

ECONOMIC WATCH

European Central Bank's Monetary Policy Tone index

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1- Introduction

This Economic Watch introduces the European Central Bank's (ECB) Monetary Policy Tone index developed from ECB documents, using text mining and Natural Language Processing (NLP) techniques. This analysis allows us to objectively identify and track the relevant themes within the ECB's monetary policy discourse.

The desirability of developing an indicator to measure the tone of the European Central Bank (ECB) as extracted from its monetary policy communiqués, press conferences, speeches by ECB members and minutes arises from the fact that central banks have adopted concrete commitments, and credible and transparent communication as monetary policy tools. More recently, after the crisis of 2008, with interest rates reaching the zero lower bound (ZLB), and the implementation of quantitative measures, the central banks' forward guidance has become particularly relevant within the monetary policy toolkit, because it allows monetary policy expectations to be affected, either easing when the rest of the instruments (interest rates and quantitative measures) run out of their margin of manoeuvre ([see](#)); or anchoring interest rate expectations when central banks begin to phase out the stimulus¹.

To build an ECB monetary policy tone indicator makes sense, because the ECB's monetary policy stance is credible and transparent. To this end, the ECB anchors its forward guidance policy tool in the ECB's main mandate (price stability) and it makes the reaction function explicit (*e. g. the situation is this, we expect it to evolve in this way and if it does, we will do the following*). In addition, the ECB applies forward guidance to all the policy instruments it has in place (interest rates, asset purchases and sequence) based on three dimensions: quantity, duration and sequence in time. Therefore, an objective analysis of the ECB speech is a key tool for tracking changes and forecasting monetary policy expectations.

2. Empirical Results: European Central Bank monetary policy tone index

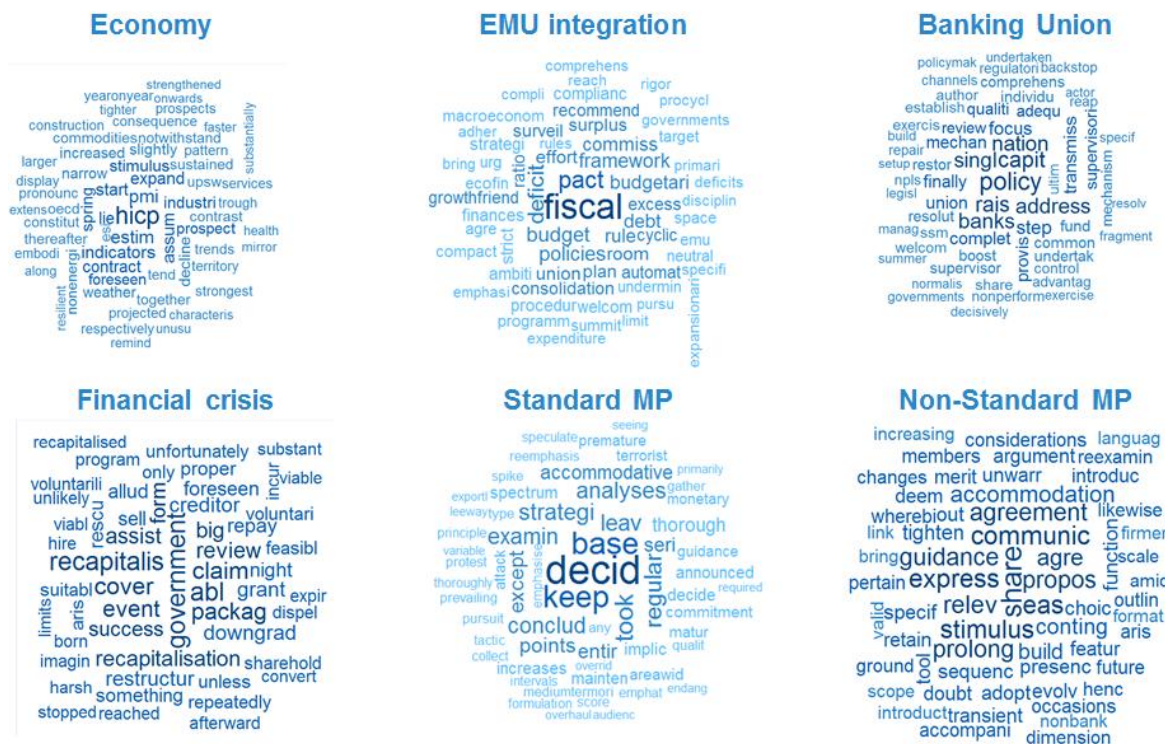
In this section we present the main results of applying the NLP techniques to the Statements and the Q&A of the European Central Bank press conferences on monetary policy from 1999 to 2017. The first section (2.1) describes some of the 30 latent vectors extracted by the Dynamic Topic Model and we look at the evolution of these topics over time. Meanwhile the interconnectedness of the topics is explained in the third section (2.2). Finally, we show the sentiment of these topics, including the sentiment of the monetary policy stance in the last section (2.3).

1: Coeuré (2017) monetary policy is transmitted by affecting expectations of future policy interest rates.

2.1 What are the main topics behind ECB’s statements? How have evolved across the time?

Taking information from the ECB Monetary Policy introductory statements and Q&A’s press conferences from the website from July 1999 to December 2017, we pre-process the text² (cleaning, stemming, tokenising, etc.), converting it into data. We use topic modelling through the Dynamic Topic Model (DTM) to obtain the latent vectors of the topics in the documents. Using K-means clustering and computing silhouette information to validate these clusters of data, we select 30 latent vectors of words. It is up to the analyst to provide meaning to the topics estimated by the DTM. While some of the estimated topics are related to the internal wording used by the bank (when and where meetings are held) or direct comments on graphs or economic results, most topics have economic interpretability. In our analysis, out of 30 estimated topics, 19 have a direct economic interpretation. In fact, some of them share a common theme. Topics have been aggregated into 6 groups: economy, EMU integration, Banking Union, financial crisis, Standard Monetary policy (Standard MP) and Non-standard monetary policy (Non-standard MP). Figure 2.1.1 shows the six main groups already identified using this technique combined with the analysts’ expert judgment.

Figure 2.1.1 Word Clouds of some the topics considered



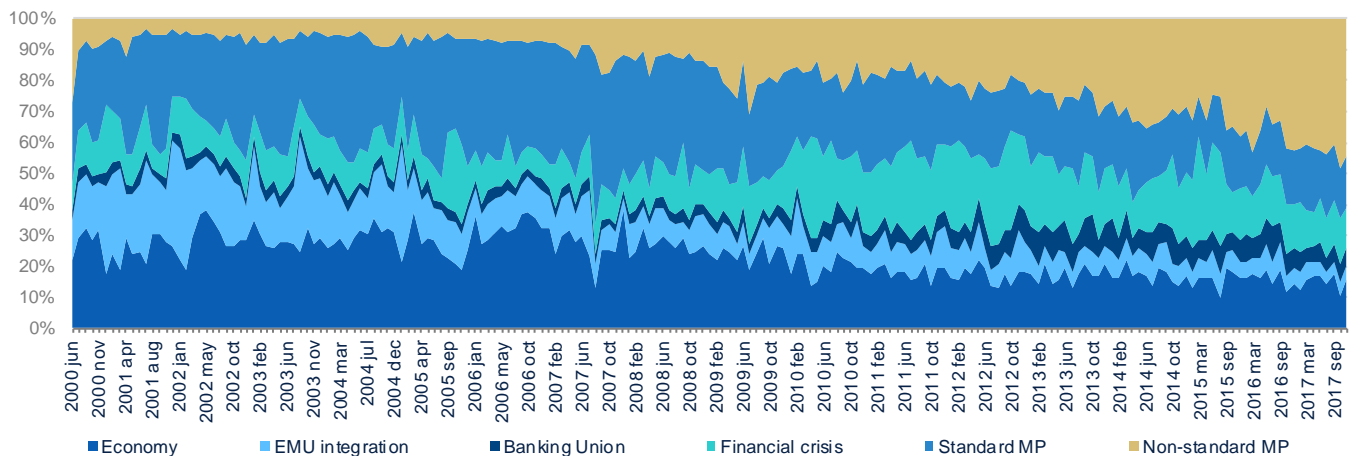
Source: BBVA Research

Regarding the prevalence over time of these topics, Figure 2.1.2 presents the estimated document average weight mix of the topics over time. This can be interpreted as the percentage of content within a document that is related to a particular topic. The topics with relevant “economic” semantics account for most of the weightings within the

2: Further details about data pre-processing and methodology can be found in Iglesias et al. (2017).

communications, ranging from well over 60% to just above 80%. Ahead of the global financial crisis (2000-2009), the topics with greater influence (or weight) are, on average, *Standard MP* (33%), *Economy* (28%) and *EMU integration* (15%). Meanwhile, since the crisis (2010-17), the topics with greater weight have been *Non-standard MP* (27%), *Standard MP* (21%) and *Financial Crisis* (20%).

Figure 2.1.2 ECB Topics evolution³ (%)



Source: BBVA Research

- The “Economic” topics have had a significant weight over the whole period analysed (on average 23%). Nonetheless, their initially high weight (around 28%) shrunk somewhat from 2009 up to now (displaced by the “non-standard MP” and “Financial crisis topics”). In the last few months, with the Eurozone recovery now on track, these topics have been gaining weight.
- The “EMU integration” topics had an initial significant weight until 2005 (around 20%) and then started losing influence afterwards. It makes sense that these topics would have a significant weight at the first stage of the monetary union, coinciding with the launch of the European central bank.
- The “Banking Union” topic has been gaining presence throughout the period of study. The need for a banking union emerged as central issue with the onset of the financial crisis in 2008 and the subsequent sovereign debt crisis. In mid-2012 the European banking union was launched and the first steps in its implementation were taken at the point the weight of this topic reached maximum levels (10-12%). While some steps remain before reaching a full-fledged banking union, since 2015 these topics have lost weight after the major advances towards European Banking Union already taken.

³: Only includes press conferences. Accounts of monetary policy meetings only available since 2015.

- The “financial crisis” topics started to gain significant weight once the financial crisis started (the Lehman Brothers collapse) and increased their importance in the worst days of European debt crisis (30%). Since the well-known “whatever it takes” speech by Mario Draghi in 2012, these topics have been losing weight, with the exception of 2015, when Greek crisis reemerged.
- Unsurprisingly, the “standard MP” component is one of the most significant in the ECB communications, floating around 28%. However, the nature of monetary policy has changed over time, as standard monetary policy has lost weight to give way to non-standard MP when the financial crisis started in 2008, with the crisis caused by the Lehman Brothers collapse and followed by the European debt crisis.
- Regarding “non-standard MP” topics, they have been gaining weight since the global financial crisis started in 2008, reaching the current level of 45% on average during 2017⁴. Since that date and in response to the subsequent European debt crisis, the ECB has adopted various measures to stabilise the economy which are aimed at achieving its ultimate goal: price stability. Apart from reducing the main refinancing rate to 0%, initially, they launched long term refinancing operations (LTROs) that allowed banks to borrow money for three years at very low interest rates⁵. Moreover, since mid-2014, the sharp drop in inflation expectations in the eurozone pushed the ECB to adopt other unconventional measures: forward guidance communication, introduction of negative interest rates, providing banks further cheap liquidity with long-term financing (for four years) at very low interest rates, and launching a programme to buy public sector securities which joined the purchase programme of private sector securities (ABS, covered and corporate bonds), better known as quantitative easing (QE).

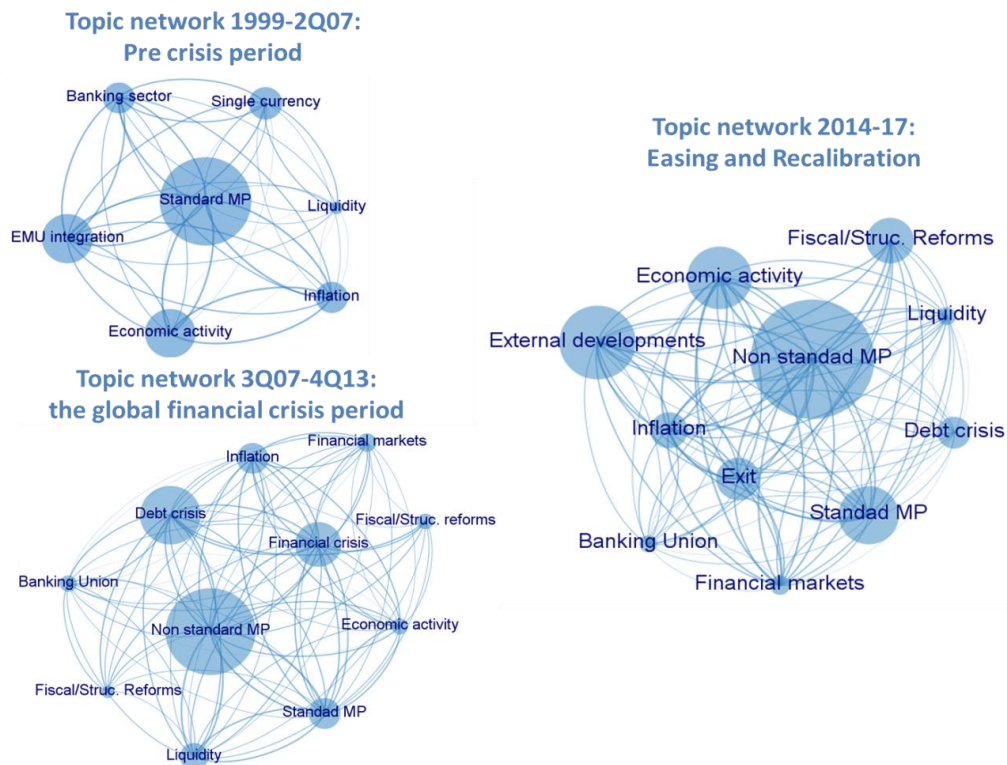
2.2 The increasing complexity of Monetary Policy: network analysis

We also use the results from the DTM to build networks and analyse the interrelations between the topics and how this relational structure can change over time. The DTM with 30 topics is considered in three ways, using only the data for each period of the eurozone’s economic history. After aggregating the latent vectors into topics, we build networks for each period using the mean weights of each group as the size of the nodes and the correlation matrix of probability of co-occurrence of the words averaged across topic groups as the edges.

Figure 2.2.1 shows the networks between the main topics identified in the ECB texts and how they are interconnected with each other depending on the challenges that the monetary authority faces in each period of time. The node colour indicates clusters using a community detection algorithm called modularity developed by Blondel et al (2008). Topics for which the labelling is unknown are removed from the graph in the interest of visual clarity.

⁴: In these topics we have included words regarding the exit strategy from non-standard monetary policy measures (tapering).
⁵: (Before the crisis in 2008, the longest LTRO maturity was three months).

Figure 2.2.1 Network analysis: topic relationships and evolution over time



Source: BBVA Research

- During the period of the first few years of the functioning of the economic and monetary union (EMU) (1999-2Q07), the establishment of the ECB and a single currency were significant movements in the integration process. Therefore, both EMU integration and Euro currency nodes display signs of centrality and relevance. This is clearly related to inflation and economic activity. During this period, monetary policies are clearly aligned with the prominence of the standard monetary policy.
- In the global financial crisis period (3Q07-4Q13), the monetary policy of the ECB and the central banks around the world became increasingly complex. Credit crunch, liquidity constraints and the recession hit the eurozone economy, and once the space for traditional monetary policy was exhausted, non-standard MP measures appeared in the network and liquidity increased its presence. Moreover, following the financial crisis and the European debt crisis, European authorities responded to the crisis with several measures, among them the creation of the banking union which appeared in the network.
- From 2014, non-standard MP measures increased their presence in the documents as during this period the ECB launched the programme to buy bonds from the sovereign states of the eurozone (QE). Although since mid-2017 the focus has been on the exit strategy which appeared in the network, given that the ECB was starting to adjust the recalibration of the asset purchase programme and beginning to communicate the next steps in the process of monetary policy normalisation.

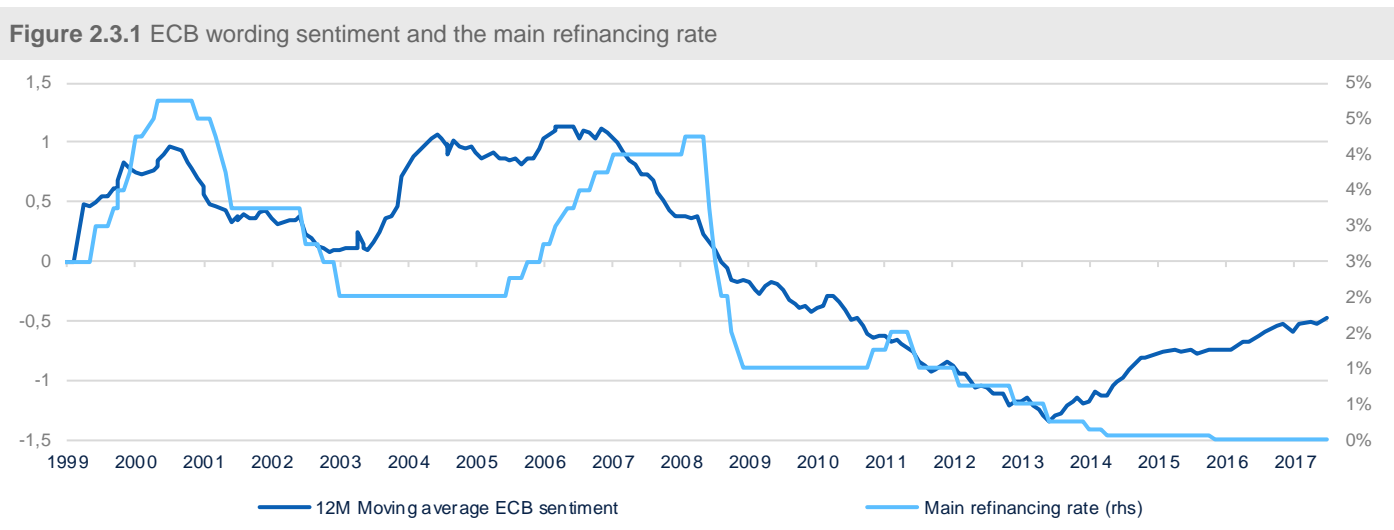
2.3 Sentiment of the monetary policy stance

To measure the tone or sentiment of the identified topics, we also assess the sentiment of the ECB statements (a proxy for ECB monetary policy stance), by using the lexicon approach. We have defined a specially-designed dictionary for central bank language ([see](#) methodology), as well as the Loughran/McDonald dictionary (Loughran and McDonald 2009) and the Fed Dictionary for Financial Stability (Correa et al, 2017), in order to identify sentiment change in the documents (positive or negative sentiment).

As positive central bank statements are associated with positive economic and financial conditions and vice versa, we can interpret the ECB sentiment as a proxy for the degree of hawkishness (or dovishness) of the monetary policy stance. Moreover, given the above, we present the indicator using a normalised index: a positive (negative) value is associated with a tone statistically more positive (negative) than the average.

In light of the results, we have identified two main periods in ECB sentiment. In the first period (1999-2007) the sentiment was positive, indicating that the ECB monetary policy stance had a hawkish bias, especially during the years 2004-2007 (years associated with economic prosperity). In the second period (2007-2017) the sentiment dropped steadily from the financial crisis in 2007 to 2013 when the sentiment reached its lowest levels.

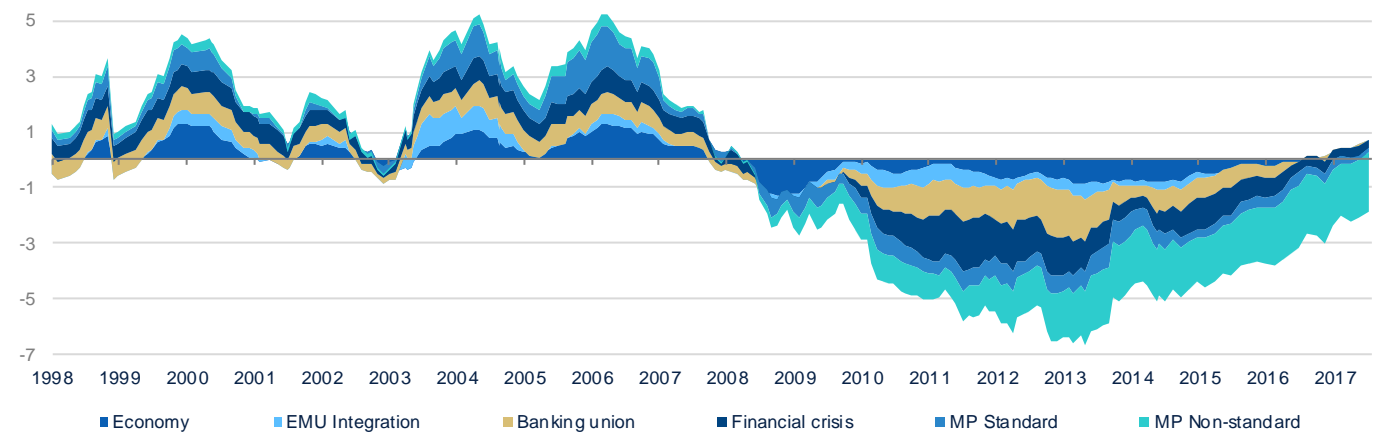
From 2013 onwards, although the sentiment has had a dovish bias, it has initiated an upward path to neutrality. More recently, the short-term sentiment has been very close to neutrality as the ECB is preparing the pullback of stimulus measures, such as the gradual ending (tapering) of the asset purchase program (QE), on the back of a gradual upward inflation path ([see](#) Synthetic inflation indicator in the Eurozone).



Source: Bloomberg and BBVA Research

The components of the ECB wording tone are the individual sentiments of each topic analysed in the previous section. In the chart below, we can see the breakdown of the ECB wording tone by the main topics identified.

Figure 2.3.2 Components of ECB wording tone by main topics (moving average and normalised index)

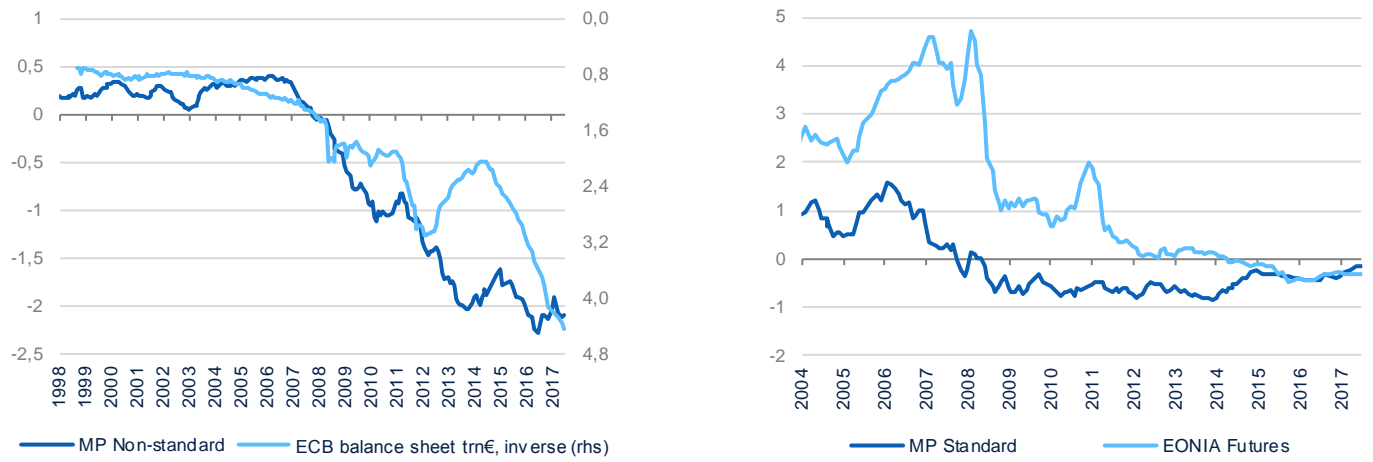


Source: BBVA Research

The results show that during the first period (1998-2007), all the components were positive. In the second period (2007-2017), the tone turned negative in all of its components, and especially negative in the financial crisis component, coinciding with the eurozone sovereign debt crisis (2009-2013). Later, in 2012, the non-standard MP component started to gain weight and placed a negative pressure on the ECB wording tone. The “whatever it takes” speech by Mario Draghi seems to have represented a reversal in the components of the ECB wording tone: all the components started to raise steadily, the financial crisis component declined in importance, while the non-standard MP component gained in importance. More recently, this component has been the major driver of ECB wording sentiment, adding a downward bias in the sentiment. Excluding this component would lead to an ECB wording sentiment slightly above the average, which is neutral with slightly positive bias.

We also analysed the relationship between the sentiment of both non-standard MP and standard MP and market-related instruments. We found a strong positive relationship between the sentiment of standard MP and the EONIA futures (73% correlation coefficient) and a strong negative relationship between the sentiment of non-standard MP and the ECB balance sheet (-89.70%), as we can see in the charts below.

Figure 2.3.3 Relationship between financial variables and non-standard and standard monetary policy sentiment



Source: Bloomberg and BBVA Research

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