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Abstract

We investigate whether the so-called textual sentiment has any impact on European depositors' behavior to withdraw their deposits. After the manual collection of monthly speeches of the president of the European Central Bank (ECB hereafter) we apply textual analysis techniques following the methodology of Loughran and McDonald (2011) and we construct two alternative sentiments able to capture the perceived uncertainty. We find that high frequency of uncertainty and weak modal words in the monthly speeches of the president of the ECB leads both households and non-financial corporations to withdraw their bank deposits. We also find that these textual sentiments have greater impact on non-financial corporations. These findings suggest that regulators and policy makers could expand the already existing early-warning systems for the banking sector by taking into consideration the frequency of uncertainty and weak modal words in the ECB president's speeches.

Keywords: European deposit flows; bank runs; ECB President's speeches; textual analysis; textual sentiment

JEL classification*:* G41, G21, D80, E71.

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Disclaimer: The views and opinions expressed in this paper are those of the authors and do not reflect those of their respective institutions.

"Central bank communication can be a powerful monetary policy tool."
European Parliament-Monetary Dialogue, September 2018[1]

1. Introduction

The theme of bank deposit flows and bank runs[2] is in general one of the fundamental drivers of financial instability and draws high attention from the banking literature, regulators and creditors. Fluctuations in bank deposits can disturb both aggregate investment and aggregate consumption causing substantial effects in the macroeconomic environment. Pursuant to Demirguç-Kunt and Detragiache (1998), excessive deposit withdrawals may lead to a banking crisis which in turn could disturb or even suspend the credit flows both to households and firms, hence reducing both investment and consumption and therefore possibly compelling even sustainable firms into bankruptcy. Thus, it becomes apparent that inordinate bank deposit outflows have a profound impact on the general macroeconomic environment.

Over the last years a fast-growing literature has tried to investigate the nature of bank runs and depositors' behavior. In this study, we shed light on this issue by introducing, for the first-time, textual analysis techniques in the bank deposit flows literature. Following the methodology of Loughran and McDonald (2011), we construct two textual sentiment variables focusing on uncertainty and weak modal words appearing in the monthly speeches of the ECB's president. We do not take into consideration alternative word lists to measure the so-called document tone or textual sentiment since earlier studies suggested that there is limited incremental value for other word lists reflecting litigious or positive

[1] http://www.europarl.europa.eu/cmsdata/153223/CASE_final.pdf
[2] A bank run arises when an economy faces great amounts of deposit withdrawals. When depositors start to take out their deposits in a non-discriminatory manner (even from non-financially distressed banks) this may provoke a banking panic, or even engender a systemic banking crisis (Diamond and Dybvig, 1983).

sentiment (Tetlock, 2007; Loughran and McDonald, 2011; Gandhi *et. al.,* 2019).

After the construction of these two textual sentiment variables, we employ them as direct measures of the depositors' perceived fear. ECB president's monthly speeches provide an opportunity to depositors to look at the state of the economy through his eyes. We argue that these two textual sentiment metrics can serve as a qualitative and valid disclosure for depositors to evaluate any risks when they conduct short-term projections of the future economic conditions. Specifically, increased uncertainty within the ECB president's monthly speeches might increase the perceived fear of depositors, thereby leading to bank deposit outflows.

Our study makes several significant contributions to the literature on bank deposits. First, the forward-looking uncertainty measures echoing through the ECB president's monthly speeches should act as early warning signals of potential bank runs. Identifying the reasons why banks are subject to unexpected deposit outflows is crucial. Any methodology that even marginally augments our knowledge is advantageous, as it enables regulators to intervene quickly lest a severe systemic banking crisis appears. Second, when the economic conditions in the European economy are deteriorating, the ECB president may unconsciously propagate uncertainty via his speeches, which further spreads fear among depositors and hence jeopardizing the banking system due to mass deposit withdrawals. We find that linguistic cues in the ECB president's speeches in a certain month with a higher fraction of uncertainty words lead to greater deposits outflows in the next month. In other words, an overly pessimistic speech from the ECB president could act as a self-fulfilling destructive prophecy mechanism, even if it may be activated unintentionally. Third, we investigate potential asymmetries between the two major types

of depositors, that is households and firms, with the latter exhibiting higher sensitivity since firms usually have a greater information set and they are also more aware of the general economic environment. Finally, we document that textual analysis is a promising methodology for the banking literature, since our findings intimate that textual analysis can enhance our capacity to understand the effect of information on bank deposits.

To the best of our knowledge, this is the first study examining whether textual sentiment impacts on total deposit flows as well as on deposit flows by sector, that is households and non-financial corporations. Our analysis provides the following key results. First, textual sentiment exerts a significant impact on European depositors' behavior over and above the usual macroeconomic fundamentals and hence it can serve as an early warning indicator for deposit flows. Second, textual sentiment has a greater impact on non-financial corporations than on households, indicating that firms are more cognizant of what the president of the ECB is saying. Finally, our findings provide empirical evidence for the theoretical models of self-fulfilling prophecy and uncertainty.

The remainder of the paper is structured as follows. Section 2 presents a review of past literature. Section 3 describes the data and the variables we employ. Sections 4 and 5 contain the econometric methodologies we employ, and the estimation results respectively. Finally, Section 6 concludes.

2. Review of the literature

Many studies have been conducted in recent decades trying to explain the causes behind bank deposits flows and bank runs. Starting with the first strand of the relevant literature, bank runs (i.e. inordinate deposit outflows) are assumed to be caused as random incidents ("sunspots") taking place as a result of depositors' coordination problems (Diamond and Dybvig, 1983; Waldo, 1985; Wallace, 1988; Engineer, 1989; Peck and Shell, 2003).

Unlike the idea that bank runs are like "sunspot" occurrences, it has also been conducted an extensive literature supporting the opposite. Gorton (1988) was the pioneer of this strand of the literature. He shaped a different explanation of why a bank could face excessive bank deposit outflows and nominated that bank runs are engendered because of asymmetric information between financial institutions and depositors. After his pioneering work, a rapidly growing literature appeared supporting that bank runs are based on bank-specific and macroeconomic fundamentals and they are not occasioned like "sunspots" or by self-fulfilling prophecies (Alonso, 1996; Allen and Gale, 1998; Demirguç-Kunt and Detragiache, 1998; Schumacher, 2000; Calomiris and Mason, 2000; Goldstein and Pauzner, 2005; Levy-Yeyati *et. al.,* 2010).

Apart from all the previous studies, there is also a widespread literature supporting that depositors' actions are not determined neither by "sunspots" nor by fundamentals but by other reasons such as depositors' network or personal beliefs and attitudes (Martinez-Peria and Schmukler, 2001; Iyer and Puri, 2012; Osili and Paulson, 2014; Oliveira *et. al.,* 2014; Nys *et. al.,* 2015; Brown *et. al.,* 2020).

In this study, we incorporate textual analysis techniques and we propose an alternative

approach for the explanation of European depositors' behavior. Our results differ from the already existing literature, providing new evidence in favor that textual sentiment is an important driving force behind bank runs.

Textual sentiment analysis, as a rapidly emerging body of research, resides across many areas in finance. For example, Ferris *et. al.,* (2013) and Loughran and McDonald (2013) focus on the textual sentiment of IPO prospectuses with emphasis on the underpricing phenomenon. Both studies suggest that an IPO pricing is lowballed when there is a high frequency of negative words within IPO prospectus. Furthermore, Gandhi *et. al.,* (2019) implement textual analysis on bank annual reports to construct a proxy for financial distress. They document that high levels of negative words are related to a greater delisting likelihood. Moreover, Katsafados *et. al.,* (2019), studying the behavior of bank mergers, emphasize that negative (positive) sentiment of annual reports implies a higher probability of becoming target (bidder). Finally, Hoberg and Phillips (2010), employing a textual-based analysis of 10-K product descriptions, suggest that product differentiation exploited via mergers and acquisitions increase product market synergies.

3. Data and Variables

3.1 Dependent variables

Our dataset covers 27-EU countries[3] on a monthly frequency spanning from 2008M2 to 2017M2. The dependent variable is the total aggregate bank deposit transaction flows (DFLOWS). DFLOWS attain negative (positive) values when a country witnesses deposit outflows (inflows).

[3] In our analysis, we do not include Denmark due to lack of data availability.

Table 1 reports the main descriptive statistics of DFLOWS by country. It becomes evident that Italy and Spain are the countries which have witnessed the largest deposit outflows, while United Kingdom seems to have the greatest deposit inflows for the under-examination period. In addition, Greece is the only country that seems to have on average negative deposit flows over the sample period. Moreover, we take into consideration the aggregate bank deposit transaction flows separately by sector, that is non-financial corporations (DFLOWS_F) and households and non-profit institutions (DFLOWS_H). We collect the three types of deposits from the ECB's Statistical Data Warehouse.

*******Insert Table 1 here*******

3.2 Textual Analysis

As a first step, we manually collect all the ECB president's speeches from the ECB website over February 2008 to February 2017, including merely those that are in English language. This yields a sample of 274 speeches. Second, for each individual retrieved speech, we follow the parsing process aligned with the methodology of Loughran and McDonald (2013). It should be mentioned, however, that following Gandhi *et. al.,* (2019) we purge each text (speech) by eliminating all abbreviations, acronyms, generic stop words, single letter words, numbers and punctuation marks.

Most of the textual analysis literature in finance still proceeds within the Bag-of-Words framework (Loughran and McDonald, 2016). Particularly, the aforementioned purified text is deconstructed into vectors of word counts, where we can then employ predefined word lists to gauge speeches' tone. Our sentiment analysis is based on the commonly used Loughran and McDonald (2011) lists of uncertainty and weak modal words (L&M lists).

Most studies perform textual analysis to construct sentiment measures using a proportional weighting scheme (Kearney and Liu, 2014). Consistent with this branch of literature, our analysis proceeds with this method which assigns equal weight to each word in the text. In practice, our algorithm computes the proportion of uncertainty (UNCERTAINTY) and weak modal (MODAL_WEAK) words based on L&M sentiment categories, always in relation to the total word count in each speech as normalization[4]. Then, we form the principal hypothesis that the frequency of weak modal and uncertain words (that is, the magnitude of *ex-ante uncertainty*[5]) exerts negative impact on the depositors' behavior.

We deem it appropriate to present some words that belong to the uncertainty and the weak modal word lists, to facilitate understanding of what kind of emotional stimuli these word lists emit regarding financial stability. The former list includes 291 words, such as doubt, fluctuate, exposure, riskier, speculate and depend, while the latter is a subset of uncertainty word list and contains merely 27 words, such as might, may, perhaps, possible and seldom.

3.3 Control Variables

Apart from the two main explanatory variables, we also control for as many and relevant country-specific characteristics as possible to reduce any possible unobserved heterogeneity concerns and omitted variable bias. Especially, we take into consideration LTGBY which is the long term (10-year) government bond yield, IPI denoting the

[4]If there is more than one speech in the same month, then the final sentiment score for that month is the average of the individual scores.
[5]This term was first employed by Loughran and McDonald (2013).

industrial production index[6], ESI standing for the economic sentiment indicator, UNEMPLOYMENT which indicates the unemployment rate and SHARE_PRICES is the share price index of each country's stock market. We express all control variables in percentage changes. The choice of these macro-controls mirrors both the data availability and the background theory.

In Table 2, we provide a brief definition for each variable, its expected sign and the source from which we obtain the data.

*******Insert Table 2 here*******

4. Econometric Methodology

Before we proceed to the estimation models and the econometric methodologies we employ, we deem it appropriate to examine the trajectory between DFLOWS and each type of textual sentiment. As Figure 1 depicts, the movements of European bank deposits are clearly shadowed by the intensity of each type of textual sentiment. In particular, the periods of negative deposit flows (drop in deposits) coincide with periods of increased textual (crisis) sentiment intensity. Both upper and lower graph demonstrate an inverse relationship between the previously mentioned variables, thus indicating negative expected sign for each type of textual sentiment. This distinct negative association between the two textual sentiment indicators and the European bank deposit flows offers tentative evidence supporting our hypothesis, which must, however, be confirmed in a context of a formal econometric setup.

[6]Given that data for real GDP on a monthly frequency are not available we employ IPI as a proxy for GDP growth.

*******Insert Figure 1 here*******

Given that *i, t* and *j* denote country, time (months) and the type of each textual sentiment variable respectively we begin by estimating the following dynamic econometric specification:

$$DFLOWS_{i,t} = a^j + \beta^j DFLOWS_{i,t-1} + \theta^j TEXT_{i,t-1} + \delta^j X_{i,t} + \varepsilon_{i,t}^j \quad (1)$$

where TEXT represents the type of each textual sentiment we use (i.e. UNCERTAINTY and MODAL_WEAK), X is a vector of country-control variables and ε is the stochastic term.

We specify a dynamic model incorporating DFLOWS on the right-hand side of the equation in one lagged period. The reason behind the dynamic nature of our model is twofold. First, because such a model specification captures any possible persistence of DFLOWS and second, because we want to eliminate the potential bias due to omitted explanatory variables. Since all models include DFLOWS in one period lag as independent variable, this may lead to endogeneity issues. In order to eliminate any possible endogeneity concerns we apply the system Generalized Method of Moments method (system-GMM hereafter)[7] of Blundell and Bond (1998) with robust standard errors. As instruments we use lagged values of both dependent and explanatory variables. The number of lags we employ in each econometric specification was selected in such a way that these instruments to be in line with the results of both the Arellano-Bond autocorrelation test and the Sargan over identification test respectively.

[7]The Difference-GMM approach, firstly proposed by Arellano and Bond (1991) was not preferred because according to the literature it suffers from poor accuracy in simulation and from significant finite-sample bias.

Then, we proceed to explore whether UNCERTAINTY and MODAL_WEAK have a symmetric impact on each type of DFLOWS, that is DFLOWS_F and DFLOWS_H respectively. To this end, we apply the methodology of Seemingly Unrelated Regressions (SUR), firstly proposed by Zellner (1962). The main advantage of the SUR estimation method is that it allows the error terms to be correlated across the equations. The SUR estimation is also employed, because it permits for tests of cross-equation constraints. Our prior belief is that the impact of UNCERTAINTY and MODAL_WEAK would be greater on DFLOWS_F than DFLOWS_H since, in general, firms are more aware of what the ECB president says.

According to Campbell (2006) households, to some extent, are not adequately educated to evaluate financial information on their own. Given that households realize their own limitations, they do not undertake some financial decisions because they do not feel qualified enough (Campbell, 2006). On the contrary, in most cases, corporations have the required resources, not only for the monitoring mechanisms with which they gather information, but also for having the qualified staff to process and use that information effectively. Therefore, given that firms have in their possession a greater information set, a natural inference is that the ECB president's speeches would probably exert a greater impact on firms' decisions to withdraw their bank deposits than on households.

5. Empirical Findings

5.1 Baseline regressions

The results[8] with the system-GMM approach are reported in Table 3 while the results with the SUR methodology are reported in Table 4. Starting with the results of Table 3, we find that the estimated coefficient of UNCERTAINTY is negative (-2.440) and statistically significant at the 10% level, while the estimated coefficient of MODAL_WEAK is also negative (-5.678) and statistically significant at the 5% level. Thus, a more uncertain and weak modal language in the monthly speeches of the ECB president is associated with higher deposit outflows. Simply put, a more pessimistic sentiment in a speech of the ECB president foreshadows bank deposit outflows. Our results indicate that when firms and households realize higher uncertainty and weak modal words in a speech of the ECB president, then in the subsequent month their perceived fear increases, which in turn leads them to withdraw their bank deposits. Therefore, the hypothesis that higher levels of textual sentiment are mapped onto higher deposit withdrawals is supported by the data.

As far as the macroeconomic-control variables are concerned, only SHARE_PRICES was found to be statistically significant at the 10% level and with the expected positive sign, suggesting that a country with a flourishing stock market experiences higher deposit inflows due to boosted economic confidence.

In addition, we find a high degree of persistence of DFLOWS, with the previous month's DFLOWS affecting the present month's DFLOWS by almost 96%. This suggests

[8]We have also examined the behavior of UNCERTAINTY and MODAL_WEAK when all explanatory variables are expressed in one period lag instead of being included in the models in the current period. For space conservation reasons, we do not provide a detailed discussion. However, the results are compatible with the baseline results and can be provided upon request.

that a negative shock to DFLOWS will have a prolonged effect on the banking sector and it will take time for DFLOWS to recover.

Furthermore, the Arellano-Bond tests reject the null hypothesis of no first order serial correlation, but they do not reject the hypothesis that the errors are not autocorrelated in the second order. Thus, the system-GMM results are consistent. Moreover, the Sargan test suggests that the imposed overidentifying restrictions are valid and the instruments are appropriate.

*******Insert Table 3 here*******

Next, in Table 4, we observe that the coefficients of both textual sentiments in the households' equation are not statistically significant. Nevertheless, both textual variables exert significant impact on DFLOWS_F. Furthermore, the cross equation joint zero effect test is rejected, suggesting that each textual sentiment variable has a statistically significant joint impact on deposit flows for both types of depositors.

Then, we turn our attention to examine whether UNCERTAINTY or MODAL_WEAK sentiment has a symmetric impact on firm deposits (DFLOWS_F) and household deposits (DFLOWS_H), respectively, and if not, then which prevails. Given that the test of symmetry of absolute effects is rejected, we conclude that each textual sentiment does not have a symmetric impact on deposit flows. A natural question that arises here is which type of depositors incurs the greatest impact. Our results suggest that the impact of each textual sentiment is stronger on firms, denoting that firm deposits are more sensitive in changes of textual sentiment than household deposits.

*******Insert Table 4 here*******

5.2 Sensitivity Analysis

Thus far, we find that both textual sentiment variables influence in a negative manner depositors' choice to withdraw their deposits. In order to check the robustness of our empirical findings, we conduct sensitivity analysis based on four variants of the previous analysis.

In the first sensitivity analysis, we re-estimate the previously discussed models including two additional explanatory variables. Particularly, we examine whether CRISIS and FINCENT have any impact on DFLOWS (both total and by type of depositor). CRISIS is a dummy variable capturing the first years of the recent financial crisis (i.e. 2008, 2009 and 2010), while FINCENT is a dummy variable that captures the so-called financial centers in EU, that is Luxemburg, Malta and Cyprus (Lane and Milesi-Ferretti, 2010). The rationale behind the inclusion of the CRISIS dummy is to make certain that the crisis effect does not determine the outcome of our findings. In addition, we believe that the EU countries that are considered to be financial centers will have higher deposit inflows than the other EU countries. Hence, we would normally anticipate a positive and a negative sign for FINCENT and CRISIS, respectively. From the results shown in Tables 5 and 6 we infer that our results remain robust even when we enhance the baseline regressions with additional control variables.

*******Insert Tables 5 and 6 here*******

Then we re-estimate our models winsorizing DFLOWS at the 1st and 99th percentiles of its empirical distribution. The rationale behind this sensitivity analysis is to avoid any outliers as possible driving forces of our baseline inferences. The results, reported in Tables 7 and 8, indicate that our results are not dependent on outliers, since both textual sentiment

metrics retain their significant negative sign.

*******Insert Tables 7 and 8 here*******

The financial turmoil of 2008 had considerably more severe effects in the Western European countries, where financial institutions realized substantial losses due to a higher exposure to sovereign debt (Chan-Lau *et. al.,* 2015). On the other hand, it appears that the financial institutions of Eastern Europe countries were less affected by the 2008 financial crisis, since banks in these countries were less exposed to sovereign debt than their Western counterparts (Efthyvoulou and Yidrim, 2014).

Therefore, to provide additional insights, we conduct an additional sensitivity analysis where we break the sample into Eastern and Western countries[9]. The results reported in Tables 9 and 10 indicate that when we separate our sample into the Eastern and the Western region, the main results are merely unaffected in the Western region.

*******Insert Tables 9 and 10 here*******

We conduct a final sensitivity analysis where we apply Principal Component Analysis (PCA), in order to isolate the common factor between UNCERTAINTY and MODAL_WEAK. The main merit of PCA is that it aggregates the already existing information in the two different textual sentiment indices into a single *ex-ante uncertainty* indicator. Thus, the key independent variable is now the first principal component after the PCA (PC1). We take into consideration only the first principal component as the common factor between the two textual sentiment metrics, since it was found to explain almost 90%

[9]We define as Western countries Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain, Sweden and United Kingdom, whilst as Eastern EU countries we specify Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

of the joint variation of UNCERTAINTY and MODAL_WEAK sentiment. This elicited first principal component also gives a sense of the dimensionality of the two word lists. From the results reported in Tables 11 and 12 we observe that PC1 has a negative and statistically significant impact on DFLOWS, denoting that it consists of a valuable proxy for uncertainty. This result also suggests that the two word lists are probably capturing the same feature which is in line with Loughran and McDonald (2013).

*******Insert Tables 11 and 12 here*******

6. Conclusions

In this study we set out to investigate whether the so-called textual sentiment, captured by the monthly speeches of the ECB's president, is related to EU bank deposit flows during the period 2008M2 to 2017M2. Although there is a significant amount of literature suggesting several factors as determinants of bank deposit flows and bank runs, this work constitutes the first study investigating the impact of textual sentiment on European bank deposit flows. We find evidence that depositors' perceived fear, captured by the proportion of uncertainty or weak modal words appearing in the ECB president's monthly speeches, consists of a very important reason behind excessive deposit withdrawals. To put it another way, the propensity of both households and non-financial corporations to withdraw their bank deposits increases when more uncertain and weak modal words appear in the monthly speeches of the president of the ECB. Finally, we document that there is an asymmetric DFLOWS sensitivity on each textual sentiment across deposits on different sector. In particular, we find that firm deposits are more sensitive in changes of textual sentiment than household deposits.

Our results retain their significance after the conduct of a variety of robustness checks and hence we conclude that both *ex-ante uncertainty* measures we propose could be considered as valid measures of depositors' perceived fear. More importantly, the proposed uncertainty metrics should be used as early warning signals of potential bank runs and, by extension, policy makers should take them into consideration when they design and implement their policies. Furthermore, our findings imply that an overly pessimistic speech from the ECB president could act as a self-fulfilling prophecy.

Regarding future research directions, this study can be extended in many ways. First, an interesting research question is whether the proposed textual sentiment metrics have any impact on depositors' decisions regarding the direction of deposit outflows. However, such an investigation needs bilateral data of bank deposit flows and a gravity model setup. Second, potential future research could extend our framework to investigate beyond the monthly speeches of the ECB's president. For instance, monthly speeches derived from each country's central bank could be explored instead. Third, a line of research would be interesting to study whether the impact of textual sentiment on bank deposit flows becomes higher or lower depending on the EU citizens' trust in the ECB. Finally, alternative econometric methodologies or other control variables could also be examined.

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Tables

Table 1: Descriptive Statistics of Total Deposit Flows by country (in millions of euro)

Country	min	mean	max
Austria	-9,490.00	1,297.58	14,423.00
Belgium	-9,662.00	2,900.38	19,801.00
Bulgaria	-2,500.00	328.92	4,119.00
Croatia	-3,084.00	202.11	7,847.00
Cyprus	-2,093.00	340.95	3,571.00
Czech Republic	-6,487.00	6,570.77	38,928.00
Estonia	-438.00	118.07	573.00
Finland	-6,004.00	742.77	8,789.00
France	-46,644.00	12,296.77	87,796.00
Germany	-39,434.00	8,889.24	55,106.00
Greece	-16,793.00	-780.61	11,274.00
Hungary	-7,663.00	43.21	5,754.00
Ireland	-20,604.00	250.44	14,810.00
Italy	-59,577.00	7,039.36	78,249.00
Latvia	-10,509.00	1,480.56	13,663.00
Lithuania	-844.00	4,339.67	18,025.460
Luxembourg	-21,925.00	430.95	15,782.680
Malta	-560.00	5,682.01	25,625.00
Netherlands	-34,585.00	1,116.51	27,717.00
Poland	-5,255.00	15,874.18	179,400.00
Portugal	-7,446.00	734.93	20,283.00
Romania	-9,629.00	1,405.91	9,472.00
Slovakia	-2,134.00	507.26	3,199.00
Slovenia	-2,234.00	229.97	1,394.00
Spain	-89,412.00	379.46	54,031.00
Sweden	-9,580.00	2,083.84	13,786.00
UK	831,476.00	1,140,616.00	1,523,021.00

Notes: This table reports the summary statistics of total deposit flows by country in millions of euro.

Table 2: Variable Definition, Expected Sign and Data Sources

Variable	Definition	Expected sign	Source
Panel A: Dependent variable and main explanatory variables of interest			
DFLOWS	Total Domestic Deposit Flows from both households and non-profit institutions and non-financial corporations	-	ECB Statistical Data Warehouse
DFLOWS_H	Domestic Deposit Flows from households	-	
DFLOWS_F	Domestic Deposit Flows from non-financial corporations	-	
UNCERTAINTY	Percentage of words in the speeches of the ECB president that are on the Loughran and McDonald (2011) uncertainty word list. Examples of uncertainty words include "doubt", "fluctuate", "exposure", "riskier", "speculate" and "depend"	Negative	ECB, Own Calculations
MODAL_WEAK	Percentage of words in the speeches of ECB president that are on the Loughran and McDonald (2011) weak modal word list. Examples of weak modal words include "might", "may", "perhaps", "possible" and "seldom"	Negative	
Panel B: Control variables			
YIELD	Long Term Government Bond Yields	Uncertain	OECD
IPI	Industrial Production Index	Uncertain	
SHARE_PRICES	Share price Index	Positive	
ESI	Economic Sentiment Indicator	Positive	EUROSTAT
UNEMPLOYMENT	Unemployment Rate	Negative	

Table 3: Baseline regressions – system-GMM estimation		
Variables	**Total Deposit Flows**	
	Uncertainty	**Modal_Weak**
DFLOWS (t-1)	0.958***	0.959***
	[0.045]	[0.045]
UNCERTAINTY (t-1)	**-2.440***	**-**
	[0.827]	
MODAL_WEAK (t-1)	**-**	**-5.678****
		[2.617]
UNEMPLOYMENT	3.721	4.299
	[16.716]	[16.421]
YIELD	-1.791	-1.774
	[2.774]	[2.770]
IPI	3.087	3.113
	[3.220]	[3.100]
ESI	21.835	21.351
	[18.974]	[18.796]
SHARE_PRICES	0.061*	0.075*
	[0.035]	[0.038]
Constant	4.508***	4.198***
	[1.577]	[1.485]
Observations	1,695	
AR(1) (p-value)	0.024**	0.025**
AR(2) (p-value)	0.162	0.159
Sargan (p-value)	0.982	0.981

Notes: (a) The dependent variable of each specification is on the first line of the table, while the main under-examination variable of each specification is on the second line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors, (e) AR(1), AR(2) and Sargan test are the Arellano–Bond tests for first and second order autocorrelation of the residuals and Sargan is the test for overidentifying restrictions.

Table 4: Baseline regressions – SUREG estimation

Variables	Deposit Flows by type of depositor			
	Uncertainty		Modal_Weak	
	Firms	Households	Firms	Households
DFLOWS_F (t-1)	0.973***	-	0.973***	-
	[0.005]		[0.005]	
DFLOWS_H (t-1)	-	-0.111***	-	-0.110***
		[0.025]		[0.024]
UNCERTAINTY (t-1)	**-1.196*** **	**0.153**	-	-
	[0.430]	**[0.190]**		
MODAL_WEAK (t-1)	-	-	**-2.798*** **	**0.157**
			[0.919]	**[0.407]**
UNEMPLOYMENT	8.905*	-0.633	8.803*	-0.646
	[5.210]	[2.304]	[5.208]	[2.304]
YIELD	-0.197	-0.839	-0.189	-0.841
	[1.167]	[0.516]	[1.166]	[0.516]
IPI	-0.666	2.239*	-0.696	2.251*
	[2.814]	[1.244]	[2.813]	[1.245]
ESI	10.415*	-0.923	10.416*	-0.903
	[6.108]	[2.701]	[6.105]	[2.701]
SHARE_PRICES	0.015	0.029**	0.023	0.028*
	[0.033]	[0.015]	[0.033]	[0.015]
Constant	1.712	0.993*	1.391	1.119**
	[1.159]	[0.512]	[1.096]	[0.485]
Number of observations	1,695			
Country dummies	Included			
Time dummies	Included			
Hypothesis testing				
Joint zero effect of each textual sentiment on the deposit flows of firms and households	8.73**		8.67***	
Symmetry of absolute effects of each textual sentiment across the deposit flows of firms and households	9.61***		9.07***	

Notes: (a) The main under-examination explanatory variable is on the second line of the table, while the dependent variable of each specification is on the third line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors.

Table 5: Robustness checks – system-GMM estimation (Including additional explanatory variables)

Variables	Total Deposit Flows	
	Uncertainty	**Modal_Weak**
DFLOWS (t-1)	0.959***	0.958***
	[0.046]	[0.046]
UNCERTAINTY (t-1)	**-2.183*** **	**-**
	[0.791]	
MODAL_WEAK (t-1)	**-**	**-5.421** **
		[2.631]
UNEMPLOYMENT	2.849	2.502
	[16.704]	[16.529]
YIELD	-1.758	-1.727
	[2.749]	[2.735]
IPI	3.028	2.972
	[3.253]	[3.148]
ESI	21.936	21.760
	[18.968]	[18.868]
SHARE_PRICES	0.064*	0.075**
	[0.035]	[0.037]
FINCENT	8.941	8.919
	[30.601]	[30.727]
CRISIS	-0.819*	-1.499**
	[0.476]	[0.584]
Constant	3.929*	3.934
	[2.259]	[2.572]
Observations	1,695	
AR(1) (p-value)	0.024**	0.025**
AR(2) (p-value)	0.161	0.158
Sargan (p-value)	0.984	0.984

Notes: (a) The dependent variable of each specification is on the first line of the table, while the main under-examination variable of each specification is on the second line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors, (e) AR(1), AR(2) and Sargan test are the Arellano–Bond tests for first and second order autocorrelation of the residuals and Sargan is the test for overidentifying restrictions.

Table 6: Robustness checks – SUREG estimation (Including additional explanatory variables)

Variables	Deposit Flows by type of depositor			
	Uncertainty		Modal_Weak	
	Firms	Households	Firms	Households
DFLOWS_F (t-1)	0.973***	-	0.973***	-
	[0.005]		[0.005]	
DFLOWS_H (t-1)	-	-0.110***	-	-0.110***
		[0.024]		[0.024]
UNCERTAINTY (t-1)	**-1.196*** **	**0.153**	-	-
	[0.430]	**[0.190]**		
MODAL_WEAK (t-1)	-	-	**-2.798*** **	**0.157**
			[0.919]	**[0.407]**
UNEMPLOYMENT	8.905*	-0.633	8.803*	-0.646
	[5.210]	[2.304]	[5.208]	[2.304]
YIELD	-0.197	-0.839	-0.189	-0.841
	[1.167]	[0.516]	[1.166]	[0.516]
IPI	-0.666	2.240*	-0.696	2.251*
	[2.814]	[1.245]	[2.813]	[1.244]
ESI	10.415*	-0.923	10.416*	-0.903
	[6.108]	[2.702]	[6.106]	[2.701]
SHARE_PRICES	0.015	0.029**	0.023	0.028*
	[0.033]	[0.015]	[0.033]	[0.015]
FINCENT	0.043	-0.407	0.033	-0.405
	[1.002]	[0.443]	[1.001]	[0.443]
CRISIS	2.321	0.877	1.840	0.976
	[1.421]	[0.628]	[1.384]	[0.612]
Constant	-0.609	0.116	-0.449	0.143
	[1.393]	[0.616]	[1.398]	[0.619]
Number of observations	1,695			
Country dummies	Included			
Time dummies	Included			
Hypothesis testing				
Joint zero effect of each textual sentiment on the deposit flows of firms and households	8.73**		9.61***	
Symmetry of absolute effects of each textual sentiment across the deposit flows of firms and households	8.67***		9.07***	

Notes: (a) The main under-examination explanatory variable is on the second line of the table, while the dependent variable of each specification is on the third line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors.

Table 7: Robustness checks – system-GMM estimation (Winsorizing DFLOWS)		
Variables	**Total Deposit Flows**	
	Uncertainty	**Modal_Weak**
DFLOWS (t-1)	0.892***	0.892***
	[0.106]	[0.105]
UNCERTAINTY (t-1)	**-2.110*** **	**-**
	[0.709]	
MODAL_WEAK (t-1)	**-**	**-3.367***
		[1.959]
UNEMPLOYMENT	-0.928	-0.056
	[11.956]	[11.688]
YIELD	-0.208	-0.184
	[2.344]	[2.351]
IPI	1.548	1.525
	[3.352]	[3.273]
ESI	1.885	1.361
	[11.075]	[10.881]
SHARE_PRICES	0.033	0.045
	[0.031]	[0.031]
Constant	7.343***	6.589***
	[2.647]	[2.287]
Observations	1,695	
AR(1) (p-value)	0.021**	0.021**
AR(2) (p-value)	0.202	0.198
Sargan (p-value)	0.989	0.989

Notes: (a) The dependent variable of each specification is on the first line of the table, while the main under-examination variable of each specification is on the second line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors, (e) AR(1), AR(2) and Sargan test are the Arellano–Bond tests for first and second order autocorrelation of the residuals and Sargan is the test for overidentifying restrictions.

Table 8: Robustness checks– SUREG estimation (Winsorizing DFLOWS)

Variables	Deposit Flows by type of depositor			
	Uncertainty		Modal_Weak	
	Firms	Households	Firms	Households
DFLOWS_F (t-1)	0.965***	-	0.965***	-
	[0.006]		[0.006]	
DFLOWS_H (t-1)	-	-0.077***	-	-0.077***
		[0.024]		[0.024]
UNCERTAINTY (t-1)	**-0.789****	**0.161**	-	-
	[0.345]	**[0.183]**		
MODAL_WEAK (t-1)	-	-	**-1.432***	**0.216**
			[0.739]	**[0.392]**
UNEMPLOYMENT	6.088	-0.515	6.075	-0.522
	[4.188]	[2.221]	[4.190]	[2.222]
YIELD	-0.447	-0.852*	-0.438	-0.855*
	[0.938]	[0.497]	[0.938]	[0.498]
IPI	-0.905	2.378**	-0.942	2.389**
	[2.262]	[1.200]	[2.263]	[1.200]
ESI	1.854	-0.576	1.813	-0.560
	[4.910]	[2.604]	[4.912]	[2.604]
SHARE_PRICES	0.014	0.026*	0.018	0.026*
	[0.027]	[0.014]	[0.027]	[0.014]
Constant	1.197	0.909*	0.808	1.021**
	[0.932]	[0.494]	[0.881]	[0.467]
Number of observations	1,695			
Country dummies	Included			
Time dummies	Included			
Hypothesis testing				
Joint zero effect of each textual sentiment on the deposit flows of firms and households	6.46**		4.31	
Symmetry of absolute effects of each textual sentiment across the deposit flows of firms and households	6.44**		4.22**	

Notes: (a) The main under-examination explanatory variable is on the second line of the table, while the dependent variable of each specification is on the third line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors.

Table 9: Robustness checks – system-GMM estimation (Breaking the sample into Western and Eastern countries)

Variables	Total Deposit Flows			
	Uncertainty		Modal_Weak	
	Eastern countries	Western countries	Eastern countries	Western countries
DFLOWS (t-1)	0.039	0.958***	0.043	0.958***
	[0.058]	[0.046]	[0.061]	[0.046]
UNCERTAINTY (t-1)	**0.110**	**-2.925*** **	**-**	**-**
	[0.129]	**[1.002]**		
MODAL_WEAK (t-1)	**-**	**-**	**-0.499**	**-6.961****
			[0.436]	**[3.295]**
UNEMPLOYMENT	-0.923*	0.487	-1.154***	1.230
	[0.478]	[31.571]	[0.437]	[31.009]
YIELD	1.094	-2.035	1.201	-2.005
	[1.981]	[2.981]	[2.069]	[2.972]
IPI	-4.380	6.799**	-4.420	6.686**
	[5.047]	[2.795]	[5.066]	[2.721]
ESI	-7.167	35.349	-7.314*	34.642
	[4.438]	[25.715]	[4.369]	[25.422]
SHARE_PRICES	-0.005	0.095**	-0.007	0.112**
	[0.039]	[0.042]	[0.041]	[0.046]
Constant	0.508***	5.782***	0.753**	5.452***
	[0.195]	[1.975]	[0.354]	[1.891]
Observations	433	1,262	433	1,262
AR(1) (p-value)	0.185	0.026**	0.184	0.027**
AR(2) (p-value)	0.344	0.161	0.343	0.158
Sargan (p-value)	0.100	0.995	0.000***	0.996

Notes: (a) The dependent variable of each specification is on the first line of the table, while the main under-examination variable of each specification is on the second line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors, (e) AR(1), AR(2) and Sargan test are the Arellano–Bond tests for first and second order autocorrelation of the residuals and Sargan is the test for overidentifying restrictions.

Table 10: Robustness checks – SUREG estimation (Breaking the sample into Western and Eastern countries)

VARIABLES	Deposit Flows by type of depositor							
	Eastern countries				Western countries			
	Uncertainty		Modal_Weak		Uncertainty		Modal_Weak	
	Firms	Households	Firms	Households	Firms	Households	Firms	Households
DFLOWS_F (t-1)	-0.244***	-	-0.244***	-	0.973***	-	0.973***	-
	[0.047]		[0.047]		[0.006]		[0.006]	
DFLOWS_H (t-1)	-	0.061	-	0.061	-	-0.154***	-	-0.154***
		[0.049]		[0.049]		[0.028]		[0.028]
UNCERTAINTY (t-1)	**0.037**	**-0.045**	-	-	**-1.628*** **	**0.213**	-	-
	[0.073]	**[0.309]**			**[0.578]**	**[0.231]**		
MODAL_WEAK (t-1)	-	-	**0.096**	**-0.192**	-	-	**-3.822*** **	**0.258**
			[0.156]	**[0.665]**			**[1.234]**	**[0.493]**
UNEMPLOYMENT	0.048	-0.560	0.050	-0.572	15.902*	-0.198	15.605*	-0.198
	[0.667]	[2.848]	[0.667]	[2.848]	[8.388]	[3.344]	[8.384]	[3.346]
YIELD	-0.274	0.707	-0.279	0.716	-0.155	-0.962*	-0.156	-0.965*
	[0.418]	[1.780]	[0.418]	[1.780]	[1.390]	[0.554]	[1.389]	[0.554]
IPI	-0.270	-2.798	-0.275	-2.791	-0.645	3.019**	-0.743	3.043**
	[0.592]	[2.539]	[0.592]	[2.539]	[3.565]	[1.422]	[3.562]	[1.422]
ESI	0.364	-4.151	0.378	-4.195	14.687*	0.478	14.867*	0.528
	[0.997]	[4.243]	[0.997]	[4.246]	[8.499]	[3.388]	[8.495]	[3.390]
SHARE_PRICES	-0.002	-0.001	-0.003	-0.000	0.013	0.039**	0.024	0.038**
	[0.006]	[0.025]	[0.006]	[0.025]	[0.044]	[0.018]	[0.044]	[0.018]
Constant	0.004	1.089	0.011	1.113*	2.232	0.594	1.803	0.754
	[0.169]	[0.718]	[0.155]	[0.661]	[1.449]	[0.578]	[1.356]	[0.541]
Observations	433				1,262			
Country dummies	Included							
Time dummies	Included							
Hypothesis testing								
Joint zero effect of each textual sentiment on the deposit flows of firms and households	0.29		0.47		9.12**		10.08***	
Symmetry of absolute effects of each textual sentiment across the deposit flows of firms and households	0.07		0.18		9.11***		9.81***	

Notes: (a) The main under-examination explanatory variable is on the third line of the table, while the dependent variable of each specification is on the fourth line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors.

Table 11: Robustness checks – system-GMM estimation (Principal Component Analysis)

Variables	Total Deposit Flows
	PC1
DFLOWS (t-1)	0.959***
	[0.046]
PC1 (t-1)	**-0.843*** **
	[0.314]
UNEMPLOYMENT	3.810
	[16.548]
YIELD	-1.788
	[2.767]
IPI	3.119
	[3.152]
ESI	21.637
	[18.900]
SHARE_PRICES	0.067*
	[0.037]
Constant	2.391**
	[0.992]
Observations	1,695
AR(1) (p-value)	0.024**
AR(2) (p-value)	0.161
Sargan (p-value)	0.982

Notes: (a) The dependent variable of each specification is on the first line of the table, while the main under-examination variable is on the second line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors, (e) AR(1), AR(2) and Sargan test are the Arellano–Bond tests for first and second order autocorrelation of the residuals and Sargan is the test for overidentifying restrictions.

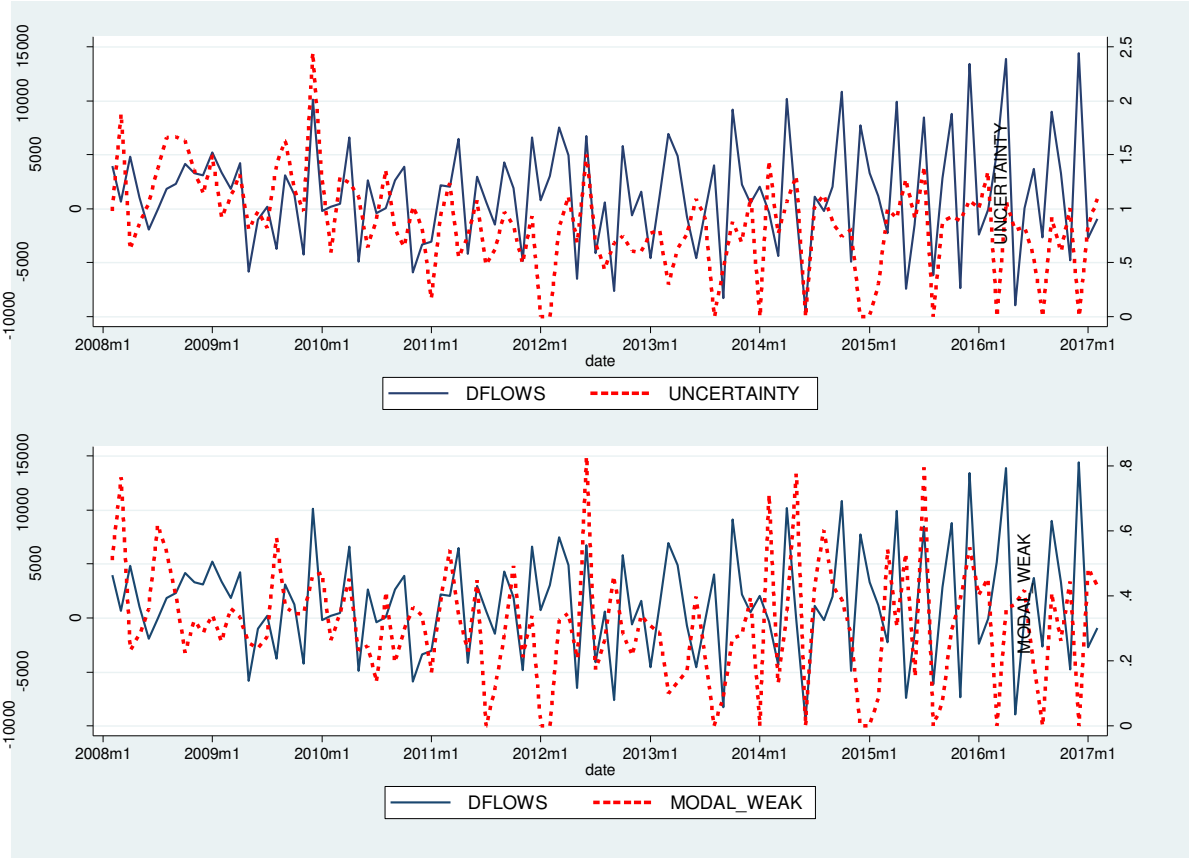
Table 12: Robustness checks – SUREG estimation (Principal Component Analysis)

Deposit Flows by type of depositor		
Variables	**PC1**	
	Firms	**Households**
DFLOWS_F (t-1)	0.973***	**-**
	[0.005]	
DFLOWS_H (t-1)	**-**	-0.110***
		[0.024]
PC1 (t-1)	**-0.410*** **	**0.036**
	[0.134]	**[0.059]**
UNEMPLOYMENT	8.821*	-0.636
	[5.208]	[2.304]
YIELD	-0.196	-0.840
	[1.166]	[0.516]
IPI	-0.668	2.245*
	[2.813]	[1.245]
ESI	10.446*	-0.915
	[6.105]	[2.701]
SHARE_PRICES	0.019	0.029*
	[0.033]	[0.015]
Constant	0.630	1.148**
	[1.032]	[0.457]
Number of observations	1,695	
Country dummies	Included	
Time dummies	Included	
Hypothesis testing		
Joint zero effect of each textual sentiment on the deposit flows of firms and households	10.08***	
Symmetry of absolute effects of each textual sentiment across the deposit flows of firms and households	9.80***	

Notes: (a) The main under-examination explanatory variable is on the second line of the table, while the dependent variable of each specification is on the third line of the table, (b) The variables are defined in Table 2, (c) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (d) numbers in brackets denote robust standard errors.

Figures

Figure 1: Trajectory between total deposit flows and each textual sentiment variable - Average across all EU countries



Notes: These figures depict the evolution of total deposit flows (DFLOWS) and each textual sentiment variable for the under-examination period (i.e. 2008M2 to 2017M2). Especially, the upper (lower) graph demonstrates an inverse association between DFLOWS and UNCERTAINTY (MODAL_WEAK).

Source: ECB, Own Estimations