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**Research Report**

## Financial crisis, speculative bubbles and the functioning of financial markets

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# FinMaP-Policy Letter No. 3



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FINMAP -

FINANCIAL DISTORTIONS AND MACROECONOMIC  
PERFORMANCE: EXPECTATIONS, CONSTRAINTS AND  
INTERACTION OF AGENTS

DATE: 03/22/2016

TITLE

## Financial Crisis, Speculative Bubbles and The Functioning of Financial Markets

by Roman Horvarth

The recent global financial crisis has showed us how extremely costly financial crises are in terms of economic activity and overall welfare of citizens. It affected strongly the stability of selected European financial institutions as well as the debt management of various governments in Europe. The European Union has undertaken a vast series of steps to safeguard financial stability in Europe, both in the way how financial market supervision is institutionally structured and also in the way how financial market supervision is implemented. Macroprudential policies, which focus on promoting stability of financial system as a whole, has become to forefront.

The financial crisis also materialized strongly in macroeconomic stability. The European Central Bank needed to implement large-scale non-standard monetary policy measures to support the euro area economic activity, to improve the functioning of monetary policy transmission mechanism and to reduce deflationary risks.

Despite all the steps undertaken in safeguarding financial stability coupled with accommodative monetary policy, we still cannot say that the global financial crisis or its effects are over.

Having the enormously negative effects of financial crises in mind, several attendant – both general and specific - questions for academia as well as for policy makers arise.

First, to what extent the financial crises are predictable? Can we observe any regularities prior to financial crisis suggesting the build-up of speculative tendencies and formation of bubbles? Are investors overconfident contributing to the build-up of speculative bubbles? How to distinguish between speculative bubbles and fundamentally-based increase in asset prices?

Second, how do the financial markets function? How do various shocks propagate through the financial system especially during the bad times? Can the development of new quantitative tools help us in understanding the nature of financial markets functioning?

Third, how effectively can monetary or financial stability oriented policies alleviate the effects of financial crisis? What is the appropriate mix of these policies in order to prevent or to reduce the concerns that accommodative monetary policy (with ultralow monetary policy interest rates coupled with non-standard monetary policy measures) contributes to the build-up of bubbles in selected financial markets such as housing market?

Forth, how to effectively communicate the policies related to financial stability and monetary policy? What is the optimal communication strategy and can public information crowd out private information (in other words, the possibility that if institution such as central bank communicates its policies to the public too much and in an excessive details, it can result to less information gathering and information evaluation on the side of financial markets with overall welfare effects of improved communication and transparency to be uncertain)?

The Work Package 2 of this research programme largely focuses on the aforementioned questions and we discuss the main findings and policy implications below.

## EVIDENCE AND ANALYSIS

Work Package 2 on the Identification of Speculative Bubbles focuses on four distinct but interrelated areas.

The first area focuses on examining the commonalities in financial markets. More specifically, it examines the correlations in volatility among various financial assets and proposes advanced econometric methodology how to systematically address the specificities of the functioning of the financial markets. This stream of research focuses on first, developing new econometric tools to analyse commonalities and second, applying them to test the relationship among financial assets in selected markets. This area of research is an important precondition to understanding the bubble formation because it examines volatility propagates through the financial system and what drives these volatilities.

More specifically, one of the papers proposes novel methodology how to assess the degree of volatility spillovers in financial markets (specifically, among stock markets). The paper builds on a notion that there is a good and bad volatility and shows that some part of volatility is vital for the functioning of financial markets. Good volatility results from firms being more productive and innovative. The improved firm conditions are reflected in their higher stock price, which materializes in good volatility of their stocks. On the other hand, bad volatility is excessive and may result from phenomena such as political risk. Interestingly, the paper finds that bad volatility transmits more strongly than good volatility shocks especially when markets are plummeting suggesting that markets react disproportionately more to bad news, as it is rather well known, but also disproportionately more to bad volatility.

Other papers in the area of research introduce wavelet analysis in order to examine the correlations among various financial assets such as oil, gold or stocks. Wavelet analysis can be potentially useful because it allows us to calculate correlations among the assets also for various frequencies (such as short-term, business cycle frequency or long-term). Therefore it can pinpoint the frequency at which various assets are correlated.

In addition, one of the papers in this area has demonstrated how wavelets can be useful for forecasting volatility of financial markets. It has been well documented that stock index options have found biases and inefficiencies in implied volatility as a forecast of future volatility. The paper proposes procedure how to correct for these biases using wavelet theory in order to provide more accurate predictions of the volatility in financial markets.

Furthermore, one of the papers uses spectral analysis (i.e. frequency analysis) to examine the links between the volatility in macroeconomic and financial variables. It argues that some links are hidden using the traditional time domain analysis. For example, some variables (and their volatility) are correlated at the business cycle frequency but not at other frequencies. Importantly, the paper extends the previous frameworks used within the spectral analysis by allowing to examine the determinants of links among macroeconomic and financial variables. Therefore, the paper provides a general framework how to study correlations and its driving factors among any macroeconomic and financial variables jointly in time and frequency domain.

The second area focuses on examining whether survey data of professional forecasters help us understand speculative bubble formation in stock markets. The resulting paper employs the survey data of professional forecasters collected by the German institute ZEW and it investigates to what extent can professional forecasters predict the future course of stock markets and to what extent their overconfidence results in biased forecasts. It is found that it is indeed the case that overconfidence tends to worsen forecasting performance.

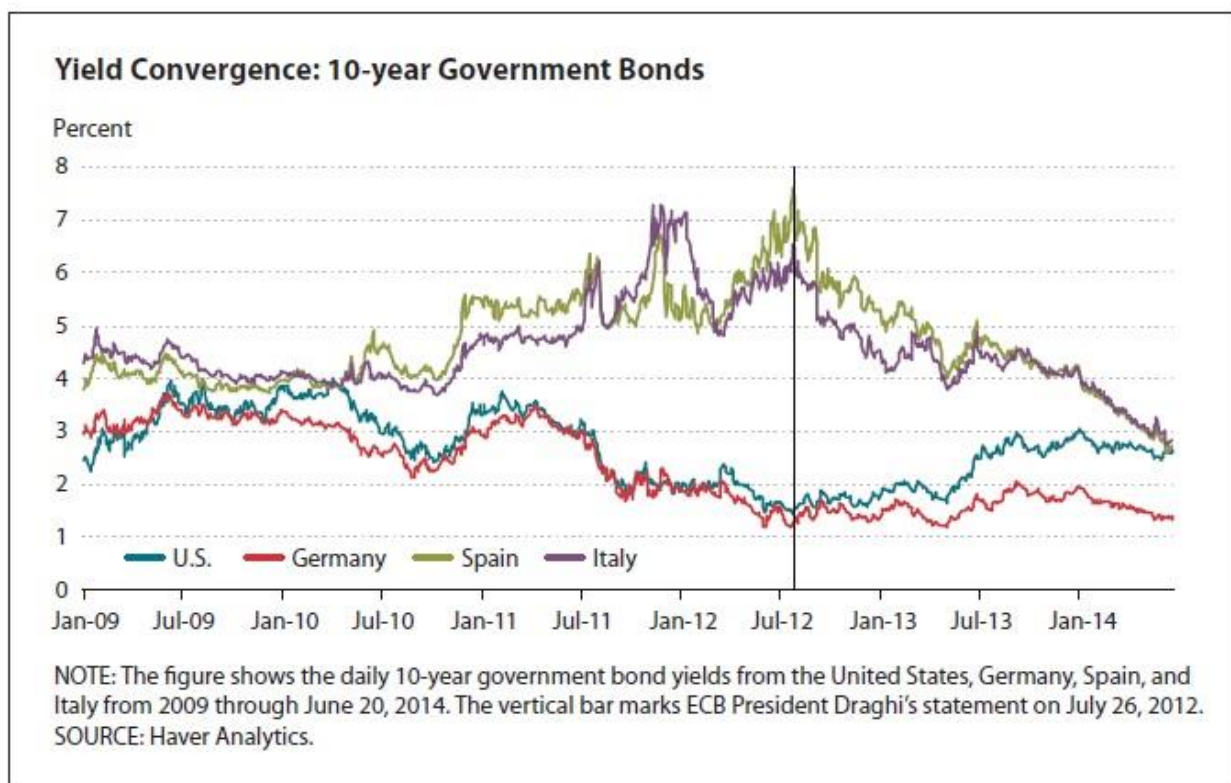
Another research in this area also employs the survey data but examines the formation of optimistic vs. pessimistic behaviour of investors. It argues that, for example, if the investors are overly pessimistic, it can contribute to the formation of asset price bubbles because with pessimistic investors the actual asset price may deviate from its fundamentally based value. Interestingly, the results suggest that when investors become pessimistic (after being confronted by a series of negative news), they stay pessimistic. However, this persistence in pessimism is not observed for optimism. Once the investors become optimistic they can relatively easily lose their optimism. This instability in optimism-pessimism formation provides a behavioural finance explanation to why we observe large swings in the asset prices and especially why stock markets are plummeting.

In addition, there is also research produced on investigating the efficiency of stock markets using the US survey data. Interestingly, the results suggest that financial markets tend to be efficient in the long-run and the professional forecasters build expectations in largely rational manner. Nevertheless, this is not the case for the short-run, for which the results cast doubt on the notion of efficient market hypothesis. Overall, these results imply that financial markets can easily deviate from its fundamental values and only slowly revert back to its steady state.

In addition, another paper in this area did not use survey data but contributed in a different, but important way for understanding whether policies can contribute to bubbles. Specifically, the paper investigates how the current monetary policies affect the housing markets in United States, the United Kingdom, Japan and the Euro Area. Unlike previous research, it is able to evaluate the effect of monetary policy on the housing market even if monetary policy rates are at the zero lower bound and, in addition, a number non-standard monetary policy measures are being implemented. For this reason, study uses the so-called shadow interest rate, which is constructed based on non-linear model of the term structure of interest rates and is not bounded by zero. Various estimates of shadow policy rate show that the rate became negative in many developed countries during the current global financial crisis. The paper employs the time-varying parameter vector autoregression model to examine whether the response of housing market has changed after the implementation of unconventional monetary policy. The results suggest that somewhat surprisingly the implementation of unconventional monetary policy has changed the monetary transmission mechanism to housing prices only a little. The authors also find the housing markets respond more to (shadow) monetary policy shocks in the USA than in the other countries included in the sample. Overall, the results suggest that accommodative monetary policy has contributed to the increase in the housing prices in all studies countries.

Another paper in this area examines to what extent the bubbles occurred in the government bond spreads from 2010 to the middle of 2012. The spreads for several euro area member countries such as Greece, Italy or Spain increased substantially to the levels several percentage points above the spreads observed in Germany, see Figure 1. Was this difference driven by the speculative bubble, fundamentals, or both? According to this paper, the difference was largely due to speculative bubble with the bubble bursting after the ECB president Draghi announced in late July 2012 that:” *Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough.*” The paper shows that if the differences in spreads were driven by fundamentals, the development in these differences should broadly correspond to the development of the fundamentals. Using the regression analysis, the results suggest that this is not the case, i.e. the government bond spreads are only weakly linked to fundamentals during the studies period.

**Figure 1 – The Differences in Government Bond Yields: Speculative Bubble or Fundamentals?**



The third area employs the methods of experimental economics to examine the investor's reaction to new information. The resulting papers in this area thoroughly compare the experimental research with available theoretical models, especially in the stream of literature investigating the information processing in the financial markets. The theoretical literature examines the social welfare effects of public information, i.e. whether the transparent communication of public institutions such as central banks increases welfare of society. Numerous theoretical models emphasized the limits of

transparency because greater dissemination of information by public institutions may “crowd-out” the information gathered by private agents and decrease welfare if the public signal about fundamentals is imprecise. Although there is some disagreement in theoretical research it can be said that, on average, this body of literature emphasizes that there is an optimal level of dissemination of information by public institutions and that this optimal level depends on the precision with which public institutions are able to assess the current and future economic conditions. Related research also emphasizes that the optimal degree of dissemination of information by public institutions depends on the type of audience (for example, the optimal degree of dissemination of information by public institutions can be higher for the financial market participants than other economic subjects).

The laboratory experiments can be helpful in testing various theoretical predictions about the optimal degree of dissemination of information by public institutions. On the other hand, the laboratory experiments may suffer from the lack of external validity and field experiments are inherently difficult to conduct in the area of financial stability. Having the pros and cons of this method in mind, the research in this area sets up laboratory experiment to investigate whether traders in financial markets will excessively respond to the release of public information, especially if the public information will not be accurate (imagine, for example, stress tests of banking sector with imprecise results). The experimental results seem to broadly support the theoretical research in the sense that the traders indeed have put too much weight on the imprecise information released by public institution.

Another research in this area shows that the investor attention (as measured by the Google searches) matters for the initial public offerings. The results suggest the investor attention causes overoptimistic market reaction and therefore, underperformance of given stocks in the long-term.

The research in the fourth area focused strongly on examining the non-linearities in financial market developments. One of the paper examines the pricing policies for the credit default spreads of the major European firms. The results suggest that the pricing of these assets depend non-linearly on economic and financial conditions of European economy. The regression analysis shows that once the financial stability deteriorates, the investors become overly cautious and react very sensitively to bad news. Overall, given this sensitivity to bad news the results contribute to explaining why we observe such large swings in financial markets.

The fourth area of research focuses on applying various heterogeneous agent based models to demonstrate how different agents on financial markets react heterogeneously to identical news. Agent based modelling is a flexible tool to examine not only heterogeneity but also non-linearity on financial (as well as other) markets.



A related paper uses empirical model of heterogeneous agents (using smooth transitions) to date the crisis periods using the data on European sovereign bonds market. This paper also demonstrates how the pricing of sovereign bonds and credit default swaps change during the crisis periods, when the pricing reacts excessively to news.

In line with this research, related paper uses heterogeneous agent-based model to explain speculative bubbles in markets. To study the emergence and breakdown of speculative bubbles, a reduced form model of speculative interaction in the form of a cusp catastrophe model has been estimated (in the sense of the mathematical theory of 'catastrophes', i.e. dynamic systems subject to discontinuous dramatic changes of behavior). Applying this methodology to U.S. stock market data, it was found that large changes in the eighties (e.g., October 1987) could be identified as bifurcations triggered by endogenous market dynamics while the more recent phases of prolonged downturns appeared to have been triggered by exogenous forces. More pervasive systemic events have been studied in more complete models that cover a larger part of financial activity or even connect the financial sector with the real sphere of the economy. Systemic break-down of activity has been particularly observed in the interbank market in 2008 and after.

## POLICY IMPLICATIONS AND RECOMMENDATIONS

This working package delivers several policy implications. We mention four implications, which we consider the most important. These policy implications are distinct but interrelated.

First, a series of papers produced within this research programme has demonstrated non-linearity in the developments of financial markets and in the reaction of financial markets to the macroeconomic conditions and news. More specifically, the financial markets react excessively to news in bad (crisis) times. In addition, economic agents react heterogeneously to news and this heterogeneity may increase during the crisis times. This has important implications to public institutions in charge of analysing the current economic conditions and forecasts. Their forecasting and policy analysis system should explicitly acknowledge the fact that the links among economic and especially financial variables change during the crisis. The modelling frameworks should be extended for the non-linearity in order to account for empirically observed large swings in the price of various financial assets. In addition, these modelling frameworks should be adjusted in the way to be able to easily incorporate one-off shocks.

Second, current monetary policy characterized by very low interest rates for extended period of time may create bubbles in specific segments of financial markets such as the housing market. With the low yields in segments such as bond markets, housing market may become vital investment option. One of the papers provides relatively easily implementable econometric framework, which sheds light on the question to what extent accommodative monetary policy increases housing prices in Europe. It finds that indeed monetary policy affects the housing prices and that one may expect high housing prices as a side-effect of loose monetary policy. So, even though the loose monetary policy might be effective in supporting domestic economic activity and reducing deflationary risks, it may create bubbles in some financial assets. In other words, accommodative monetary policy may increase risk taking behaviour in financial markets as the investors search for the yield and as a consequence, to contribute to the build-up of future instability in financial markets.

Third, the research also contributes to the question on how to optimally communicate the policies to the public. Optimal transparency of public institutions is higher in good times than in bad times. In addition, it is far from easy to decrease the degree of transparency during bad times because this is likely to be associated with reputational costs (a straightforward example is publishing financial stability reports and stress tests in good times and hesitating to publish or even not publishing them in bad times). The communication about financial stability issues is particularly delicate given the high interconnectedness of financial institutions and high information asymmetry between the financial sector and the public, which may result in bank runs.

Fourth, a series of papers documented that speculative bubbles occur. Some papers examine the pricing of government bonds and find that their yields were characterized by speculative bubble in 2010-2012 in selected European countries. The policy implication of this finding is that both the words and deeds of central bank are extremely important in this manner. The central bank should be actively involved in the communication of financial markets misalignments and should act as the lender of last resort in the (secondary) government bond markets. More generally, these results warn against application of the efficient market hypothesis in economic policy, which is by definition oriented at short or medium-term. While the results in this area of research support the notion that financial markets are efficient in the long-term, the deviations from fundamentals in the short-run occurs and economic policies should be structured accordingly.

The projects have used different modelling frameworks tailored to address the specific research hypothesis.

To analyse the correlations among financial assets at different frequencies, the papers use different variants of wavelet analysis. In addition, the papers also propose a new econometric framework based on generalized autoregressive conditional heteroscedasticity model, which explicitly accounts for the heterogeneous effects of bad and good news, and bad and good volatility.

Another stream of research applies non-linear panel regressions and time-varying parameter vector autoregression especially when examining how financial variables respond disproportionately to macroeconomic conditions in good vs. bad times.

The papers also use standard methods to evaluate forecasting performance especially when examining survey data of professional forecasters to document the efficiency of financial markets. In addition, the papers conduct several laboratory experiments. A series of papers uses agent based modelling.