedback loops between the financial sector and the real economy, and result in the materialisation of these extreme events ("tail risks").

Our paper explores the effectiveness of the broadly used unconventional monetary policies (UMPs) of the four major central banks— the Federal Reserve (Fed), European Central Bank (ECB), Bank of England (BOE) and Bank of Japan (BoJ)-

in mitigating ex-ante tail risk perceptions. These anticipated probabilities of extreme events are measured through the information contained in the risk-neutral densities (RNDs) of option prices from the most liquid stock market indexes.<sup>1</sup> When investors take positions in the stock index options market at different time horizons (maturities), they reveal their expectations about the probabilities they assign to the future states of the underlying asset and their degree of risk aversion. These states also reflect the view about the future economic situation (and, more specifically, about future developments in the valuations of listed companies) which underlies the reference stock market indices. We extract daily risk-neutral densities that incorporate the subjective probability of all the states of the underlying variable, including those states associated with extreme macro-financial events.

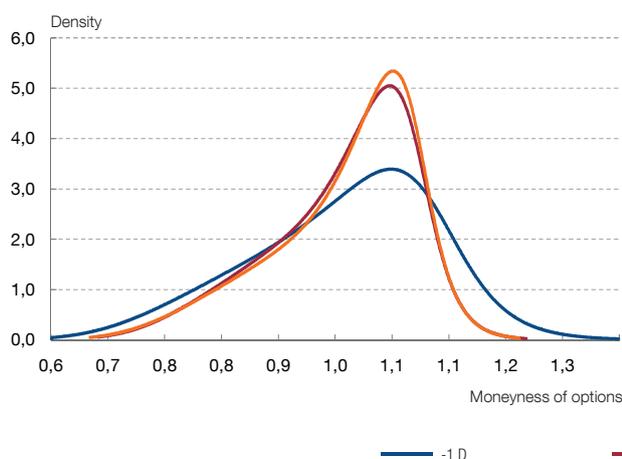
As an example, figure 1 displays complete risk-neutral densities and shows how they behave on specific dates around UMP announcements. The different lines represent

<sup>1</sup> S&P500 (US), EuroStoxx50 (Eurozone), FTSE100 (UK) and Nikkei225 (Japan).

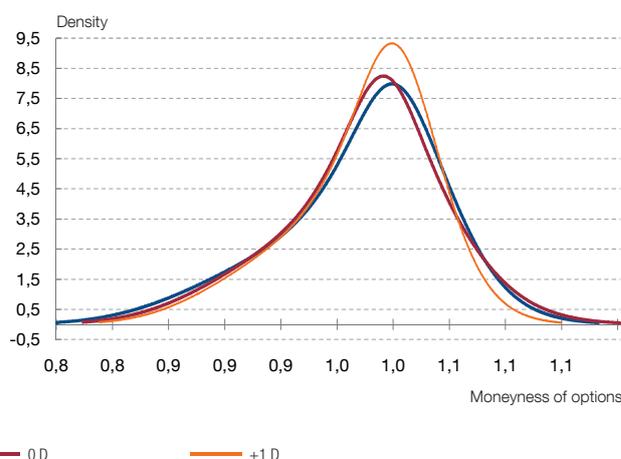
Figure 1

## CHANGES IN RISK-NEUTRAL DENSITIES ON DAYS OF MONETARY ANNOUNCEMENTS

1 ECB (10 MAY 2010)



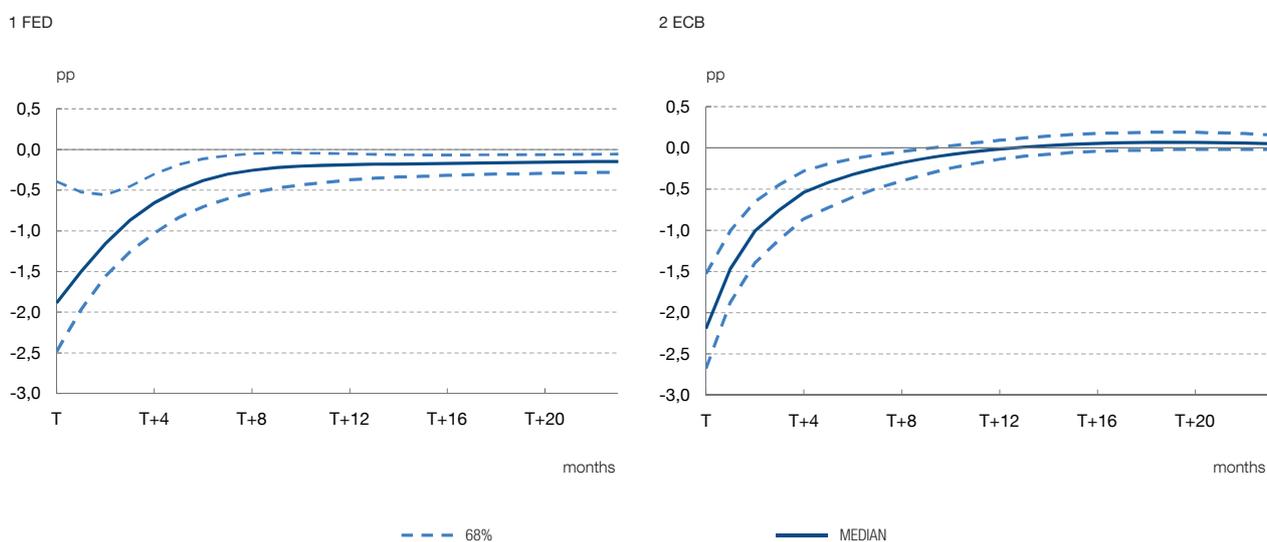
2 FED (3 NOVEMBER 2010)



NOTE: The panels show changes in the "risk-neutral densities" for a one-month horizon on the dates indicated for the announcements of UMP measures by the moneyness of options. Where moneyness is equal to one, the price of the underlying asset in 30 days is equal to the current present price. For a value of 0.9, markets estimate a fall of 10% in the underlying asset one month ahead. The figures show the "risk-neutral densities" implied in the corresponding stock market indices (S&P 500 for the United States and EURO STOXX 50 for the euro area).

Figure 2

**THE EFFECT OF AN UNCONVENTIONAL MONETARY SHOCK ON TAIL RISK PERCEPTIONS**



NOTE: The charts show the impulse-response function of tail risk perceptions to a one standard deviation (expansive) unconventional monetary shock according to a Bayesian structural (VAR) model using monthly data from January 2007 until December 2016. Each panel shows the median of the subsequent distribution (unbroken line) and the series which delimit the credibility interval at 68 % (broken lines).

the RNDs for the day of the announcement (in red), a day before (in blue) and a day after (in yellow) for two events: the Security Market Programme (SMP) announcement by the ECB in May 2010 and Fed’s announcement of an additional \$600 billion purchase of longer term Treasuries (LSAP2) on November 3, 2010. Both decisions were associated with a reduction in the left-hand tail mass of the distribution (where negative events are concentrated). In economic terms, these changes in the densities around the monetary policy announcement reflect lower demand for hedging by investors against extreme movements in asset portfolio valuations.

**THE EFFECT OF UNCONVENTIONAL MEASURES ON PERCEPTIONS OF TAIL RISK**

In order to assess the effect of UMPs on the expectations of market crashes, we rely on different quantitative tools.

First, we develop a daily “event study” for each area from January 2007 to end-2016 to assess the impact of the

announcements of UMPs (captured through a dummy<sup>2</sup>) on changes in perceptions of tail risks.<sup>3</sup> According to this analysis, UMP announcements mitigate the probability of (expected) sharp market declines for various thresholds of a given loss and across different horizons in the four areas analysed. For instance, between 7% (BoJ), 9% (the ECB), and 14% (the Fed) of the fall observed in the ex-ante probabilities of a decline of 10% or more in the stock market index over the horizon of one month can be attributed to unconventional monetary policy. In addition, monetary policy announcements seem to have affected extreme risks to a greater degree (the 10<sup>th</sup> percentile versus the 5<sup>th</sup> percentile). Finally, the impact on tail risks is higher for shorter term horizons (one month as opposed to three months). This suggests that UMP constitutes a

<sup>2</sup> More than 160 events have been identified, mostly including announcements on press conferences, press releases and statements of the four central banks.

<sup>3</sup> This approach assumes that, in a very small window of time around these announcements (one day), financial assets will only respond to these monetary policy announcements. Additionally, we control for the publication of relevant macroeconomic data and other central banks’ announcements of monetary measures.

significant signalling mechanism for mitigating current tail risks, but its effects are diluted as time passes.<sup>4</sup>

Second, in order to capture the dynamics of UMPs on risk perceptions, we rely on a Bayesian structural VAR model estimated with monthly data from January 2007 to December 2016 for each area. This model is based on four variables: real monthly GDP, the CPI, the shadow rate of Wu and Xia (2016), which approximates the monetary policy stance, and perceptions of extreme events identified by the probability of at least a 10 % decline in the corresponding stock market index over a one-month horizon. The structural shocks are identified following a sign restrictions framework, which differentiates between supply, demand, UMP and financial uncertainty shocks. Specifically, an unconventional monetary shock is determined by a contemporaneous reduction in shadow rates and a positive reaction of inflation and GDP with a one-month lag in both cases.<sup>5</sup>

This alternative approach confirms that UMP temporarily mitigates financial markets' perceptions of tail risks. According to the findings of this model, a one standard deviation unconventional monetary shock reduces perceptions of extreme events by approximately 2 percentage points (pp) at the time of impact in the four areas under study (see figure 2 for the US and the euro area). However, this effect is temporary and disappears within a year.

In a nutshell, unconventional monetary policies of the four major central banks (the Fed, the ECB, BOE and BOJ) have contributed to significantly reducing market perceptions of the probability of extreme macro-financial events, such as during the global financial crisis. These measures have served to mitigate the materialisation of extremely unfavourable events through the feedback loop between the financial sector and the real economy and to ensure adequate monetary policy transmission.

<sup>4</sup> This analysis is extended in two ways. First, when comparing between different types of UMPs, liquidity and forward guidance measures systematically seem to have a stronger impact in mitigating tail risks. Second, foreign UMP actions also prove to be significant variables affecting domestic tail risks, mainly at longer horizons.

<sup>5</sup> Other identifications are considered such as sign identification with balance sheet expansion or through the Cholesky decomposition, among others.

## REFERENCES

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