# Central Bank Communication by ???
# The Economics of Public Policy Leaks

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**Abstract**

*Leaks of confidential information emanating from public institutions have been the focus of a long-standing line of research. Yet, their determinants as well as their potential impact on public views and on policy effectiveness remain elusive. To address this gap, we study leaks from central banks because their effects are instantaneously reflected in financial markets. Based on a novel database of anonymous monetary policy leaks in the euro area as reported by newswires, we provide evidence that many of these leaks are likely placed by individual insiders with minority opinions. While we find that leaks have large effects on markets and weaken official policy announcements, our results also suggest that leaks do not lock in decision-makers, and that attributed communication can mitigate some of their effects.*

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*[O]ur communication is transparent, crystal clear and public. There is absolutely no concept of "anonymous communication" by the Governing Council. We don't like and we don't need anonymous communication. Why would we need anonymous communication?*

– Jean-Claude Trichet, ECB Press Conference 6 April 2006.

# 1 Introduction

According to practitioners and scientific experts, public institutions around the world "leak like sieves" (Grønbach Jensen, 1998; Pozen, 2013; Rottman, 2019). Disclosures of confidential information which are transmitted by insiders to the media with an expectation of anonymity[1] have even been characterized as a "routine method of communication about government" (House Committee on the Judiciary, 1982; Lee, 2008; Herrmann, 2015). Besides making for catchy headlines, leaks can have a large impact on public policy-making. On the one hand, they can be key in revealing misconduct and corruption in agencies funded by taxpayer money (Kielbowicz, 2006; De Jong and De Vries, 2007; Kwoka, 2015; Spaniel and Poznansky, 2018). On the other hand, leaks may harm the credibility and reputation of public institutions, in particular if they trigger unintended side effects or turn out to be factually wrong (Oei and Ring, 2018; Assenmacher et al., 2021). In addition, leaks could reduce policy flexibility (Fehrler and Hahn, 2023) and cause considerable welfare losses whenever they lock in decision-makers on undesirable paths by moving public opinion in specific directions (Vissing-Jorgensen, 2019).

Despite the long-standing interest in leaks and their potential implications, in the academic literature "our comprehension of leaking has not kept pace with our fascination" (Pozen, 2013). For example, we still know little about how leaks affect public views. The inherent absence of accountability in leaking suggests that these effects may not be clear-cut. While anonymous disclosures of secret information could reveal or be perceived as particularly relevant bits of new information, the public may also be more prone to discount statements whose authors hide behind the veil of anonymity. Moreover, attempts to quantify the precise impact of leaks on the effectiveness of public policy have remained elusive. In contrast to the high-frequency nature of news about leaks, the effects of many public policies can only be measured over monthly, quarterly or even annual intervals. For similar reasons, we also lack systematic evidence indicating whether official communication can act as a tool to mitigate the potentially adverse impact of leaks on public opinion and institutional credibility. Evaluating the effect of leaks and of mitigation efforts requires a fast-moving variable that captures public perceptions. For most public policies, measurable high-frequency outcomes simply do not exist.

Another fundamental, yet difficult to answer question concerns the nature of leaks. While public policy leaks may simply be random accidents, they could also represent intentional releases by individuals with their own agendas or constitute institutionally authorized "plants".[2] Initiatives such as media awareness coaching may help to reduce accidents, but they will do little to change personal agendas or to curtail plants. Hence, knowing more about the underlying nature of public policy leaks is crucial because it determines whether and how affected institutions may most effectively react.

Our paper addresses these gaps in the literature by analyzing leaks from one specific area of public policy-making: central banking. Central banks constitute particularly promising cases to study public policy leaks for at least three reasons. First, the well-defined scope and the recurrent nature of monetary policy decisions ensure that the content of related leaks is comparable over time, allowing the compilation of a consistent database over a long sample period. Second, news about monetary policy instantaneously move financial markets (e.g.

[1] We distilled our working definition for leaks from the academic literature in legal and journalism studies (Flynn, 2006; Kielbowicz, 2006; Pozen, 2013; Patz, 2016; Rottman, 2019). In this paper, we do not analyze whistle-blower cases (such as the well-known WikiLeaks (Julian Assange) or the NSA disclosures (Edward Snowden)), but concentrate on anonymous leaks that keep the focus of attention on the information, rather than the identity of the source (Flynn, 2006).

[2] Plants constitute (more or less) formally authorized disclosures of secret information for the purpose of advancing a public institution's own goals and interests. Hess (1984) and Abel (1987) are among the first to distinguish between leaks and plants. Pozen (2013) adds so-called "pleaks" to describe the vast middle ground between these two forms of anonymous disclosures. Hess (1984) also provides a classification of personal motivations for leaking.

Gürkaynak et al., 2005a,b; Altavilla et al., 2019; Cieslak and Schrimpf, 2019; Cieslak et al., 2019; Hansen et al., 2019; Jarociński and Karadi, 2020; Swanson, 2021; Gnan et al., 2022). Since markets listen when central banks speak, we can obtain a reliable high-frequency measure of public views and policy effectiveness to study public policy leaks: financial market tick data. Third, monetary policy represents a clear-cut case of decision-making by committee. Our paper therefore speaks to a form of decision-making prevalent in many public institutions, especially at the supranational level (e.g. the Council of the European Union, the United Nations Security Council or the World Trade Organization's General Council). The flip-side of the coin is that parts of our analysis may not fully generalize to institutions with more concentrated decision-making power.[3] Moreover, due to our focus on financial markets, our results need not necessarily generalize to how leaks affect the broader public opinion.

In our study, we focus on the case of the Eurosystem, i.e. the National Central Banks (NCBs) of the euro area countries and the European Central Bank (ECB). We compile a novel database of leaks related to monetary policy (sometimes labeled "sources stories"[4]), including their precise time stamps to the minute, by filtering the *Reuters*, *Bloomberg* and *Market News International* archives between 2002 and 2021. To the best of our knowledge, our unique data and setting allow us to conduct the most systematic quantitative assessment of public policy leaks to date.

First, using high-frequency financial market data in narrow intra-day event study windows, we quantify when and how central bank leaks impact markets, that is, shape public expectations. Second, we compare the impact of leaks to that of attributed communication by policy-makers. Third, we are able to estimate to what extent leaks alter the market impact of official central bank announcements. Finally, we identify the nature of public policy leaks from the Eurosystem. Our main findings are as follows.

*Leaks shape public views.* We provide evidence that Eurosystem leaks have sizable effects on public views. Leaks trigger market reactions that are consistently larger than those of placebo events and often larger than those of attributed statements by the members of the ECB's decision-making body, the Governing Council. Leaks counteract prevailing trends in market expectations and weaken the effect of official policy announcements on longer-term expectations. We also show that the average pre-meeting leak does not move public expectations closer to the eventual policy outcome. This suggests that leaks largely originate from insiders with minority opinions, but also that the Governing Council is not locked in by anonymous disclosures. Hence, leaks appear to mainly add noise to official central bank communication, such that market participants would seem to be better off if they treated most leaks about Eurosystem monetary policy with caution.

Why do markets respond to leaks although they are generally not informative? One explanation could be that market participants use leaks as a coordination device in the spirit of Morris and Shin (2002) – even if the signal contained in leaks is very noisy. The market reaction to leaks can also be rationalized by models formalizing the impact of media reporting on economic outcomes. Chahrour et al. (2021) show that accurate reporting about unrepresentative developments may still affect agents' behavior. The analogy to leaks that mainly represent minority views is straightforward. Also, according to Nimark (2014), "unusual events are more likely to be considered newsworthy than events that are commonplace", and the mere availability of these signals is in itself informative and affects agents' beliefs. Leaks are a good example of "man-bites-dog" news: both their form and their information content are highly unusual because most central bank communication goes through official channels and contains little information about disagreement on the Governing Council.

*Many Eurosystem leaks likely are no accidents.* Our second set of results suggests that many Eurosystem leaks are no accidents. We find that the incidence of leaks exhibits clear variations over time. Over the entire

[3]For instance, relative to the case of concentrated decision-making power, committee decisions might also stir the public's interest in the balance of views on the committee before a decision is taken. This in itself may give rise to the release of more soft information such as the views of committee members or the degree to which members disagree.

[4]In his memoirs, Meyer (2004) mentions the existence of "sources stories" on U.S. Federal Reserve policy. These "sources stories" draw on the content of background talks between policy-makers and journalists. While journalists can use this content in media reporting, they must not attribute it to any individual or the institution. Although Eurosystem leaks are sometimes labeled "sources stories" too, we do not know how and why they originate.

sample, i.e. between 2002 and 2021, the overwhelming majority of leaks relates to policy rates and unconventional monetary policy (UMP). Anonymous disclosures generally cluster around monetary policy meetings, partially at a time when policy-makers' media contacts are restricted by the ECB's quiet period rules.[5] We also observe a notable shift in the timing of leaks from before the monetary policy meetings to after the meetings since 2015. This recent shift is driven by leaks related to UMP. We corroborate this descriptive evidence by uncovering several empirical regularities using regression analysis. We document a *systematic* relationship between leaks, proxies for disagreement among policy-makers and specific events linked to the conduct of monetary policy.

*Eurosystem leaks likely are no plants.* Our third series of findings reveals that most Euroystem leaks are unlikely to represent institutional plants. We find that attributable statements by ECB policy-makers *systematically* counteract the market impact of leaks. This result has two implications. First, many Eurosystem leaks seem to be released by individuals pursuing their own agendas instead of being intentionally placed by the institution.[6] Second, attributed communication appears to be effective in mitigating the impact of leaks. Related to this second point, we also show that a higher intensity of attributable communication before leaks correlates with lower market impacts of these anonymous disclosures.

Our paper contributes to several literatures. First, it complements a vast literature in communication science, journalism studies, law and political science studying anonymous disclosures of confidential information in the realm of public policy-making (e.g. Hess, 1984; Abel, 1987; Flynn, 2006; Kielbowicz, 2006; De Jong and De Vries, 2007; Lee, 2008; Pozen, 2013; Patz, 2016; Landert and Miscione, 2017; Sampedro et al., 2018; Rottman, 2019). Existing studies of leaks typically discuss selected case studies or survey leaks in a particular sphere (e.g. the U.S. government), including their drivers, their impact and their legal treatment. Most previous contributions in this line of research are largely descriptive in nature. While this narrative approach is crucial to gauge the phenomenon of leaking in all its facets, it falls short of providing a systematic quantitative assessment of leaks' effects on public views, of their impact on policy effectiveness and of potential efforts to mitigate their effects. Our paper exploits the market-moving power of central banks to shed a first light on these important gaps in the literature.

Second, our paper speaks to the existing literature on decision-making by (monetary policy) committees. Riboni and Ruge-Murcia (2010) document that decision-making at the ECB is best described by a "consensus" model, where a supermajority is required for a policy change. Committee members might decide to behave strategically if their preferences differ considerably from those of the decisive voter. While Visser and Swank (2007) have shown that strategic considerations can affect committee members' voting behavior, one would expect that the same holds for their decision to leak: insiders with minority views may be more likely to strategically disclose confidential information. Since committee deliberations can generate a tendency towards conformity (due to, e.g., reputational concerns (Visser and Swank, 2007), and even more so for highly transparent committees (Prat, 2005; Hansen et al., 2018)), members with non-conforming views might decide to express these views "off-protocol", outside the official deliberations and in an anonymous fashion. Our findings suggest that many Eurosystem leaks indeed transpire from insiders with minority opinions. This behavior can lead to inferior outcomes. Because committee deliberations are particularly beneficial when members have heterogeneous preferences (Iaryczower et al., 2018), it is precisely in these instances that the deliberations should be held openly in the room.

The extent to which committee members disagree is a major factor in determining strategic behavior, the deliberation process and the final decisions. Previous contributions measure dissent on monetary policy committees by drawing on voting records and meeting minutes (Meade, 2005; Harris et al., 2011; Eichler and Lähner, 2014; Riboni and Ruge-Murcia, 2014; Thornton and Wheelock, 2014; Madeira and Madeira, 2019; Baerg, 2020) or use explicit information on the prevalence of diverging views as reported in press conferences

[5]These rules foresee that policy-makers refrain from public statements on policy-related topics in the seven days before the monetary policy meetings of the Governing Council (Ehrmann and Fratzscher, 2009; Gnan and Rieder, 2023).

[6]Identifying the precise personal motivations or identifying the individuals behind the leaks is beyond the scope of our paper.

and attributable *ad hoc* communication (Tillmann and Walter, 2019; Vissing-Jorgensen, 2019; Tillmann, 2021; Grebe and Tillmann, 2022). Our paper suggests that these identification methods may miss the true extent of disagreement by disregarding information on diverging views conveyed through anonymous disclosures. Post-meeting leaks in the euro area regularly stress the presence of disagreement during ECB Governing Council meetings. We show that a measure of disagreement based on the acknowledgment of diverging views during ECB press conferences (Tillmann, 2021) and post-meeting leaks about disagreement is strongly correlated with the amount of other leaks. Using observational data, we also confirm experimental work in political science highlighting that more controversial decisions exert less sway on public views (Zink et al., 2009; Mikulaschek, 2023a,b). We find that post-meeting leaks weaken the initial policy announcement effects on longer-term expectations. Leaks thus appear to constitute a general expression or "symptom" of disagreement that may convey particularly powerful signals in the case of public institutions which do not publish voting records (apart from the ECB, e.g. the European Court of Justice, the IMF Executive Board and the World Bank Boards of Directors).

Third, we contribute to a growing literature on the effects of *ad hoc* communication efforts by central bankers. The bulk of these studies investigates the impact of attributable statements such as public speeches and press interviews by individual monetary policy-makers on financial markets, meeting outcomes and policy predictability (e.g. Ehrmann and Fratzscher, 2009; Gertler and Horvath, 2018; Bennani et al., 2020; Lustenberger and Rossi, 2020; Ehrmann et al., 2022; Istrefi et al., 2022; Ahrens et al., 2023; Gnan and Rieder, 2023). In contrast to previous work, we analyze the consequences of *ad hoc* communication via anonymous informal channels (i.e. non-attributable *ad hoc* communication). While others have studied anonymous information flows in monetary policy (Finer, 2018; Cieslak et al., 2019; Vissing-Jorgensen, 2019; Morse and Vissing-Jorgensen, 2020), we are the first to compile a systematic database of leaks to measure their high-frequency market impact. Our paper is also the first to assess the interplay between leaks and other central bank communication, to quantify the impact of leaks on official central bank announcements and to explore the nature and drivers of monetary policy leaks.

Finally, our paper contributes to the existing literature on the high-frequency identification of monetary policy shocks (e.g. Bernanke and Kuttner, 2005; Gürkaynak et al., 2005b; Gertler and Karadi, 2018; Nakamura and Steinsson, 2018; Altavilla et al., 2019; Cieslak and Schrimpf, 2019; Jarociński and Karadi, 2020; Paul, 2020). This approach attempts to cleanly disentangle monetary policy shocks from other information releases by focusing on narrow intra-day event study windows around policy announcements. We find that Eurosystem leaks on monetary policy often are released shortly before or after these official announcements. Hence, pre-policy announcement leaks could affect market expectations prior to the start of event study windows, thereby altering the surprise component of official announcements. Likewise, post-meeting leaks dampen policy announcement effects. In both cases, monetary policy shocks extracted from official announcements alone may miss the overall extent of new information available to financial market participants. Leaks represent an additional source of monetary policy surprises whose nature and effects remain to be fully understood. Thus, taking into account leaks when identifying monetary policy shocks may also increase the relevance of available high-frequency surprise instruments (Ramey, 2016; Bauer and Swanson, 2022; Swanson, 2023).

The remainder of this paper is organized as follows. In Section 2, we explain the institutional context of our study, present our new database and discuss the descriptive evidence on Eurosystem leaks. Section 3 test for the presence of systematic components in the incidence of leaks. Section 4 documents the impact of leaks on public views, meeting outcomes and policy announcements. In Section 5, we analyze the interaction between leaks and attributable communication efforts. Section 6 concludes. A detailed online appendix complements the paper.

# 2 A first glance at Eurosystem monetary policy leaks

## 2.1 Institutional setting

The ECB Governing Council – consisting of the NCB governors of all euro area countries and six Executive Board members (one of whom is the ECB President) – convenes eight times a year to decide on monetary policy.[7] After every monetary policy meeting, the ECB communicates its latest decision in a press release. Later on the same day, the ECB President holds a press conference, where she reads the so-called monetary policy statement, followed by a Q & A session with journalists, to provide further details on the policy decision and the underlying considerations. Once a quarter, the policy announcement is also accompanied by the release of macroeconomic projections compiled by ECB staff (March and September) or in a joint exercise of ECB and NCB staff (June and December). During our sample period, policy announcements consistently took place on Thursdays, with the press release scheduled at 13:45 CET and the monetary policy press conference starting at 14:30 CET.

Previous contributions consider the decision-making process and the policy deliberation phase inside the ECB Governing Council to be more consensus-based than at other major central banks (Blinder, 2007; Ehrmann and Fratzscher, 2007). Reflecting this consensual character, policy communication within the Eurosystem is guided by a "single voice" principle:[8] Governing Council members are expected to discuss and resolve disagreements on appropriate policy internally, while representing the official policy stance vis-à-vis the general public (Rieder, 2022). As the ECB does not release voting records and the summary of monetary policy discussions are not attributed, it is generally difficult to gauge the degree of agreement among Governing Council members. Of course, some disagreement among policy-makers in a large committee that furthermore covers a heterogeneous monetary union has to be expected. In fact, Governing Council members often state their preferred policy options in their public statements, a practice that is generally tolerated. Communication by other central bank staff is also subject to rules. For instance, they are not supposed to speak on behalf of their institution, and disclosures of confidential information are prohibited.

## 2.2 New data

We compile a new database containing the near-universe of leaks related to monetary policy that transpired from the Eurosystem during the last two decades (January 2002 – December 2021).[9] We draw on the archives of three major financial news providers – *Reuters News*, *Bloomberg* and *Market News International* – to ensure that we capture close to all policy-relevant public leaks. These news outlets subscribe to codes of conduct that describe how to handle reporting from unnamed sources (Winkler, 2011; Thomson Reuters, 2023). The guidelines specify that anonymous sources may only be used when necessary, i.e. when the relevant information is not available on the record. The codes also clarify that ensuring the accuracy of such information requires special scrutiny. For instance, the source's track record, position, potential motive and the relationship to the reporting journalist are considered to judge its likely accuracy. Winkler (2011) expresses a preference to have at least two people with direct knowledge of the matter conveying the same facts. Moreover, news stories based on leaks may require special authorization procedures and reporters are requested to ask the affected persons or institutions for comments before the stories are published.

To reliably identify Eurosystem leaks from millions of news reports, we resort to a careful combination of keyword-driven pre-filtering and subsequent manual classification of "candidate" items. We provide the

[7] From the beginning of our sample in 2002 until 2014, monetary policy meetings followed a monthly frequency. Prior to 2002, meetings were held every other week.

[8] The single voice policy is part of the "Organisational principles for the Eurosystem and the Single Supervisory Mechanism" available on the ECB's website.

[9] We choose 2002 as a starting point for two reasons. First, it allows us to hold the frequency of ECB monetary policy meetings roughly constant across our sample period (c.f. previous subsection). Second, our high-frequency Overnight Indexed Swap (OIS) data are less reliable before 2002 (c.f. Altavilla et al., 2019).

corresponding details in Appendix A. Throughout our paper, we concentrate on "policy-relevant" leaks, i.e. anonymous disclosures of information directly related to monetary policy and general economic developments from a euro area-wide perspective reported in public media outlets. Private information disclosures that advantage individual market participants (e.g. insider trading) are not the focus of this paper. Policy-relevant leaks touch on one of the five following topics: policy rates, unconventional policy tools (UMP), economic growth, inflation or the euro exchange rate.[10] We exclude leaks referring exclusively to local economic conditions (e.g. GDP growth in a specific euro area country) or to topics that should have no direct implication for the stance of monetary policy (e.g. disclosures on banking regulation or rumors about managerial appointments). Overall, we obtain 1,253 news items reporting on 368 unique leaks by unnamed Eurosystem insiders. We aggregate these data to the leak-level, including our manual classification of topics covered by the individual news items and the exact minute-level timestamp of the first news item corresponding to a given unique leak. Of our 368 unique leaks, 178 refer to policy rates, 207 to UMP, 47 to economic growth, 41 to inflation and 36 to the euro exchange rate (several leaks cover multiple topics). In Appendix B, we provide several examples for policy-relevant Eurosystem leaks.

For parts of our subsequent analysis, we also require data on public statements that can be directly attributed to members of the ECB Governing Council. We draw on the more than 60 million news items contained in the *Reuters News Archive* to single out statements clearly attributed to specific policy-makers.[11] Focusing on breaking news headlines only, we draw on a combination of three steps to identify relevant statements: keyword-based pre-filtering, manual classification of a random sample containing 20% of resulting candidate items and a final step to classify the remaining 80% of candidate items using machine learning techniques. We describe the details of this process in Appendix C. Altogether, we obtain 7,883 unique public statements attributable to individual Governing Council members. We combine these statement-level data with the time stamp for the first news item reporting on a given statement and the name of the speaker.

### 2.3 Descriptive evidence

This subsection provides a first examination of our novel leaks database. We explore the extent and timing of Eurosystem leaks during our observation period. We also look for first potential patterns in our data that point towards (or rule out) random, unintentional accidents as the main reason for information leakage. The upper panel in Figure 1 documents a sharp rise in the number of leaks during the second half of our sample.[12] The peak in 2019 shows 36 non-attributable policy-relevant statements. This corresponds to an average of more than four leaks per policy meeting in 2019. More recently, we observe a substantial decline in the number of leaks. Since the beginning of Christine Lagarde's presidency in November 2019, the number of leaks has fallen by more than a third from the 2019 high point. This decline is consistent with the more inclusive and consensus-seeking leadership style that she pledged to work towards when taking over the ECB presidency (Lagarde, 2019). At the same time, changes due to the Covid-19 pandemic (such as a temporary move to online policy meetings with potentially fewer participants or the smaller number of conferences and other physical events where insiders and journalists can get together) may also represent a possible explanation for this decline. Moreover, monetary policy might have become less controversial during this period, as it was apparent that an easing of monetary policy was required in response to the outbreak of the pandemic.

The lower panel in Figure 1 provides an additional breakdown of time trends for individual topics. Most

[10] UMP covers asset purchases and (targeted) longer-term refinancing operations. We classified leaks about rate forward guidance as leaks about policy rates.

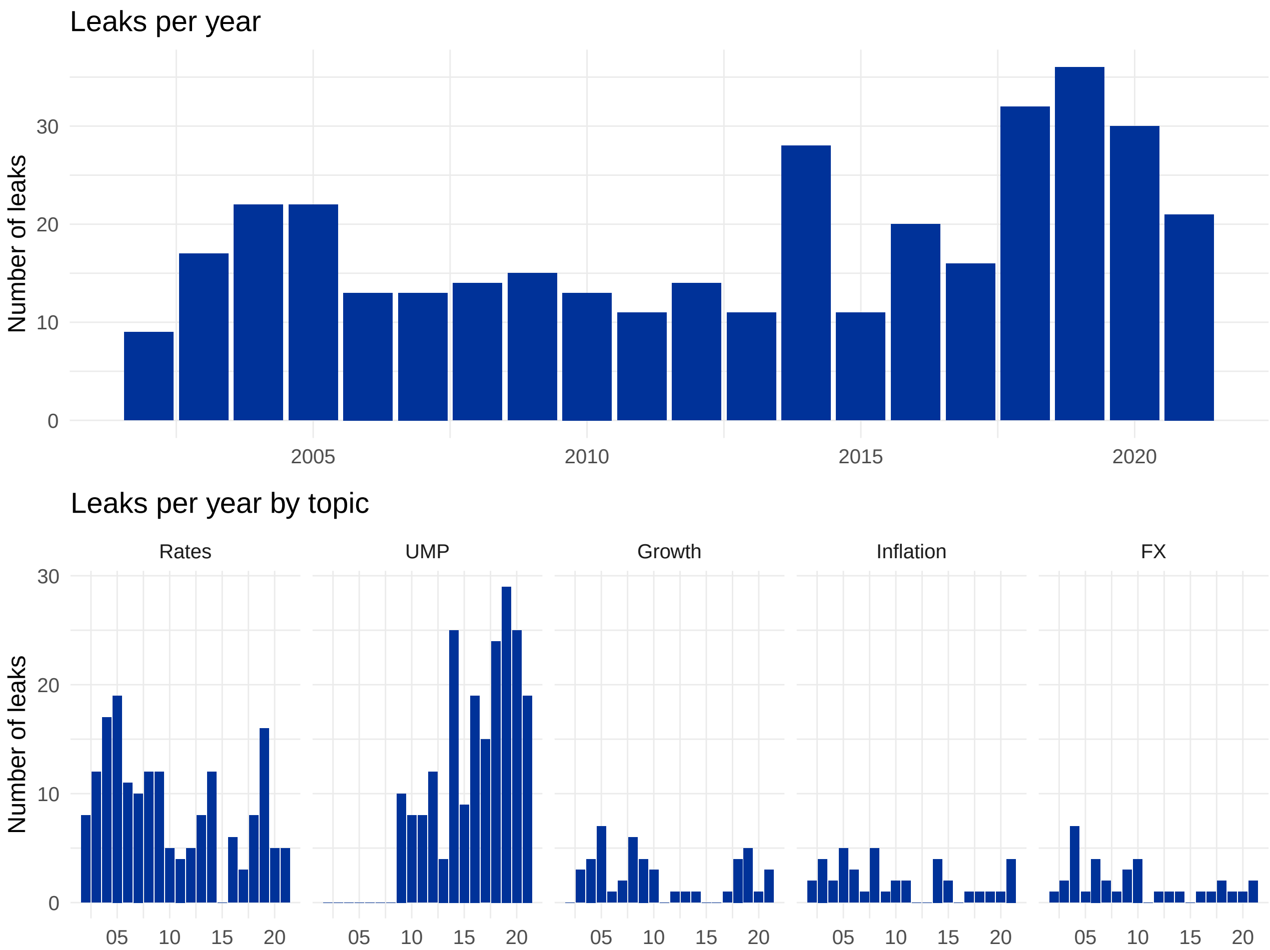
[11] Attributable statements are likely to be instantaneously reported in all news outlets. In contrast, leaks are often reported by one outlet first, before appearing in the other outlets subsequently. To identify the precise time stamp of leaks, it is therefore important to scan the different outlets.

[12] Figure A1 in Appendix F adjusts leak counts for the increase in ECB Governing Council members over time (as additional countries joined the euro area) and for the decrease in the number of policy meetings per year (falling from 12 to 8 in 2015). Similar to the raw counts presented in Figure 1, both alternative measures indicate elevated leak incidence over recent years and strong variation over time.

notably, the data suggest a pronounced shift away from leaks about policy rates – and, less pronounced, economic conditions – towards anonymous disclosures related to unconventional policy.

Figure 1: **Number of leaks per year**

This figure plots the annual counts of all Eurosystem leaks related to the topics "policy rates", "UMP", "economic growth", "inflation" and "euro exchange rate" for the period 2002 to 2021. The upper panel shows the evolution of total leaks over time. The lower panel documents frequencies for each topic. Since one leak may refer to more than one topic, the sum of leaks across topics in the lower panel is larger than the total number of leaks shown in the upper panel.



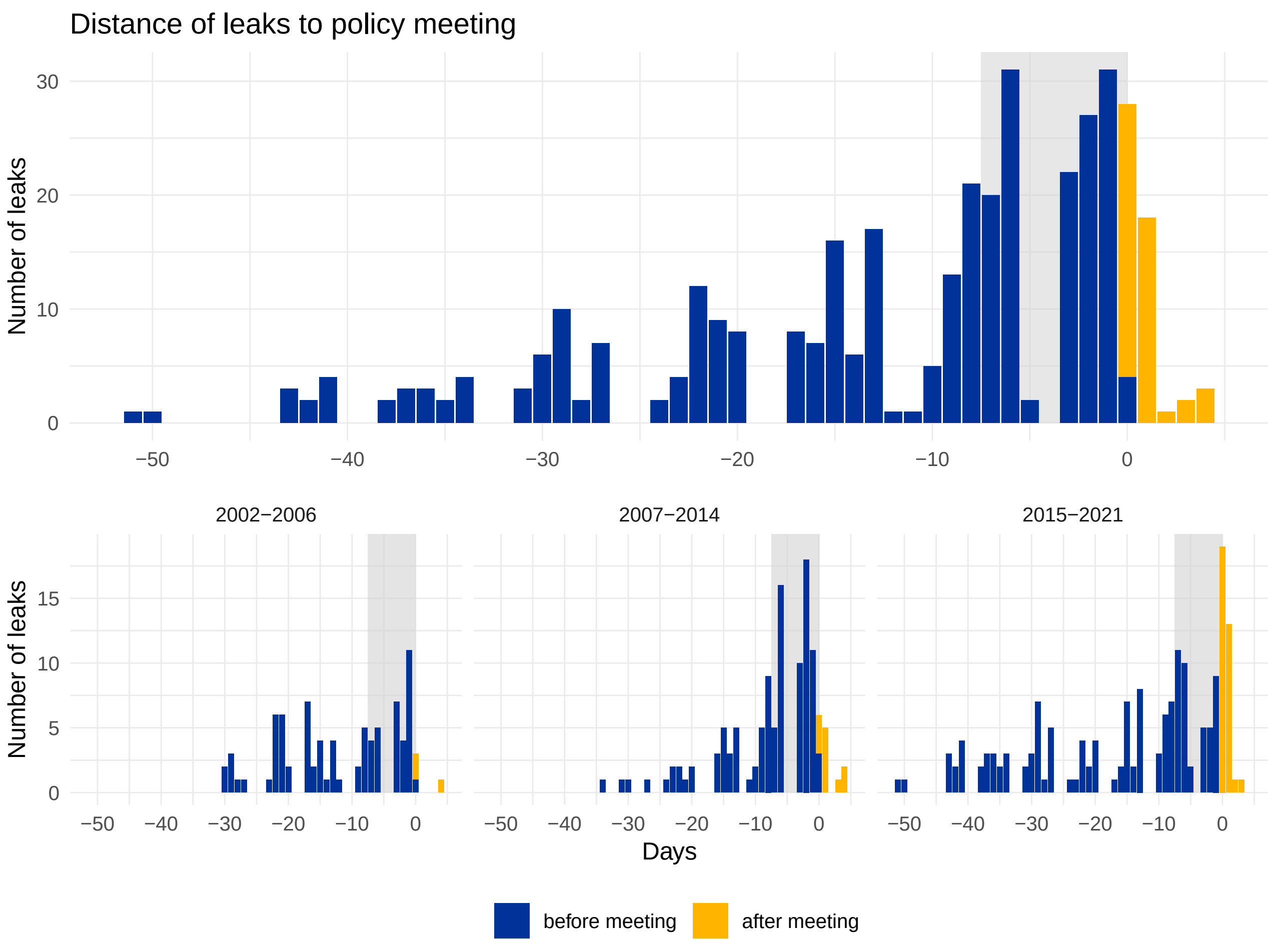

In Figure 2, we explore the timing of leaks around monetary policy meetings. For this purpose, we compute the distance of each leak to the next meeting. Leaks occurring up to the Monday after a given ECB Governing Council decision on monetary policy are included in the leaks corresponding to the previous meeting.[13] The upper panel in Figure 2 documents a pronounced concentration of leaks around policy decisions. We observe a steady increase in the daily number of leaks in the run-up to policy meetings. Perhaps more surprisingly, we also document a high number of leaks directly *after* the announcement of the policy decision – both on the announcement day and the following Friday. The frequent occurrence of pre-meeting leaks aligns well with the model in Vissing-Jorgensen (2019): insiders with heterogeneous policy preferences might try to steer public expectations into their individually desired directions to lock in the committee prior to the actual policy decision. Yet, through the lens of the model in Vissing-Jorgensen (2019) alone, it is less clear why insiders appear to have equally strong incentives to leak information directly *after* a meeting, when the new policy stance has already been decided.

One possible explanation for the leaks transpiring shortly after policy decisions could be related to the advent

[13]The ECB always announces policy decisions on Thursdays. Upon reading all post-meeting leaks one by one, we found that leaks up to the following Monday typically refer to closed-door policy discussions during the previous meeting. Hence, throughout the paper, leaks occurring until Monday after a given meeting are still associated with this meeting rather than the next one.

Figure 2: **Distribution of leaks around policy meetings**

This figure plots the distribution of all leaks related to the topics "policy rates", "UMP", "economic growth", "inflation" and "euro exchange rate" around policy meetings. On the policy announcement day, a leak is classified as 'before meeting' if it occurs before the ECB's press release (13:45 CET) and as 'after meeting' otherwise. The horizontal axis measures the distance to the closest policy meeting in calendar days. The upper panel summarizes our whole sample period (January 2002 – December 2021), whereas the lower panel distinguishes three sub-periods – the pre-crisis period (2002-2006), the acute crisis phase (2007-2014) and the subsequent years of extensive use of UMP (2015-2021). The area shaded in gray indicates the ECB's quiet period.




of UMP in recent years. UMP tools rely heavily on the management of expectations about future actions – for example, through the signalling effect of asset purchases (Rossi, 2021). Post-meeting leaks might therefore represent an effective means for dissenting insiders to change public expectations that are otherwise guided by the ECB's official communication on monetary policy decisions (i.e. in particular, the press releases and press conferences). Supporting this hypothesis, the lower panel in Figure 2 reveals a substantial shift in the timing of leaks from before the policy meeting to after the policy meeting particularly during recent years. This finding is also consistent with the fact that unconventional policy tools have recently become the predominant topic addressed by leaks (c.f. Figure 1 above).[14]

Overall, this section provides first tentative pieces of evidence against the *random accidents* hypothesis as the main cause of Eurosystem leaks. First, the incidence of leaks exhibits clear trends over time. Second, the precise timing of leaks around policy meetings also speaks against predominantly accidental information leakage: the number of leaks is elevated in the run-up to policy meetings, when the interaction between policy-makers and the media is subject to the ECB's quiet period rules. A possible alternative explanation would be that relatively more policy-relevant information is generated and exchanged in the run-up to policy meetings. Yet, this alternative hypothesis cannot account for the patterns in the lower panel of Figure 2. The incidence of leaks

[14]In Figure A2 in Appendix F, we plot the distance of leaks to policy meetings separately for each topic to confirm that post-meeting leaks typically refer to UMP.

increases over time and shifts from before to after policy meetings, while the information generation process around policy meetings has arguably stayed constant.

## 3 Systematic components of Eurosystem leaks

In this section, we explore how the frequency of leaks relates to different proxies for disagreement among Governing Council members and the release of macroeconomic projections compiled by Eurosystem staff. For this purpose, we aggregate the number of individual leaks to the meeting level. Each leak is assigned to a single policy meeting as explained in Section 2: leaks more than four days after the previous meeting and leaks up to four days after the current meeting are assigned to the current meeting. We count the number of leaks associated with every policy meeting and estimate the Poisson regression model specified in equation (1):

$$log\left(E[N_t^{leak}|x_t]\right) = \tau_t^{year} + x_t\beta + \varepsilon_t \tag{1}$$

where $N_t^{leak}$ denotes the number of leaks associated with policy meeting $t$. Model (1) includes year-fixed effects $\tau_t^{year}$ to capture variation in the number of Eurosystem member institutions, variation in the frequency of policy meetings and other broad trends in the euro area policy-making landscape. $x_t$ is a vector containing potential drivers of leaks.

Vector $x_t$ includes the following elements. First, we investigate whether the incidence of leaks is related to proxies for potential disagreement among Governing Council members. As the amount of disagreement among policy-makers is not directly observable, our baseline specification proxies disagreement using the following variables: i) spread between 10Y sovereign yields of Italy and Germany (lagged by one month) as a measure for the divergence of financial conditions in the euro area; ii) the inter-quartile range of national inflation figures (also lagged by one month) to account for differences in the macroeconomic conditions across euro area countries; and iii) the number of attributable statements associated with a given monetary policy meeting (as we expect a more intense public debate around relatively more controversial Governing Council meetings). We also check the robustness of our results to replacing these proxy variables with a more explicit index for dissent proposed by Tillmann (2021). This index series uses information from the Q & A sessions during ECB press conferences, where reporters regularly ask the ECB President about the degree of unanimity underlying a given policy decision.[15]

Second, we draw on a dummy variable to flag meetings coinciding with the release of macroeconomic projections. We hypothesize that these meetings are accompanied by a higher number of leaks because the projections often form the basis for pivotal policy decisions and because their content constitutes relevant information that could be leaked before the meeting.

It is important to note that macroeconomic projection releases follow a fixed quarterly schedule. Hence, they can be considered as exogenous to the incidence of leaks. Furthermore, since we lag all variables measuring financial and macroeconomic conditions by one month, we do not see reverse causality as a major concern in this context. The same applies to attributable statements: Figure A3 in Appendix F shows hardly any immediate leading or lagged relationship between the occurrence of leaks and attributable statements, as measured in a window spanning the day before to the day after a given leak.[16]

In column 1 of Table 1, we display the estimation results for equation (1) including only the proxies for

[15] The binary index takes a value of one whenever the Q & A session reveals some disagreement among policy-makers. In contrast, it takes the value of zero for explicit indications of a consensual decision. We extend the dissent series compiled by Tillmann (2021) by applying the same classification rules to cover our full sample period. Moreover, in order to obtain a more comprehensive measure of dissent that also takes into account information released subsequently, we augment this index using the ECB's monetary policy accounts. We also use attributable as well as anonymous statements after every meeting to identify references to disagreement. We do not use the index in our baseline specifications: for some meetings, we are not able to ascertain whether dissent prevailed, resulting in several missing values.

[16] Nevertheless, we made sure that the estimated coefficients discussed below are robust to the exclusion of the number of attributable statements from the model.

disagreement on the Governing Council in $x_t$.[17] In column 2, we augment $x_t$ by adding the dummy variable for the release of macroeconomic projections. Since the model is non-linear, we also report average marginal effects in square brackets. Both specifications suggest a substantial link between the incidence of leaks and proxies for disagreement on the Governing Council. On average, every percentage point increase in the sovereign yield spread is associated with half a leak more per monetary policy meeting. Similarly, the number of leaks increases in times of intense public exchange of opinions as proxied by the number of attributable statements. In addition, we find more pronounced leaking activities in connection with the release of quarterly macroeconomic projections.

In columns 3 and 4 of Table 1, we substitute the dissent index based on Tillmann (2021) for our disagreement proxies. Some index values are informed by the content of specific leaks in our database (c.f. footnote 15). To avoid endogeneity concerns, this alternative specification therefore excludes all leaks about disagreements among ECB policy-makers from the count of leaks representing our dependent variable. Overall, the results in columns 3 and 4 confirm our previous estimates: the number of leaks remains robustly linked to dissent on the Governing Council. While our specification can only explain around 15 per cent of the variation in the data, we uncover *systematic* drivers behind the occurrence of anonymous disclosures. The findings in Table 1 therefore strongly suggest that many Eurosystem leaks do not occur by accident.[18]

[Table 1 about here]

In Table A6 in Appendix E, we provide additional evidence in support of the notion that Eurosystem leaks often do not represent mere accidents. We ask whether the number of leaks prior to a policy meeting is informative about the propensity of policy changes.[19] We find that the propensity of policy changes increases by between four to six percentage points with each additional pre-meeting leak (statistically significant at the 5% or 10% level). Hence, the number of leaks in the run-up to meetings contains *systematic* signals about future changes in the monetary policy stance. This empirical regularity is hard to square with the hypothesis that leaks mainly constitute random accidents.

# 4 Leaks and public views

## 4.1 Market reactions to leaks

### 4.1.1 Leaks and placebo events

If leaks do not happen by accident, they likely serve a common purpose: to influence public views and expectations about monetary policy. To assess the market relevance of Eurosystem leaks, we compare the absolute size of market reactions following these anonymous disclosures to market moves following 5,000 randomly sampled placebo events, for Overnight Indexed Swap (OIS) rates and the EURO STOXX 50.[20] Placebo events are sampled in a way to match the empirical distribution of leaks along i) year-month combinations and ii) the time of day to ensure their validity as control cases. On monetary policy decision days, we do not draw any placebo events between 13:00 and 16:15 CET to avoid interference with the ECB's policy communication.

[17] Summary statistics for all variables used in the model estimations of our paper are provided in Tables A2, A3 and A4 in Appendix E.

[18] An alternative hypothesis is that media are more prone to report on leaks at certain times, which could be correlated to our disagreement proxies. Given the continuous interest in monetary policy matters by financial markets, we maintain the assumption that newswires at all times seek to retrieve information through leaks and report on them instantaneously.

[19] We count the number of leaks and attributable statements *before* each policy meeting, and we manually tag meetings which resulted in a monetary policy change. We document all meetings resulting in a policy change in Table A5 in Appendix E.

[20] This event study approach allows for a more precise measurement of the market impact than standard time series methods that would require splitting high-frequency data into equally spaced intra-day sub-periods, since i) leaks themselves are not equally spaced in time and ii) noise in high-frequency quotes prevents the use of sufficiently small sub-periods to accommodate this non-equal spacing. Our approach follows earlier work by Istrefi et al. (2022) and Gnan and Rieder (2023). Details are provided in Appendix D.

For both leaks and placebo events, we look at market reactions associated with event $i$ at time $t$ (i.e. $\Delta y_i$) by using an asymmetric event window starting 5 minutes before the event time stamp and ending 30 minutes thereafter.[21] We compute the basis point change between the median quote during the 10 minutes before the event window and the median quote during the 10 minutes after the event window, as indicated in equation (2), and analogously for the basis point return of the EURO STOXX 50.

$$\Delta y_i = \text{med}\left(\{y_{t+k}\}_{k=30+1}^{30+10}\right) - \text{med}\left(\{y_{t-k})\}_{k=5+1}^{5+10}\right) \tag{2}$$

$$|\Delta y_i| = \alpha + \beta D_i^{leak} + \varepsilon_i \tag{3}$$

To compare the absolute size of market reactions to leaks and placebo events, we run regressions that take placebo events as the baseline and flag actual leaks with a dummy, as shown in equation (3). Table 2 shows that leaks trigger unusually large market moves across the entire term structure of OIS rates and in the EURO STOXX 50.[22] Market movements around leaks are up to 85% larger than the average size of market reactions to placebo events (i.e. the estimate for the intercept).[23]

[Table 2 about here]

The market impact of Eurosystem leaks varies substantially depending on the topic of the anonymous disclosure. Table 3 distinguishes between leaks related to policy rates, unconventional policy tools and general economic conditions (growth, inflation, euro exchange rate). Not surprisingly, leaks about policy rates mainly move the short- and medium-term region of the yield curve, whereas leaks related to UMP affect the long end and equities. Interestingly, markets do not appear to pay much attention to leaks about general economic conditions. One potential explanation for this finding is that leaks about economic conditions may require more interpretation as they only inform markets indirectly about the future path of monetary policy.

[Table 3 about here]

Finally, Table A7 in Appendix E compares market reactions around placebo events and leaks for different periods of the monetary policy meeting cycle. We distinguish between days far away from meetings, a period shortly before meetings (the ECB's quiet period) and a period up to the Monday, i.e. four days, after each policy meeting. We find that market reactions to leaks that take place long before policy meetings are consistently larger across the entire term structure. During the quiet period, leaks mainly impact the medium to long maturities. Leaks occurring shortly after policy meetings in turn only yield statistically significant effects on the long end of the yield curve. This last finding resonates well with our conjecture from Section 2 that anonymous disclosures directly after policy meetings might be used predominately to influence market expectations related to unconventional policy tools.

[21] Our event window is therefore slightly longer than the press release window of Altavilla et al. (2019). We choose this specification for the following reasons. First, while markets are expecting the pre-scheduled ECB press release and can react immediately, it might take them longer to learn about a leak: often, leaks are initially reported by only one particular news outlet. Second, our choice of 30 minutes is motivated by the time that typically passes in live reporting between the first and the last news item associated with a particular attributable statement (reporting on leaks typically takes less time). In 90% of all cases of attributable communication, the last news item arrives less than 13.5 minutes after the initial breaking news headline. A 30-minute window encloses the entire live reporting related to a story in 97% of all cases. Hence, we can adopt an identical event window definition for leaks and attributable statements to measure market reactions across communication types in a consistent way.

[22] High-frequency data on OIS rates for the 5Y and 10Y maturity are only available since 2011. Since market reactions at the long end of the yield curve have become particularly relevant since the onset of unconventional policy actions, i.e. during the period covered by our data, this does not limit our analysis.

[23] In about 90% of the cases, and in line with the newswires' code of conduct, the news items reporting on a unique leak were explicitly based on more than one anonymous source. In unreported results, we tested whether leaks based on multiple sources yield stronger market impacts than leaks based on a single source. We did not find any statistically significant differences.

### 4.1.2 Leaks and attributable statements

Next, we compare the market reaction to instances of anonymous disclosures to the effect of attributable statements by individual policy-makers. For this purpose, we compute market reactions to named statements in the same way as previously done for leaks and placebo events (c.f. equation (2) above). The regression model defined by equation (4) below takes leaks as the baseline and flags attributable statements with a dummy. We specify the model in this manner to gauge the market reactions to leaks relative to the effect of statements by different groups of Governing Council members in a single regression further below. Since, in contrast to the sample of placebos, the empirical distribution of attributable statements does not match the one of leaks when it comes to the timing of events, we include fixed effects $\tau_i$ for years, months, weekdays and hours of each day in our regressions.

$$|\Delta y_i| = \beta D_i^{attr} + \tau_i^{year} + \tau_i^{month} + \tau_i^{weekday} + \tau_i^{hour} + \varepsilon_i \tag{4}$$

Coefficient estimates presented in Table 4 demonstrate that average absolute market moves around leaks are consistently larger than for attributable statements. This conclusion holds across the entire term structure and for equities. It suggests that one motivation for resorting to anonymous disclosures instead of attributable communication could be the desire to exploit the larger market impact of leaks.[24] Moreover, Table A8 in Appendix E shows that this result is robust to differentiating between different members of the ECB Governing Council, i.e. the ECB President, the other ECB Executive Board members and NCB governors.

We also account for differences in the distance of leaks and attributable statements to policy meetings. Table A9 in Appendix E suggests that a large portion of average size wedges in the market reactions to leaks and to attributable statements is effectively driven by the distance to policy meetings. Size differences across the entire term structure only persist for periods far away from policy meetings. Shortly before or after a meeting, only the long end of the yield curve still shows somewhat weaker reactions to attributable statements compared to leaks. Yet, the average absolute market reactions to unnamed disclosures never fall below those to attributable statements. Leaks clearly constitute powerful means of communication.

[Table 4 about here]

### 4.1.3 Leaks and prevailing market trends

We established that leaks impact market expectations about monetary policy. This result raises the question precisely *how* expectations change in response to leaks. Do Eurosystem leaks typically reinforce or counteract prevailing trends in market expectations? To measure the prevailing market trend in the run-up to leaks, we compute the yield change over the preceding seven days until directly before the 30-minute event window (i.e. the change between the closing price seven days before the leak and the median quote during the 10 minutes before the leak event window). We drop leaks for which the seven-day window covers an actual policy announcement.[25] We then regress market reactions to leaks and to 5,000 placebo events on the prevailing trend in expectations as described in equation (5). The maturity used to compute the prevailing market trend always matches the maturity considered on the left-hand-side of equation (5). We draw on market reactions to the 5,000 placebo events (and their respective pre-trends) already used in subsection 4.1.1 for every maturity when estimating equation (5). The inclusion of placebo events allows us to obtain a benchmark for the typical relationship between the seven-day trend and the market reaction during a subsequent high-frequency event window in the absence of an actual leak. In equation (5), we flag actual leaks with a dummy:

$$\Delta y_i = \alpha + \beta Trend_i + \gamma D_i^{Leak} + \delta \left(Trend_i \times D_i^{Leak}\right) + \varepsilon_i \tag{5}$$

[24] The larger market impact of leaks could be due to several factors, including content (e.g. less cautious framing), news format (e.g. "punchier" writing style) and the possibility to make a minority view appear more generally accepted.

[25] We discuss evidence on the implications of leaks shortly after official ECB policy announcements further below.

For the short end of the yield curve, the estimates in Table 5 testify to a strong negative relationship between leak-induced market moves and the trend during the preceding seven days. As shown in Tables A10 and A11 in the Appendix, this result is driven by anonymous statements about policy rates.

[Table 5 about here]

### 4.2 Leaks and post-meeting rate levels

Section 3 reveals a systematic connection between the number of pre-meeting leaks and the propensity of policy changes. Do leaks also push market expectations into the "right direction", i.e. are they informative about the sign of policy changes? To answer this question, we compute the absolute distance of market rates to the levels prevailing directly after the subsequent policy announcement for each leak in our database. We do so at two points in time: once directly before and once directly after the anonymous disclosure happened.[26] We then investigate whether the absolute distance of rates to their post-announcement levels decreases following the leak. We denote this change in the absolute distance around leak $i$ by $\delta_i$. $\delta_i < 0$ means that the leak moved rates closer to the post-announcement level, whereas $\delta_i > 0$ means that rates have moved away. To test whether the average $\delta_i$ across all leaks is different from 0, we regress $\delta_i$ on a constant. We further augment this model by including a dummy for the quiet period to flag leaks close to the upcoming policy meeting, as indicated in equation (6):

$$\delta_i = \alpha + \beta D_i^{QP} + \varepsilon_i \tag{6}$$

Table 6 presents the corresponding estimates for every maturity from 3M to 10Y.[27] For the model, the intercept corresponds to the average change in the absolute distance to post-announcement rates induced by leaks. In the augmented model, the intercept captures the average for leaks outside the quiet period. Across specifications, we find that the average leak does not move market rates closer to the levels prevailing directly after the subsequent policy announcement. This strongly contrasts with attributable statements which *do* contribute to a better alignment of market expectations with subsequent policy outcomes, as shown in Table 7.

[Table 6 about here]

[Table 7 about here]

The "non-result" for leaks has two potential implications. First, it could be that anonymous disclosures reflect minority views within the Governing Council. Disclosing such views anonymously could be one way to give them prominence without incurring the reputational cost of being publicly overruled.[28] Second, the fact that pre-meeting leaks do not move market expectations closer to the outcome of the meeting shows that the ECB Governing Council is not systematically locked in by leaks (contradicting the hypothesis formulated by Vissing-Jorgensen (2019)). Thus, leaks mainly add noise to official central bank communication. Our findings suggest that market participants would fare best if they looked through the average leak about Eurosystem monetary policy.

Why do markets respond to leaks although they are generally not informative? There are several different potential explanations for this behavior. For instance, high-frequency market reactions could be dominated by

[26] Our event window is defined as in other parts of the paper. Post-announcement levels in interest rates are measured as the median quote from 15:40 to 15:50 CET as in Altavilla et al. (2019).

[27] Note that to precisely compare the actual meeting outcome against market expectations, one would need to compare a post-announcement rate to the corresponding *forward* rate prevailing before/after a leak. For sufficiently long maturities, however, spot rates constitute a good enough approximation, since leaks are typically only a few days away from the policy meeting. Thus, this part of our analysis only considers maturities greater or equal to 3 months.

[28] Alternatively, our findings are also consistent with the use of institutional plants to "test the waters" for new policy innovations. Yet, results presented further below make this option appear highly unlikely as i) leaks generally run against official policy announcements and because ii) the effect of leaks is partially undone by attributable communication efforts of the ECB Executive Board.

automated trading, which does not differentiate between leaks and attributable central bank communication. Also, leaks could serve as a coordination device in the spirit of Morris and Shin (2002), even if the signal contained in them is very noisy. Finally, models formalizing the impact of media reporting on economic outcomes can help rationalize our findings. In Chahrour et al. (2021)'s model, media reporting about sectoral developments can lead firms throughout the economy to change their hiring decisions – despite the fact that these sectoral developments are unrepresentative of the economy. There is a compelling analogy to the results in this paper: leaks are not representative of the views on the Governing Council, but their reporting affects the views about upcoming Governing Council decisions and overall market pricing. A similar channel is at play in Nimark (2014): the media are more likely to report on "unusual" events (labeled "man-bites-dog" news), and the mere availability of these signals is in itself informative and affects agents' beliefs. Once again, there is a clear analogy to leaks, which are unusual both in terms of the frequency of their occurrence (there are far fewer leaks than attributed statements) and in terms of their content (leaks often reveal disagreement, which is rarely covered in the attributed communication). The nature of leaks thus suggests that the media are more likely to report on them, and that they can shift beliefs beyond their actual information content.

### 4.3 Leaks and policy announcement effects

The final part of this section examines whether and to what extent leaks impact the effect of policy announcements on longer-term policy expectations. Our analysis is related to Tillmann (2021), who shows that public awareness of dissent on the ECB Governing Council weakens the transmission of policy news to the long end of the yield curve: market participants anticipate future policy changes to be less persistent or forceful than announced if they learn that policy-makers are divided. We directly build on his empirical framework to show that leaks shortly after policy announcements lead to a similarly dampened reaction in longer-term rates.

Following Tillmann (2021), our initial point of departure is the model in equation (7) which linearly relates end-of-day changes in longer-term OIS rates to the news content of the ECB's press release and press conference, identified from high-frequency moves in the 2Y OIS rate. The 2Y rate offers two advantages. First, it is the most liquid OIS rate. Second, it also remains responsive as monetary policy hits the effective lower bound, when shorter rates become stale.[29]

$$\Delta y_t = \alpha + \beta e_t^{MP} + \varepsilon_t \tag{7}$$

where $\Delta y_t$ denotes the change in longer-term OIS rates with a 2Y, 5Y or 10Y maturity from directly before the publication of the ECB's press release (announcing the latest policy decision) until the end of the trading day and $e_t^{MP}$ stands for the high-frequency response in the 2Y OIS rate over the entire monetary policy announcement. Following the timing conventions in Altavilla et al. (2019), this response is defined as the change from the median quote during the 13:25-13:35 CET window (before the press release) to the median quote during the 15:40-15:50 CET window (after the press conference). We expect the coefficient $\beta$ to be positive, i.e. an unexpected policy tightening also raises longer-term rates.

We augment this simple model to distinguish between policy announcements with or without subsequent leaks. In equation (8) below, the dummy $D_t^{leak}$ takes the value of one if there is at least one leak between the end of the monetary policy announcement window and the end of trading hours on the announcement day.[30] While we still expect $\beta > 0$, the transmission of policy news to longer-term rates may differ in the presence of leaks, as captured by the coefficient $\delta$. If leaks generally tend to reinforce the effect of monetary policy news, we should find $\delta > 0$. In contrast, if leaks counteract the latest policy announcement, we should find $\delta < 0$.

[29] Gnan et al. (2022) show that the 2Y maturity captures news about the policy reaction function as well as news about general economic conditions emanating from ECB policy announcements. Although a clean distinction is desirable for some applications, the precise origins of shocks emanating from central bank communication are not crucial for our analysis in this section.

[30] In analogy to Tillmann (2021), we verify that using the residuals obtained from a logistic regression of our leak dummy on potential drivers, including dissent, does not change any of the results presented in this subsection (for details, c.f. Table A12 in Appendix E).

Equation 8 also includes analogous dummy and interaction terms for attributable statements after the policy announcement.

$$\Delta y_t = \alpha + \beta e_t^{MP} + \gamma D_t^{leak} + \delta \left(e_t^{MP} \times D_t^{leak}\right) + \kappa D_i^{attr} + \lambda \left(e_t^{MP} \times D_i^{attr}\right) + \varepsilon_t \quad (8)$$

Our estimates in Table 8 strongly support the notion that leaks dampen policy announcement effects. Table 8 contains three columns for each longer-term maturity OIS rate. The first of these columns always corresponds to the model in equation (7). The second column for each OIS rate shows regression results for equation (8). The third column also controls for the presence of attributable communication shortly after the official policy announcement. Our results can be summarized as follows. First, we find that monetary policy surprises have effects on 2Y, 5Y and 10Y maturities that persist until the end of the trading day (c.f. columns 1, 4, 7). Second, these effects become considerably weaker if a leak occurs shortly after the announcement (c.f. columns 2, 5, 8). Third, the opposite happens in the case for attributable statements shortly after policy announcements: the coefficient of the interaction term for named statements is significantly positive across maturities (c.f. columns 3, 6, 9). Thus, leaks tend to counteract market reactions induced by the official ECB monetary policy announcement, whereas attributable statements reinforce the official policy line.

[Table 8 about here]

Finally, our results also speak to the optimal design of quiet periods, during which policy-makers are not supposed to talk about policy-sensitive issues. Their design varies across central banks. For example, the ECB's quiet period ends with the policy announcement, whereas the Fed's quiet period also comprises the day after the meeting. Based on our findings, allowing for attributable communication shortly after the announcement may contribute to mitigating the effects of leaks. We analyze potential mitigation efforts more explicitly in the next section.

# 5 Interaction of leaks and attributable communication

Leaks and attributable communication by individual Governing Council members may interact through their timing or through their content and market impact. As regards timing, we find little systematic connection between the two types of communication (see Figure A3 in Appendix F). Yet, since the calendars of Governing Council members are often filled long in advance, the absence of clear patterns in the descriptive data is not surprising. In this section, we instead focus on the interplay of leaks and attributable communication via their impact on public expectations.

## 5.1 Attributable communication and the impact of leaks

Does the extent of attributable communication efforts by central bank officials in the run-up to a given leak influence the market impact of that very leak? To answer this question, we focus on the period of the policy cycle that is further away from the next Governing Council meeting. We do so to minimize the scope for spurious correlations: the proximity to actual policy decisions is likely to affect both market reactions to leaks and the amount of attributable communication. We start by measuring the distance in hours, $\Delta hr_{ij}$, between every leak $i$ and every attributable statement $j$. Taking into account all $J_i$ attributable statements from 36 hours[31] up to half an hour before leak $i$, we define a measure for the intensity $\lambda_i$ of attributable communication before every leak as shown in equation 9. Our measure for the intensity of named statements in the run-up to a leak increases if i) more attributable statements are issued or ii) attributable statements occur closer to the leak.

[31]Since communication rarely takes place during night hours, a 36-hour window covers close to all attributable statements on the same day and the preceding day.

$$\lambda_i = \sum_{j=1}^{J_i} \frac{1}{\Delta hr_{ij}} \tag{9}$$

We regress the absolute market reaction to a leak on pre-leak attributable communication intensity $\lambda_i$, while controlling for year, month, weekday and hour of day fixed effects (c.f. the model in equation 10). Coefficient estimates in Table 9 suggest that higher values of $\lambda_i$ correlate with a statistically significantly lower market impact of the subsequent leak across most maturities, even after controlling for the timing of leaks. Thus, more intense attributable communication in run-up to leaks partially mitigates their market impact.

$$|\Delta y_i| = \beta\lambda_i + \tau_i^{year} + \tau_i^{month} + \tau_i^{weekday} + \tau_i^{hour} + \varepsilon_i \tag{10}$$

[Table 9 about here]

## 5.2 Leaks and the impact of attributable communication

Is the policy inclination (proxied by the sign of its market impact) of a given leak systematically related to the inclination of attributable statements during the subsequent 36 hours?[32] To answer this question, we regress market reactions to attributable statements, $\Delta y_i^{attr}$, on market reactions to the corresponding preceding leak, $\Delta y_i^{leak}$. In equation (11), we also include an additional interaction term to differentiate between attributable statements issued by NCB Governors (baseline) and the ECB's Executive Board.

$$\Delta y_i^{attr} = \alpha + \beta\Delta y_i^{leak} + \gamma D_i^{ExB} + \delta\Delta y_i^{leak} \times D_i^{ExB} + \varepsilon_i \tag{11}$$

The results in Table 10 are interesting for two reasons. First, while we find generally weak and ambiguous effects for communication efforts by NCB governors, the inclination of statements by ECB-affiliated policy-makers are systematically negatively correlated with the market impact of leaks across the entire yield curve.[33] For medium maturities, coefficient estimates are also statistically significant. Hence, attributable communication can be helpful in mitigating the adverse consequences of anonymous disclosures by (partly) reversing the effects of leaks on public expectations.

A second important implication from the findings in Table 10 concerns the nature of leaks. In Sections 2 and 3, we marshal evidence inconsistent with the hypothesis that Eurosystem leaks mainly constitute random accidents. An alternative possibility is that leaks represent institutional plants to test the waters for new policy options. Although plants have been found to be very common in politics (Hess, 1984; Abel, 1987; Pozen, 2013), our results in this subsection suggest they are an unlikely explanation for anonymous disclosures in the case of the Eurosystem, as attributed statements by ECB-affiliated Governing Council members tend to mitigate the effect of leaks. Based on these findings, together with our results in Section 4.3 showing that leaks shortly after policy meetings tend to counteract policy announcement effects, we conclude that most Eurosystem leaks are unlikely to constitute plants.

[Table 10 about here]

[32] We explain our choice of the 36-hour window in footnote 31. In case of multiple leaks, we match each attributable statement to the closest leak. To measure market reactions to attributable statements in the cleanest possible way, we drop attributable statements less than half an hour after a leak.

[33] Importantly, the estimates in Table 10 do not imply that NCB governors are unwilling to speak up against leaks. While Jansen and De Haan (2006) suggest that ECB Executive Board members and NCB governors follow different communication strategies, an alternative explanation for our findings is that statements by the average NCB governor trigger smaller market movements, as suggested by Gertler and Horvath (2018), Istrefi et al. (2022) and Gnan and Rieder (2023).

## 6 Conclusion

Systematic empirical studies on the drivers and consequences of public policy leaks have proven elusive for a range of different reasons. Not only is it hard to infer motives without ever knowing who disclosed the information, it is also difficult to quantify the impact of leaks on public policy effectiveness: in contrast to the high-frequency nature of news about leaks, the effects of many public policies can only be measured over longer intervals. Our paper addresses this gap in the academic literature by analyzing leaks related to monetary policy. Central banks constitute interesting cases to study public policy leaks for several reasons. Thanks to the well-defined scope and the recurrent nature of monetary policy decisions, the content of related leaks is comparable over time, allowing the compilation of a consistent database over a long sample period. In addition, the impact of monetary policy leaks on public views can be directly extracted from high-frequency data on market interest rates. Finally, monetary policy represents a prominent example for decision-making by committee, which prevails in many public institutions, especially at the supranational level.

Our paper provides a comprehensive analysis of the role of leaks during the last two decades of monetary policy-making in the euro area. We describe the broad trends and the timing of Eurosystem leaks. We uncover several systematic drivers of leaks in the euro area, including proxies for potential disagreement among the members of the ECB Governing Council, which contradicts the hypothesis that leaks are random accidents. Moreover, our results suggest that most Eurosystem leaks do not represent institutional "plants", as attributed statements by ECB policy-makers tend to mitigate the market impact of leaks.

Eurosystem leaks are frequent and have sizable impacts on financial markets, irrespective of whether they occur before or after policy meetings. At the same time, leaks are generally not informative about upcoming monetary policy decisions. While this might be surprising, our findings are in line with models formalizing the effects of media reporting on economic agents (Nimark, 2014; Chahrour et al., 2021). Market participants would therefore be well advised to treat such unattributed communication with caution. Our results show that up to now, this has not been the case. Yet, we also find that the market impact of leaks can at least partially be mitigated by attributed communication. Moreover, the decline in the number of leaks since 2020 implies that unattributed communication affected markets less often in recent times.

Other questions remain for future research. In particular, our analysis has focused on the short-term impact of public policy leaks, leaving aside their potential longer-term implications, e.g. for the reputation of the institutions concerned.

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# Tables in main paper

Table 1: **Drivers of leaks**

This table presents coefficient estimates for the Poisson regression model in equation (1). Average marginal effects are indicated in square brackets. The dependent variable in columns 1 and 2 is the total count of leaks associated with each ECB monetary policy meeting. In columns 3 and 4, we omit leaks on disagreement among policy-makers issued shortly (up to four days) after policy decisions from the count. Explanatory variables include the Italy-Germany 10Y sovereign yield spread (percent), the inter-quartile range of national inflation figures (percent), the number of attributable statements as well as a dummy for the release of new macroeconomic projections at policy meetings. All estimations include year-fixed effects. The sample period ranges from January 2002 to December 2021. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | Leak count | | Leak count (excl. leaks on dissent) | |
|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) |
| *Variables* | | | | |
| IT-DE 10Y spread | 0.2705** | 0.2569** | | |
| | (0.1257) | (0.1182) | | |
| | [0.4673] | [0.4438] | | |
| Inflation IQR | -0.0391 | -0.0416 | | |
| | (0.2333) | (0.2239) | | |
| | [-0.0676] | [-0.0718] | | |
| Count of attributable | 0.0120*** | 0.0119*** | | |
| | (0.0038) | (0.0037) | | |
| | [0.0208] | [0.0206] | | |
| Dissent | | | 0.3497*** | 0.3287** |
| | | | (0.1284) | (0.1326) |
| | | | [0.6340] | [0.5958] |
| Macroeconomic projections | | 0.2527** | | 0.1618 |
| | | (0.1085) | | (0.1225) |
| | | [0.4446] | | [0.2943] |
| *Fixed-effects* | | | | |
| Year | Yes | Yes | Yes | Yes |
| *Fit statistics* | | | | |
| Observations | 213 | 213 | 171 | 171 |
| Squared Correlation | 0.4411 | 0.4593 | 0.4003 | 0.4065 |
| Pseudo $R^2$ | 0.1543 | 0.1619 | 0.1478 | 0.1510 |

Table 2: **High-frequency market reactions to leaks and placebo events**

This table presents linear regression estimates of the marginal impact of monetary policy leaks on the size of movements in overnight index swap (OIS) rates and the EURO STOXX 50 over a given event window. The dependent variable in all regressions is the absolute change in an OIS rate or the stock index return, $|\Delta y_{-5,+30}|$ (in basis points), over an event window starting 5 minutes before the release of the respective news report and ending 30 minutes after the release. Changes in interest rates or stock index returns are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. For each regression, market reactions to actual leaks are combined with reactions to 5,000 randomly sampled placebo events. The sampling procedure for the placebo event windows is explained in Appendix D. The *Leak* dummy distinguishes between leaks and placebo events. The regression intercept can be interpreted as the average absolute market reaction to placebo events. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | \|Δ1M\| | \|Δ3M\| | \|Δ6M\| | \|Δ1Y\| | \|Δ2Y\| | \|Δ5Y\| | \|Δ10Y\| | \|ΔSTOXX\| |
|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Variables* | | | | | | | | |
| Intercept (Placebo) | 0.2273*** | 0.2432*** | 0.2417*** | 0.3126*** | 0.4260*** | 0.4208*** | 0.5450*** | 19.48*** |
| | (0.0080) | (0.0056) | (0.0051) | (0.0060) | (0.0080) | (0.0077) | (0.0083) | (0.3327) |
| Leak | 0.1457*** | 0.1457*** | 0.1877*** | 0.2939*** | 0.3614*** | 0.2384*** | 0.2234*** | 4.902*** |
| | (0.0443) | (0.0352) | (0.0372) | (0.0519) | (0.0633) | (0.0557) | (0.0558) | (1.659) |
| *Fit statistics* | | | | | | | | |
| Observations | 5,212 | 5,255 | 5,279 | 5,289 | 5,292 | 5,166 | 5,166 | 5,290 |
| $R^2$ | 0.0026 | 0.0060 | 0.0120 | 0.0208 | 0.0184 | 0.0059 | 0.0044 | 0.0022 |
| Adjusted $R^2$ | 0.0024 | 0.0058 | 0.0118 | 0.0207 | 0.0182 | 0.0057 | 0.0042 | 0.0020 |

Table 3: **High-frequency market reactions to leaks (by topic) and placebo events**

This table presents linear regression estimates of the marginal impact for three types of leaks on the size of movements in overnight index swap (OIS) rates and the EURO STOXX 50 over a given event window. The dependent variable in all regressions is the absolute change in an OIS rate or the stock index return, $|\Delta y_{-5,+30}|$ (in basis points), over an event window starting 5 minutes before the release of the respective news report and ending 30 minutes after the release. Changes in interest rates or stock index returns are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. For each regression, market reactions to actual leaks are combined with reactions to 5,000 randomly sampled placebo events. The sampling procedure for the placebo event windows is explained in Appendix D. The dummy variables *Rates*, *UMP* and *Growth, inflation, FX* indicate actual leaks related to policy rates, unconventional policy tools (UMP) and economic conditions (comprising economic growth, inflation and the euro exchange rate) respectively. The regression intercept can be interpreted as the average absolute market reaction to placebo events. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | \|Δ1M\| | \|Δ3M\| | \|Δ6M\| | \|Δ1Y\| | \|Δ2Y\| | \|Δ5Y\| | \|Δ10Y\| | \|ΔSTOXX\| |
|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Variables* | | | | | | | | |
| Intercept (Placebo) | 0.2293*** | 0.2448*** | 0.2439*** | 0.3165*** | 0.4306*** | 0.4216*** | 0.5458*** | 19.49*** |
| | (0.0080) | (0.0056) | (0.0052) | (0.0060) | (0.0080) | (0.0076) | (0.0083) | (0.3318) |
| Rates | 0.1955*** | 0.2917*** | 0.3250*** | 0.5428*** | 0.5937*** | 0.2146* | 0.1261 | 3.989 |
| | (0.0754) | (0.0632) | (0.0699) | (0.0973) | (0.1086) | (0.1178) | (0.0970) | (2.715) |
| UMP | 0.0005 | -0.0556 | -0.0104 | -0.0755 | -0.1049 | 0.2010*** | 0.2256*** | 7.005*** |
| | (0.0510) | (0.0401) | (0.0437) | (0.0588) | (0.0754) | (0.0680) | (0.0735) | (2.394) |
| Growth, inflation, FX | 0.0052 | -0.0267 | -0.0624 | -0.0814 | 0.0724 | -0.1708* | -0.1925* | -3.992* |
| | (0.1087) | (0.0664) | (0.0600) | (0.0788) | (0.1259) | (0.0943) | (0.1026) | (2.406) |
| *Fit statistics* | | | | | | | | |
| Observations | 5,212 | 5,255 | 5,279 | 5,289 | 5,292 | 5,166 | 5,166 | 5,290 |
| $R^2$ | 0.0023 | 0.0111 | 0.0172 | 0.0336 | 0.0268 | 0.0067 | 0.0051 | 0.0037 |
| Adjusted $R^2$ | 0.0018 | 0.0105 | 0.0166 | 0.0330 | 0.0263 | 0.0061 | 0.0045 | 0.0032 |

Table 4: **High-frequency market reactions to leaks vs. attributable communication**

This table presents linear regression estimates of the marginal impact of statements attributable to individual policy-makers relative to leaks. Market impacts are measured as the size of movements in overnight index swap (OIS) rates and the EURO STOXX 50 during a given event window. The dependent variable in all regressions is the absolute change in an OIS rate or the stock index return, $|\Delta y_{-5,+30}|$ (in basis points), over an event window starting 5 minutes before the release of the respective news report and ending 30 minutes after the release. Changes in interest rates or stock index returns are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. In all estimations, the baseline corresponds to leaks, whereas statements attributable to individual policy-makers are flagged by the dummy variable *Attributable*. To account for differences in the distribution of leaks and attributable statements over time, all estimations include year, month, weekday and hour-of-day fixed effects. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | $\lvert\Delta$1M$\rvert$ | $\lvert\Delta$3M$\rvert$ | $\lvert\Delta$6M$\rvert$ | $\lvert\Delta$1Y$\rvert$ | $\lvert\Delta$2Y$\rvert$ | $\lvert\Delta$5Y$\rvert$ | $\lvert\Delta$10Y$\rvert$ | $\lvert\Delta$STOXX$\rvert$ |
|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Variables* | | | | | | | | |
| Attributable | -0.1181*** | -0.1111*** | -0.1353*** | -0.2122*** | -0.2508*** | -0.1940*** | -0.1925*** | -3.918** |
| | (0.0423) | (0.0345) | (0.0354) | (0.0483) | (0.0602) | (0.0516) | (0.0554) | (1.618) |
| *Fixed-effects* | | | | | | | | |
| Year, Month, Weekday and Hour | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Fit statistics* | | | | | | | | |
| Observations | 3,724 | 4,695 | 5,228 | 5,442 | 5,487 | 2,253 | 2,273 | 5,115 |
| $R^2$ | 0.1442 | 0.0873 | 0.1240 | 0.1566 | 0.1814 | 0.1697 | 0.1369 | 0.1240 |
| Within $R^2$ | 0.0039 | 0.0031 | 0.0045 | 0.0046 | 0.0049 | 0.0077 | 0.0060 | 0.0014 |

Table 5: **Market reactions to leaks and pre-trends in market expectations**

This table presents linear regression estimates for the model in equation (5). The dependent variable in all regressions is the change in an OIS rate, $\Delta y_{-5,+30}$ (in basis points), over an event window starting 5 minutes before the release of a news report on a monetary policy leak and ending 30 minutes after the release. Changes in interest rates are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. For every maturity, observations related to actual leaks are combined with 5,000 randomly sampled placebo events. The variable *Trend* measures the prevailing market trend in the run-up to a respective leak, computed as the yield change over the preceding seven days until directly before the 30-minute event window. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | Δ 1M | Δ 3M | Δ 6M | Δ 1Y | Δ 2Y | Δ 5Y | Δ 10Y |
|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| *Variables* | | | | | | | |
| Intercept | -0.0072 | -0.0140** | -0.0067 | -0.0055 | -0.0115 | -0.0116 | -0.0123 |
| | (0.0093) | (0.0067) | (0.0060) | (0.0069) | (0.0094) | (0.0098) | (0.0112) |
| Trend | -0.0120 | -0.0160*** | -0.0042 | -0.0012 | 0.0006 | 0.0021 | 0.0026 |
| | (0.0081) | (0.0057) | (0.0040) | (0.0037) | (0.0032) | (0.0038) | (0.0027) |
| Leak | 0.0649 | 0.0080 | 0.0205 | 0.0151 | -0.0373 | 0.0022 | 0.0941 |
| | (0.0452) | (0.0425) | (0.0483) | (0.0690) | (0.0855) | (0.0938) | (0.0911) |
| Trend × Leak | -0.0618** | -0.0417* | -0.0275* | -0.0042 | 0.0019 | -0.0025 | 0.0126 |
| | (0.0278) | (0.0223) | (0.0166) | (0.0199) | (0.0168) | (0.0296) | (0.0166) |
| *Fit statistics* | | | | | | | |
| Observations | 5,175 | 5,213 | 5,231 | 5,241 | 5,242 | 5,131 | 5,132 |
| $R^2$ | 0.0136 | 0.0163 | 0.0051 | 0.0003 | 0.0002 | 0.0002 | 0.0010 |
| Adjusted $R^2$ | 0.0131 | 0.0157 | 0.0046 | -0.0003 | -0.0004 | -0.0004 | 0.0004 |

Table 6: **Leaks do not move market expectations closer to post-policy meeting rates**

This table presents coefficient estimates for the regression model in equation (6). We compute the absolute distance of OIS rates to the levels prevailing directly after the following policy announcement for each leak in our database at two points in time: once five minutes before and once thirty minutes after the release of the respective news report. More precisely, we compute the median quotes during the 10 minutes before and the 10 minutes after this event window. Post-announcement levels in interest rates are measured as the median quote from 15:40 to 15:50 CET as in Altavilla et al. (2019). Our dependent variable is defined as the change in the absolute distance of rates to their post-announcement levels from just before to immediately after the leak. We denote this change in the absolute distance around leak $i$ by $\delta_i$. To illustrate, $\delta_i < 0$ means that the leak moved rates closer to the post-announcement level, whereas $\delta_i > 0$ means that rates have moved away. The regression results displayed in odd columns test whether the average $\delta_i$ across all leaks is different from 0 (i.e. regression of $\delta_i$ on a constant). The regression results displayed in even columns also include a dummy for the quiet period, i.e. leaks close to the upcoming policy meeting. Clustered (policy meeting) standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | 3M | | 6M | | 1Y | | 2Y | | 5Y | | 10Y | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| *Variables* | | | | | | | | | | | | |
| Intercept (average $\delta_i$) | -0.0169 | -0.0187 | 0.0107 | 0.0018 | 0.0910* | 0.0722 | -0.0381 | -0.1235 | -0.0864 | -0.1271 | -0.0092 | -0.0522 |
| | (0.0430) | (0.0549) | (0.0426) | (0.0560) | (0.0538) | (0.0786) | (0.0664) | (0.0980) | (0.0752) | (0.0945) | (0.0884) | (0.0959) |
| Quiet period | | 0.0046 | | 0.0232 | | 0.0483 | | 0.2219 | | 0.1496 | | 0.1540 |
| | | (0.0890) | | (0.0767) | | (0.1112) | | (0.1460) | | (0.1312) | | (0.1444) |
| *Fit statistics* | | | | | | | | | | | | |
| Observations | 251 | 251 | 276 | 276 | 288 | 288 | 291 | 291 | 162 | 162 | 165 | 165 |
| $R^2$ | | $1.15 \times 10^{-5}$ | | 0.0003 | | 0.0005 | | 0.0071 | | 0.0051 | | 0.0047 |
| Adjusted $R^2$ | | -0.0040 | | -0.0034 | | -0.0030 | | 0.0037 | | -0.0011 | | -0.0014 |

Table 7: **Attributable statements move market expectations closer to post-policy meeting rates**

This table presents coefficient estimates for the regression model in equation (6), but for changes in interest rates induced by statements attributable to individual policy-makers (instead of anonymous leaks). We compute the absolute distance of OIS rates to the levels prevailing directly after the following policy announcement for each attributable statement in our database at two points in time: once five minutes before and once thirty minutes after the release of the respective news report. More precisely, we compute the median quotes during the 10 minutes before and the 10 minutes after this event window. Post-announcement levels in interest rates are measured as the median quote from 15:40 to 15:50 CET as in Altavilla et al. (2019). Our dependent variable is defined as the change in the absolute distance of rates to their post-announcement levels from just before to immediately after the attributable statement. We denote this change in the absolute distance around statement $i$ by $\delta_i$. To illustrate, $\delta_i < 0$ means that the statement moved rates closer to the post-announcement level, whereas $\delta_i > 0$ means that rates have moved away. The regression results displayed in odd columns test whether the average $\delta_i$ across all attributable statements is different from 0 (i.e. regression of $\delta_i$ on a constant). The regression results displayed in even columns include a dummy for the quiet period, i.e. statements close to the upcoming policy meeting. Clustered (policy meeting) standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | 3M | | 6M | | 1Y | | 2Y | | 5Y | | 10Y | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| *Variables* | | | | | | | | | | | | |
| Intercept (average $\delta_i$) | -0.0433*** | -0.0389*** | -0.0449*** | -0.0442*** | -0.0518*** | -0.0544*** | -0.0329** | -0.0362** | 0.0222 | 0.0172 | -0.0024 | -0.0087 |
| | (0.0096) | (0.0098) | (0.0105) | (0.0104) | (0.0151) | (0.0150) | (0.0163) | (0.0167) | (0.0227) | (0.0229) | (0.0260) | (0.0262) |
| Quiet period | | -0.0413 | | -0.0067 | | 0.0248 | | 0.0307 | | 0.0804 | | 0.0984 |
| | | (0.0321) | | (0.0425) | | (0.0513) | | (0.0555) | | (0.0752) | | (0.0916) |
| *Fit statistics* | | | | | | | | | | | | |
| Observations | 4,404 | 4,404 | 4,930 | 4,930 | 5,145 | 5,145 | 5,187 | 5,187 | 2,061 | 2,061 | 2,099 | 2,099 |
| $R^2$ | | 0.0006 | | $1.38 \times 10^{-5}$ | | $8.08 \times 10^{-5}$ | | $8.46 \times 10^{-5}$ | | 0.0006 | | 0.0007 |
| Adjusted $R^2$ | | 0.0004 | | -0.0002 | | -0.0001 | | -0.0001 | | 0.0001 | | 0.0002 |

Table 8: **Post-meeting leaks and the effectiveness of the ECB's policy communication**

This table presents coefficient estimates for the regression model in equation (8). The dependent variable is the high-frequency change in an OIS interest rate on policy announcement days, measured from directly before the start of the official ECB policy announcement until the end of trading hours. Δ *2Y decision* is the high-frequency response in the 2Y OIS rate to the monetary policy announcement, i.e. the change from the median quote during the 13:25-13:35 CET window (before the press release) to the median quote during the 15:40-15:50 CET window (after the press conference). *Post-meeting leak* is a dummy that takes a value of one if there is at least one leak between the end of the monetary policy announcement window and the end of trading hours on the announcement day. *Post-meeting attributable* is defined in the same way, but for statements attributable to individual policy-makers. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | | Δ 2Y day end | | | Δ 5Y day end | | | Δ 10Y day end | |
|---|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| *Variables* | | | | | | | | | |
| Intercept | 0.0662 | 0.0643 | -0.0035 | -0.3864* | -0.4780** | -0.4618* | -0.2491 | -0.3898 | -0.4311 |
| | (0.1363) | (0.1401) | (0.1638) | (0.1999) | (0.2018) | (0.2406) | (0.2761) | (0.2810) | (0.3274) |
| Δ 2Y decision | 1.163*** | 1.176*** | 1.124*** | 1.082*** | 1.195*** | 1.104*** | 0.7734*** | 0.9191*** | 0.7703*** |
| | (0.0394) | (0.0409) | (0.0431) | (0.1045) | (0.0953) | (0.1005) | (0.1442) | (0.1305) | (0.1102) |
| Post-meeting leak | | -0.3638* | -0.2584 | | 0.3411 | 0.3250 | | 0.6902 | 0.7316 |
| | | (0.2103) | (0.2135) | | (0.2209) | (0.2572) | | (0.4591) | (0.4918) |
| Δ 2Y decision × Post-meeting leak | | -0.2008*** | -0.1487*** | | -0.3945*** | -0.3032*** | | -0.5003*** | -0.3515*** |
| | | (0.0417) | (0.0442) | | (0.0956) | (0.1007) | | (0.1341) | (0.1146) |
| Post-meeting attributable | | | 0.0852 | | | -0.1744 | | | 0.0542 |
| | | | (0.3290) | | | (0.3912) | | | (0.6080) |
| Δ 2Y decision × Post-meeting attributable | | | 0.1701** | | | 0.2808** | | | 0.4493** |
| | | | (0.0686) | | | (0.1302) | | | (0.1824) |
| *Fit statistics* | | | | | | | | | |
| Observations | 213 | 213 | 213 | 95 | 95 | 95 | 98 | 98 | 98 |
| $R^2$ | 0.8763 | 0.8779 | 0.8816 | 0.7881 | 0.8110 | 0.8194 | 0.4882 | 0.5355 | 0.5624 |
| Adjusted $R^2$ | 0.8758 | 0.8761 | 0.8787 | 0.7858 | 0.8047 | 0.8093 | 0.4829 | 0.5207 | 0.5386 |

Table 9: **Market reactions to leaks and pre-leak communication (far from meeting)**

This table presents coefficient estimates for the regression model in equation (10). The dependent variable in all estimations is the absolute change in an OIS rate or the EURO STOXX 50 return, $|\Delta y_{-5,+30}|$ (in basis points), over an event window starting 5 minutes before the release of a news report on a monetary policy leak and ending 30 minutes after the release. Changes in interest rates or stock index returns are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. The variable *Attributable communication intensity* measures the intensity of attributable communication efforts by individual policy-makers from 36 hours before up to half an hour before the respective leak, as defined in equation (9). In these regressions, we focus on the period of the policy cycle that is further away from the next Governing Council meeting. We do so to minimize the scope for spurious correlations: the proximity to actual policy decisions is likely to affect both market reactions to leaks and the amount of attributable communication. All estimations include year, month, weekday and hour-of-day fixed effects. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | $\|\Delta$1M$\|$ | $\|\Delta$3M$\|$ | $\|\Delta$6M$\|$ | $\|\Delta$1Y$\|$ | $\|\Delta$2Y$\|$ | $\|\Delta$5Y$\|$ | $\|\Delta$10Y$\|$ | $\|\Delta$STOXX$\|$ |
|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Variables* | | | | | | | | |
| Attributable comm. intensity | -0.0138 | -0.1078** | -0.1263** | -0.1172* | -0.1450*** | -0.2735* | -0.1783 | -0.7864 |
| | (0.0265) | (0.0472) | (0.0495) | (0.0669) | (0.0501) | (0.1518) | (0.1956) | (1.084) |
| *Fixed-effects* | | | | | | | | |
| Year, Month, Weekday and Hour | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Fit statistics* | | | | | | | | |
| Observations | 112 | 134 | 146 | 152 | 154 | 96 | 96 | 153 |
| $R^2$ | 0.5697 | 0.3950 | 0.4367 | 0.4780 | 0.5337 | 0.5413 | 0.3964 | 0.4484 |
| Within $R^2$ | 0.0014 | 0.0524 | 0.0487 | 0.0207 | 0.02824 | 0.03550 | 0.0140 | 0.0016 |

Table 10: **Market reactions to leaks and to subsequent attributable communication**

This table presents coefficient estimates for the regression model in equation (11). The dependent variable in all estimations is the change in an OIS rate, $\Delta y_{-5,+30}$ (in basis points), over an event window starting 5 minutes before the release of a news report on a statement attributable to an individual policy-maker and ending 30 minutes after the release. Changes in interest rates are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. The variable *Market reaction to leak* measures the market reaction to the closest leak preceding an attributable statement. We only consider attributable statements that occurred up to 36 hours after a leak and that are at least half an hour away from the leak. *ExB* is a dummy variable that takes a value of one if an attributable statement is issued by a member of the ECB's Executive Board. Standard errors are clustered at the leak-level as a leak may be followed by more than one attributable statement. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | Δ 1M | Δ 3M | Δ 6M | Δ 1Y | Δ 2Y | Δ 5Y | Δ 10Y |
|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| *Variables* | | | | | | | |
| Intercept | -0.0315 | -0.0154 | -0.0280 | 0.0068 | -0.0249 | -0.1595* | -0.1043 |
| | (0.0403) | (0.0622) | (0.0406) | (0.0597) | (0.0946) | (0.0876) | (0.1101) |
| Market reaction to leak | 0.1137 | 0.1818 | 0.1487 | 0.0393 | 0.0340 | -0.0146 | 0.0311 |
| | (0.1108) | (0.1176) | (0.0960) | (0.0554) | (0.0639) | (0.0921) | (0.1098) |
| ExB | 0.1290* | 0.1047 | -0.0159 | -0.0532 | -0.0919 | 0.1564 | 0.3664** |
| | (0.0688) | (0.0918) | (0.0715) | (0.0866) | (0.1151) | (0.1231) | (0.1648) |
| Market reaction to leak × ExB | -0.1312 | -0.0458 | -0.2592* | -0.2102** | -0.2332** | -0.2054* | -0.1798 |
| | (0.1535) | (0.2135) | (0.1313) | (0.0912) | (0.0934) | (0.1095) | (0.1613) |
| *Fit statistics* | | | | | | | |
| Observations | 134 | 165 | 212 | 227 | 233 | 125 | 126 |
| $R^2$ | 0.0372 | 0.0472 | 0.0341 | 0.0272 | 0.0328 | 0.0650 | 0.0497 |
| Adjusted $R^2$ | 0.0150 | 0.0294 | 0.0202 | 0.0141 | 0.0201 | 0.0418 | 0.0264 |

# Central bank communication by ???
# The Economics of Public Policy Leaks

## APPENDIX FOR ONLINE PUBLICATION

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# A Construction of the data set on leaks

To compile our novel database on monetary policy-related leaks emanating from Eurosystem insiders, we draw on three major financial news providers: Reuters News, Bloomberg News and Market News International. To identify leaks, we apply filtering procedures that are tailored to the specifics of each of these three news sources, as described further below in this section. In all cases, we filter news reports falling into the period between 2002-01-01 and 2021-12-31.

For each news source, the outcome of the filtering process is a list of candidate news items that constitute likely reports on monetary policy-related leaks. More than one news item may refer to the same leak, both within and across news outlets, while some news items may represent "false positives" that do not actually refer to a leak at all. We combine the candidate news items from all three sources and manually identify *actual* monetary policy-related leaks. Monetary policy-related leaks satisfy the following criteria: i) the identity of the source cited by the news report is not revealed, but the source is plausibly based inside a Eurosystem institution; ii) the statement cited in the news report relates to one of the five topics policy rates, unconventional policy tools (UMP), economic growth, inflation or the euro exchange rate. We exclude leaks referring exclusively to local economic conditions (e.g. GDP growth in one specific country) or to topics that should have no direct implication for the stance of monetary policy (e.g. disclosures on banking regulation or rumors about appointments of top management personnel). Finally, we aggregate individual news items belonging to the same leak to the leak level and keep the time stamp of the first news item reporting on the leak.

**Reuters News.** To identify candidate items for leaks from the more than 60 million news items contained in the Thomson Reuters News Archive database between 2002 and 2021, we use a combination of keywords contained in the wording of news items and also meta information on individual news items provided by the database (e.g. topic or language tags):

1. The news item must be written in English (language tag "en").
2. The news item must be related to the ECB (topic tag "N2:ECB").
3. Headline or body must match at least one of a list of regular expressions based on the following keywords:[1] *"anonymous", "anonymity", "unnamed", "not named", "not to be named", "declined to be named", "unidentified", "not identified", "not to be identified", "declined to be identified", "unattributable", "unattributed", "not attributed", "confidential", "source", "central bank official", "central bank staff", "ECB official", "ECB staff", "insider", "policymaker", "ECB declined to comment", "spokesperson declined to comment", "familiar", "knowledge", "leak", "secret", "document seen", "discussions in private", "private discussion", "private conversation", "direct insight", "people said", "person said"*
4. The headline must not match a number of keywords that clearly indicate that the news report re-processes previously known information and does not report fresh news (e.g. "WRAPUP", "DIGEST", "FACTBOX", "CHRONOLOGY").

**Bloomberg News.** To detect candidate items from reports by Bloomberg News, we directly use the Bloomberg terminal to enter three types of search queries and manually download the results. The search queries vary in terms of their granularity and scope to strike a balance between the degree of comprehensiveness, precision and keeping the number of results manageable for manual download and subsequent manual classification.

1. All sources, only headlines.
   *KEYWORDS:(("anonymous" OR "central bank official" OR "central bank staff" OR "confidential" OR*

[1] The regular expressions actually employed in the `R` code also avoid matching frequent "false positives". For example, the string "source" is only matched if not preceded or followed by a number of specified terms, such as "government" (government source), "re" (resource) or "link" (source link). Furthermore, note that "source" is also matched in "sources".

*"declined to comment" OR "declined to be named" OR "direct insight" OR "document seen" OR "ecb official" OR "ecb staff" OR "familiar" OR "insider" OR "knowledge" OR "leak" OR "not attributed" OR "not identified" OR "not named" OR "not to be identified" OR "people said" OR "person said" OR "private conversation" OR "private discussion" OR "secret" OR "unattributable" OR "spokesperson declined to comment" OR "ecb declined to comment" OR "unattributed" OR "unidentified" OR "source") AND (NOT "market source") AND (NOT "govt source") AND (NOT "government source") AND (NOT "treasury source") IN HEADLINES) AND TOPIC:HEADS AND (TOPIC:ECB OR TOPIC:ESCB)*

2. Only Bloomberg and recommended news outlets, not pure-headline reports.
   *KEYWORDS:(("anonymous" OR "central bank official" OR "central bank staff" OR "confidential" OR "declined to comment" OR "declined to be named" OR "direct insight" OR "document seen" OR "ecb official" OR "ecb staff" OR "familiar" OR "insider" OR "knowledge" OR "leak" OR "not attributed" OR "not identified" OR "not named" OR "not to be identified" OR "people said" OR "person said" OR "private conversation" OR "private discussion" OR "secret" OR "unattributable" OR "spokesperson declined to comment" OR "ecb declined to comment" OR "unattributed" OR "unidentified" OR "source") AND (NOT "market source") AND (NOT "govt source") AND (NOT "government source") AND (NOT "treasury source") IN HEADLINES) AND ((TOPIC:ECB OR TOPIC:ESCB) AND (NOT TOPIC:HEADS))*

3. Separate search for "official(s) familiar with the matter".
   *KEYWORDS:("official familiar with the matter" OR "officials familiar with the matter") AND (TOPIC: ECB OR TOPIC:ESCB)*

**Market News International.** The headline of news reports by Market News International on monetary policy leaks typically exhibits a specific format: "MNI SOURCES: *remaining headline*" (e.g. "MNI SOURCES: ECB Seen Buying EUR40-60 Bln A Month After March"). To obtain relevant news reports by Market News International, we draw on the Factiva news archive and filter for news reports that satisfy the following criteria:

1. The news outlet is Market News International.

2. The string "sources" (ignoring upper-/lower-case) must appear among the first 15 words of the news report (counting from the start of the headline).

3. "ECB" or "European Central Bank" must appear among the first 30 words.

# B Examples for policy-relevant Eurosystem leaks

Below, we present examples of leaks covering the five topics that we consider as "policy-relevant" in our analysis. News outlets may report on leaks either in the form of full stories consisting of headline and text body or through breaking news headlines alone (just headline, no text body).

**Policy rates** Market News International, 28 Januar 2014 (breaking news headline): ECB SOURCES: NEG [ATIVE] DEPOSIT RATE 'ACADEMIC DISCUSSION' AT PRESENT

**Unconventional policy tools** Reuters, 21 October 2014: "EXCLUSIVE-ECB looking at corporate bond buys, could move as soon as Dec - sources". *The European Central Bank is considering buying corporate bonds on the secondary market and may decide on the matter as soon as December with a view to begin buying early next year, several sources familiar with the situation told Reuters. The ECB has already carried out work on such purchases, which would widen out the private-sector asset-buying programme it began on Monday - stimulus it is deploying to try to foster lending to businesses and thereby support the euro zone economy. "The pressure* *in this direction is high," said one person familiar with the work inside the ECB, speaking on condition of anonymity. [...]*

**Economic growth** Reuters, 16 April 2019 (breaking news headline): SEVERAL ECB POLICYMAKERS DOUBT PROJECTIONS FOR GROWTH REBOUND IN H2, SOME EVEN QUESTION ACCURACY OF FORECASTING MODELS: SOURCES

**Inflation** Market News International, 1 March 2011 (breaking news headline): ALERT: SOURCES: ECB TO RATCHET UP INFLATION WARNINGS THIS THURSDAY

**Euro exchange rate.** Market News International, 1 October 2003: "ECB Sources -1- Euro May Need To Rise More - Must Be Gradual". *The Eurosystem's position is that the dollar has to depreciate vis a vis the other important currencies in order to help remedy the U.S. current account deficit, but that ideally as little as possible of this depreciation should be against the euro, European central bank sources told Market News. Some further euro appreciation, however, is probably inevitable, they conceded. Sources gave differing figures on what would be an acceptable limit for the euro's appreciation over the next year, though all figures used were above $1.20. The sources stressed that the pace of any further euro appreciation would matter as much as its level. "What we don't want to see and will take measures against is a sharp rise or drop of the European currency," said a senior ECB source. "In such an event the monetary policy of the ECB should adjust accordingly." However, he indicated that a euro-dollar exchange rate of as high as $1.30 later next year might not disturb the ECB, as long as the rise to that point was gradual and smooth. What would worry the ECB is a "chain reaction" of pressures on the dollar, including possible Asian revaluations, that would cause a sharp, abrupt drop in the U.S. currency's exchange rate. [. . . ]*

# C Construction of the data set on attributable statements by policy-makers

To compile a data set on public statements attributable to individual policy-makers from the Eurosystem, we draw on the Reuters News Archive database and apply a careful combination of i) pre-filtering, ii) manual classification of a random subset of resulting candidate news items and iii) subsequent prediction by means of machine learning techniques to classify the remaining items.

The Reuters news coverage of ECB policy-makers' public statements typically starts with a breaking news headline released immediately upon receipt of new information by the the news agency. For example, on 2003-06-03 12:46:07, Reuters released a breaking news headline reporting on a statement by then ECB President Wim Duisenberg that read: *"DUISENBERG – INFLATION TO FALL MORE SIGNIFICANTLY IN 2004"*. Typically, several of these headlines are released only seconds apart in real-time as the policy-maker is speaking. In addition, a longer article also containing a full body is usually released shortly after the end of the event. The Reuters News Archive database also provides an event-level identifier that allows to link all news items (breaking news headlines and follow-up reports) that belong to the same event.

To identify reports on *new* statements by ECB policy-makers, we first focus on breaking news headlines and filter for all headlines that contain the name of an ECB Governing Council member during her term of office. We also retain all other news items with the same event-level identifier, even if there is no mention of a Governing Council member in the other headlines.[2] This procedure results in more than 56,000 candidate news items.

[2]Usually, the name of the policy-maker speaking is repeated in every consecutive row of breaking news headlines. Yet, sometimes it is omitted from single headlines or misspelled. We also capture these headlines by drawing on the event-level identifier.

In a second step, we sample a random 20% of events (using the event-identifier) and manually tag all corresponding news items that report on an ECB policy-maker's statement. We focus on statements relevant for monetary policy, i.e. statements that touch on one of the five topics "policy rates", "unconventional policy tools (UMP)", "economic growth", "inflation" or the "euro exchange rate".

In a third step, we train a Support Vector Machine (SVM) with our hand-classified data and predict the classification (monetary policy-relevant or not) for the remaining 80% of our data which remained unclassified so far. SVM is a popular machine learning technique used in a broad range of scientific fields and for diverse machine learning problems, ranging from text classification to image recognition. For example, in economics, it has been recently used on text data by Manela and Moreira (2017). Crucially, SVM can handle classification and regression problems when the number of predictors vastly exceeds the number of observations, as is common in applications that involve text data. Our procedure entails the following three main steps:

1. **Pre-processing of the headlines.** We first lemmatize (e.g. "mice" becomes "mouse") the text contained in all headlines and assign part-of-speech (POS) tags (e.g. adjective, noun, verb) to each word. We then create uni- and bigrams ("n-grams") of words within a headline and only retain n-grams consisting of adjectives, nouns and proper nouns. Finally, we count the occurrence of n-grams within each headline.

2. **SVM training.** SVM with a linear kernel requires tuning of a single hyper-parameter (commonly called the "cost" parameter) for classification problems. We randomly split all hand-classified news items into a training (75%) and a hold-out test (25%) data set.[3] We tune the cost parameter on the training set, using five-fold cross-validation, and pick the parameter value that maximizes the area under the ROC curve. Using this value for the cost parameter, we refit the SVM to the entire training data. Subsequently, we use the fitted SVM to perform predictions for the test data and assess the quality of predictions against the actual tags that were assigned by hand. The resulting area under the ROC curve amounts to 0.902. In addition, Table A1 summarizes the percentage of overall observations in the test data that were correctly or incorrectly classified by the SVM. For 42.5% of cases, SVM and classification by hand agreed that the news item is not of interest, for another 41.3% of cases they agreed that the news item reports on a policy-relevant statement by an ECB policy-maker. Overall, we therefore correctly classify about 84% of the test data and errors are almost symmetrically distributed among false negatives (8.8%) and false positives (7.3%).

3. In a final step, we use the fitted SVM to classify news items in the remaining 80% of our candidate items that we never tagged by hand. Since our sampling of items into the 20% classified by hand – and also the sub-split into train and test data – was *random*, we can expect SVM to perform similarly well on the remaining 80%. We therefore expect to have 100% accuracy on a random 20% of the data actually classified by hand and 84% accuracy on the remaining 80% of the data. Across the entire data set (pooling the hand-classified and SVM-predicted parts), this amounts to an accuracy of about 87%, or almost 9 out of 10.

[3]More precisely, we employ stratified sampling that ensures an equal proportion of positive outcomes in both samples.

Table A1: **Confusion matrix**

This table presents the confusion matrix for predictions of policy-relevant statements by SVM against the actual classification by hand for the test data set. The outcome "TRUE" represents a news report on a policy-relevant statement by an ECB Governing Council member. Values are given in percent and represent the percentage of overall observations in the test data set falling into the respective category.

| | Hand-classification: FALSE | Hand-classification: TRUE |
|---|---|---|
| Prediction: FALSE | 42.5 | 7.3 |
| Prediction: TRUE | 8.8 | 41.3 |

# D Sampling of placebo events

We compare monetary policy leaks to "usual" market movements in so called "placebo event" windows. These placebo events are generated to approximately match i) the distribution of actual leaks across time on the year-month level and ii) the timing of leaks on each day. Our goal is to generate 5,000 new time stamps of the form "yyyy-mm-dd hh:mm", for example "2012-08-11 14:35". We employ the following procedure to obtain each of these placebo time stamps $t^{(j)}$ and the associated market reactions for different interest rates/assets $k$, $\Delta y_k^{(j)}$:

1. Extract the "yyyy-mm" component from the time stamps of all actual leaks. Use the resulting empirical distribution of "yyyy-mm" combinations to draw a candidate placebo "yyyy-mm" combination.

2. Randomly draw a calendar day ("dd") and append it to the "yyyy-mm" combination to obtain a date of format "yyyy-mm-dd".

3. Extract the "hh:mm" component of all actual leaks and keep only those falling into European trading hours. Use the resulting empirical distribution to draw a "hh:mm" combination and append it to the previously drawn date to obtain a placebo time stamp $t^{(j)}$ of the form "yyyy-mm-dd hh:mm".

4. If market price data is available for interest rate/asset $k$ over the high-frequency event window around $t^{(j)}$, compute the placebo event change/return $\Delta y_k^{(j)}$, otherwise discard $t^{(j)}$. We also discard $t^{(j)}$ if it coincides with an official ECB policy announcement, i.e. if occurs between 13:00 and 16:15 CET on policy announcement days.

5. Return to step 1 until 5,000 placebo events are available for every interest rate/asset.

# E Additional tables

Table A2: **Summary statistics – variables on the policy meeting-level**

This table presents summary statistics for all variables defined on the policy-meeting level that are used throughout the paper.

| Variable | N | Min | Q1 | Mean | Q3 | Max | Unit | Table |
|---|---|---|---|---|---|---|---|---|
| Leak count | 213 | 0.0000 | 1.0000 | 1.7277 | 2.0000 | 9.0000 | count | 1 |
| Count of attributable | 213 | 1.0000 | 24.0000 | 36.9812 | 47.0000 | 93.0000 | count | 1 |
| IT-DE 10Y spread | 213 | 0.1400 | 0.2600 | 1.3285 | 1.7600 | 5.1900 | percent | 1 |
| Inflation IQR | 213 | 0.4603 | 0.8562 | 1.1175 | 1.2982 | 2.3452 | percent | 1 |
| Dissent | 171 | 0.0000 | | 0.3216 | | 1.0000 | binary | 1 |
| Macroeconomic projections | 213 | 0.0000 | | 0.3756 | | 1.0000 | binary | 1, A6 |
| Policy change (yes/no) | 213 | 0.0000 | | 0.2817 | | 1.0000 | binary | A6 |
| Pre-meeting leaks count | 213 | 0.0000 | 1.0000 | 1.5023 | 2.0000 | 8.0000 | count | A6 |
| Pre-meeting attributable count | 213 | 0.0000 | 19.0000 | 31.9624 | 42.0000 | 83.0000 | count | A6 |
| $\Delta$ 2Y day end | 213 | -24.0000 | -2.3950 | -0.1580 | 1.4000 | 26.3000 | basis points | 8 |
| $\Delta$ 5Y day end | 95 | -13.8000 | -2.7550 | -0.4269 | 1.0375 | 16.4900 | basis points | 8 |
| $\Delta$ 10Y day end | 98 | -6.9100 | -2.6000 | -0.2255 | 1.6800 | 16.3500 | basis points | 8 |
| $\Delta$ 2Y decision | 213 | -22.8000 | -2.1500 | -0.1928 | 1.5000 | 18.7000 | basis points | 8 |
| Post-meeting leak | 213 | 0.0000 | | 0.0376 | | 1.0000 | binary | 8 |
| Post-meeting attributable | 213 | 0.0000 | | 0.2254 | | 1.0000 | binary | 8 |

Table A3: **Summary statistics – market reactions to communication events**

This table presents summary statistics for high-frequency market reactions to leaks, policy statements attributable to individual policy-makers and placebo events used throughout the paper. Note that for some parts of our analysis, we only use (sub)samples of these variables, while summary statistics in this table are always based on all available observations.

| Variable | N | Min | Q1 | Mean | Q3 | Max | Unit | Table |
|---|---|---|---|---|---|---|---|---|
| *Leaks* | | | | | | | | |
| Δ 1M | 212 | -3.5000 | -0.1000 | 0.0688 | 0.1119 | 4.4000 | basis points | 2, 3, A7, 4, A9, 5, 9, 10 |
| Δ 3M | 255 | -3.1750 | -0.2000 | -0.0178 | 0.1175 | 3.3500 | basis points | 2, 3, A7, 4, A9, 5, 9, 10 |
| Δ 6M | 279 | -4.3750 | -0.2425 | -0.0096 | 0.2000 | 3.2500 | basis points | 2, 3, A7, 4, A9, 5, 9, 10 |
| Δ 1Y | 289 | -5.7500 | -0.2550 | -0.0142 | 0.2700 | 4.0500 | basis points | 2, 3, A7, 4, A9, 5, 9, 10 |
| Δ 2Y | 292 | -5.6000 | -0.4706 | -0.1057 | 0.3000 | 5.7750 | basis points | 2, 3, A7, 4, A9, 5, 9, 10 |
| Δ 5Y | 166 | -4.3000 | -0.4500 | -0.0245 | 0.4250 | 3.3500 | basis points | 2, 3, A7, 4, A9, 5, 9, 10 |
| Δ 10Y | 166 | -3.1200 | -0.5713 | 0.0437 | 0.4987 | 3.0000 | basis points | 2, 3, A7, 4, A9, 5, 9, 10 |
| Δ STOXX | 290 | -153.1363 | -15.4044 | 0.4155 | 13.0699 | 153.8021 | basis points | 2, 3, A7, 4, A9, 9 |
| *Attributable communication* | | | | | | | | |
| Δ 1M | 3,512 | -6.0000 | -0.1200 | 0.0087 | 0.1500 | 4.7000 | basis points | 4, A9, 10 |
| Δ 3M | 4,440 | -4.6000 | -0.1500 | 0.0077 | 0.1750 | 5.4000 | basis points | 4, A9, 10 |
| Δ 6M | 4,949 | -5.9000 | -0.2000 | 0.0045 | 0.2000 | 5.4000 | basis points | 4, A9, 10 |
| Δ 1Y | 5,153 | -24.7500 | -0.2500 | 0.0141 | 0.2500 | 7.0500 | basis points | 4, A9, 10 |
| Δ 2Y | 5,195 | -13.2000 | -0.3500 | 0.0154 | 0.3750 | 8.1000 | basis points | 4, A9, 10 |
| Δ 5Y | 2,087 | -7.0000 | -0.3900 | -0.0300 | 0.3500 | 4.5500 | basis points | 4, A9, 10 |
| Δ 10Y | 2,107 | -5.5000 | -0.4800 | -0.0214 | 0.4625 | 4.7000 | basis points | 4, A9, 10 |
| Δ STOXX | 4,825 | -266.0367 | -13.4398 | 0.0101 | 13.8416 | 286.7452 | basis points | 4, A9 |
| *Placebo events* | | | | | | | | |
| Δ 1M | 5,000 | -24.5000 | -0.0500 | -0.0049 | 0.0500 | 15.0000 | basis points | 2, 3, A7 |
| Δ 3M | 5,000 | -8.6500 | -0.1000 | -0.0083 | 0.1000 | 3.9000 | basis points | 2, 3, A7 |
| Δ 6M | 5,000 | -10.9000 | -0.1350 | -0.0068 | 0.1250 | 4.0000 | basis points | 2, 3, A7 |
| Δ 1Y | 5,000 | -5.1000 | -0.1750 | -0.0007 | 0.1750 | 5.3000 | basis points | 2, 3, A7 |
| Δ 2Y | 5,000 | -5.5300 | -0.2500 | -0.0116 | 0.2150 | 6.4100 | basis points | 2, 3, A7 |
| Δ 5Y | 5,000 | -15.2000 | -0.3000 | -0.0104 | 0.2750 | 10.6500 | basis points | 2, 3, A7 |
| Δ 10Y | 5,000 | -9.1000 | -0.4000 | -0.0126 | 0.3750 | 5.9500 | basis points | 2, 3, A7 |
| Δ STOXX | 5,000 | -285.7354 | -12.4460 | -0.5885 | 12.2928 | 282.0354 | basis points | 2, 3, A7 |

Table A4: **Summary statistics – further variables**

This table presents summary statistics for further selected variables of interest not covered by Tables A2 or A3.

| Variable | N | Min | Q1 | Mean | Q3 | Max | Unit | Table |
|---|---|---|---|---|---|---|---|---|
| Trend 1M | 5,175 | -32.6000 | -0.7000 | -0.2596 | 0.4000 | 17.6500 | basis points | 5 |
| Trend 3M | 5,213 | -29.4000 | -0.7500 | -0.3055 | 0.5000 | 14.8500 | basis points | 5 |
| Trend 6M | 5,231 | -32.5500 | -1.0200 | -0.3441 | 0.7000 | 15.4500 | basis points | 5 |
| Trend 1Y | 5,241 | -38.6500 | -1.6600 | -0.3711 | 0.9600 | 22.1250 | basis points | 5 |
| Trend 2Y | 5,242 | -43.4250 | -2.4581 | -0.3942 | 1.7194 | 32.5000 | basis points | 5 |
| Trend 5Y | 5,131 | -21.0000 | -3.3000 | -0.6405 | 1.8000 | 37.2000 | basis points | 5 |
| Trend 10Y | 5,132 | -23.2000 | -4.8513 | -0.8645 | 2.7000 | 39.3000 | basis points | 5 |
| $\delta_i$ 3M | 251 | -3.3500 | -0.1900 | -0.0169 | 0.1063 | 2.8250 | basis points | 6 |
| $\delta_i$ 6M | 276 | -4.3750 | -0.1762 | 0.0107 | 0.2081 | 3.0000 | basis points | 6 |
| $\delta_i$ 1Y | 288 | -5.7500 | -0.2000 | 0.0910 | 0.3781 | 4.2000 | basis points | 6 |
| $\delta_i$ 2Y | 291 | -5.6000 | -0.3225 | -0.0381 | 0.3350 | 5.7750 | basis points | 6 |
| $\delta_i$ 5Y | 162 | -4.3000 | -0.4575 | -0.0864 | 0.2794 | 3.3500 | basis points | 6 |
| $\delta_i$ 10Y | 165 | -3.1200 | -0.4950 | -0.0092 | 0.4900 | 2.7500 | basis points | 6 |
| Attributable comm. intensity | 182 | 0.0000 | 0.0000 | 0.4203 | 0.4306 | 12.6211 | - | 9 |

Table A5: **Policy meetings resulting in policy changes**

This table lists all ECB monetary policy meetings during our sample period that resulted in a policy change according to our manual classification.

| Meeting | Rate change | UMP change | Meeting | Rate change | UMP change |
|---|---|---|---|---|---|
| 2002-12-05 | Yes | No | 2012-02-09 | No | Yes |
| 2003-03-06 | Yes | No | 2012-06-06 | Yes | Yes |
| 2003-06-05 | Yes | No | 2012-07-05 | Yes | No |
| 2005-12-01 | Yes | No | 2012-08-02 | No | Yes |
| 2006-03-02 | Yes | No | 2012-09-06 | No | Yes |
| 2006-06-08 | Yes | No | 2012-12-06 | Yes | No |
| 2006-08-03 | Yes | No | 2013-05-02 | Yes | Yes |
| 2006-10-05 | Yes | No | 2013-11-07 | Yes | Yes |
| 2006-12-07 | Yes | No | 2014-04-03 | No | Yes |
| 2007-03-08 | Yes | No | 2014-06-05 | Yes | Yes |
| 2007-06-06 | Yes | No | 2014-07-03 | No | Yes |
| 2008-07-03 | Yes | No | 2014-09-04 | Yes | Yes |
| 2008-10-08 | Yes | No | 2014-10-02 | No | Yes |
| 2008-11-06 | Yes | No | 2015-01-22 | No | Yes |
| 2008-12-04 | Yes | No | 2015-09-03 | No | Yes |
| 2009-01-15 | Yes | No | 2015-12-03 | Yes | Yes |
| 2009-03-05 | Yes | No | 2016-03-10 | Yes | Yes |
| 2009-04-02 | Yes | No | 2016-12-08 | No | Yes |
| 2009-05-07 | Yes | Yes | 2017-01-19 | No | Yes |
| 2009-12-03 | Yes | Yes | 2017-10-26 | No | Yes |
| 2010-03-04 | Yes | Yes | 2018-06-14 | No | Yes |
| 2010-12-02 | Yes | Yes | 2019-03-07 | No | Yes |
| 2011-03-03 | Yes | Yes | 2019-06-06 | No | Yes |
| 2011-04-07 | Yes | No | 2019-09-12 | Yes | Yes |
| 2011-06-09 | Yes | Yes | 2020-03-12 | No | Yes |
| 2011-07-07 | Yes | No | 2020-04-30 | No | Yes |
| 2011-08-04 | Yes | Yes | 2020-06-04 | No | Yes |
| 2011-10-06 | Yes | Yes | 2020-12-10 | No | Yes |
| 2011-11-03 | Yes | No | 2021-07-22 | No | Yes |
| 2011-12-08 | Yes | Yes | 2021-12-16 | No | Yes |

Table A6: **Leaks and subsequent policy changes**

This table presents coefficient estimates for the following logistic regression model: logit $P(D_t^{change} = 1) = \tau_i^{year} + \beta N_t^{leak} + \gamma N_t^{attr} + \delta D_t^{projections} + \varepsilon_t$ . Average marginal effects are indicated in square brackets. The dependent variable in all columns is a dummy variable that takes a value of one whenever an ECB monetary policy meeting resulted in a policy change. Explanatory variables include the number of leaks prior to the policy meeting, the release of new macroeconomic projections at the policy announcement and the number of attributable statements before the monetary policy meeting. All estimations include year-fixed effects. The sample period ranges from January 2002 to December 2021. Compared to Table 1, the logistic regression drops 12 observations corresponding to one year without variation in the dependent variable on the year-level (i.e. no policy change). Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variable: | Policy change (yes/no) | | |
|---|---|---|---|
| Model: | (1) | (2) | (3) |
| *Variables* | | | |
| Pre-meeting leaks count | 0.3371** | 0.2962** | 0.2524* |
| | (0.1395) | (0.1402) | (0.1425) |
| | [0.0596] | [0.0486] | [0.0408] |
| Macroeconomic projections | | 1.298*** | 1.389*** |
| | | (0.3806) | (0.4023) |
| | | [0.2274] | [0.2391] |
| Pre-meeting attributable count | | | 0.0219 |
| | | | (0.0148) |
| | | | [0.0035] |
| *Fixed-effects* | | | |
| Year | Yes | Yes | Yes |
| *Fit statistics* | | | |
| Observations | 201 | 201 | 201 |
| Squared Correlation | 0.1530 | 0.2083 | 0.2233 |
| Pseudo $R^2$ | 0.1311 | 0.1854 | 0.1971 |

Table A7: **High-frequency market reactions to leaks and placebo events over the policy meeting cycle**

This table presents linear regression estimates of the marginal impact for three types of leaks on the size of movements in overnight index swap (OIS) rates and the EURO STOXX 50 over a given event window. The dependent variable in all regressions is the absolute change in an OIS rate or the stock index return, $|\Delta y_{-5,+30}|$ (in basis points), over an event window starting 5 minutes before the release of the respective news report and ending 30 minutes after the release. Changes in interest rates or stock index returns are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. For each regression, market reactions to actual leaks are combined with reactions to 5,000 randomly sampled placebo events. The sampling procedure for the placebo event windows is explained in Appendix D. The *Leak* dummy distinguishes between leaks and placebo events. The regression model is estimated without intercept. Instead, for each observation, precisely one of the three dummy variables *Far from meeting*, *Quiet period* or *Post meeting* takes a value of one to control for the timing of the event relative to monetary policy meetings. The coefficient estimate for each of these dummy variables can be interpreted as the average absolute market reaction to placebo events in the respective period. The interactions with the *Leak* dummy estimate the marginal increase in market movements for actual leaks relative to placebo events during the respective period. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | \|Δ1M\| | \|Δ3M\| | \|Δ6M\| | \|Δ1Y\| | \|Δ2Y\| | \|Δ5Y\| | \|Δ10Y\| | \|ΔSTOXX\| |
|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Variables* | | | | | | | | |
| Far from meeting | 0.2177*** | 0.2412*** | 0.2351*** | 0.3082*** | 0.4202*** | 0.4096*** | 0.5276*** | 19.38*** |
| | (0.0099) | (0.0065) | (0.0055) | (0.0072) | (0.0098) | (0.0092) | (0.0095) | (0.4003) |
| Quiet period | 0.2575*** | 0.2577*** | 0.2631*** | 0.3157*** | 0.4221*** | 0.4227*** | 0.5621*** | 18.95*** |
| | (0.0174) | (0.0136) | (0.0134) | (0.0122) | (0.0148) | (0.0131) | (0.0174) | (0.6310) |
| Post meeting | 0.2156*** | 0.2208*** | 0.2347*** | 0.3372*** | 0.4782*** | 0.5106*** | 0.6476*** | 21.55*** |
| | (0.0165) | (0.0144) | (0.0174) | (0.0213) | (0.0302) | (0.0363) | (0.0387) | (1.384) |
| Far from meeting × Leak | 0.1318*** | 0.1443*** | 0.2677*** | 0.4003*** | 0.4065*** | 0.2249*** | 0.1814*** | 2.200 |
| | (0.0498) | (0.0481) | (0.0563) | (0.0824) | (0.0915) | (0.0733) | (0.0674) | (1.985) |
| Quiet period × Leak | 0.1220 | 0.1241** | 0.0984* | 0.1945*** | 0.2943*** | 0.1429** | 0.1804* | 8.930*** |
| | (0.0845) | (0.0578) | (0.0545) | (0.0633) | (0.0838) | (0.0694) | (0.0951) | (3.062) |
| Post meeting × Leak | 0.2599 | 0.2188* | 0.0535 | 0.0683 | 0.3828 | 0.4399** | 0.4230** | 4.537 |
| | (0.1722) | (0.1187) | (0.0852) | (0.1498) | (0.2891) | (0.2073) | (0.2037) | (5.752) |
| *Fit statistics* | | | | | | | | |
| Observations | 5,212 | 5,255 | 5,279 | 5,289 | 5,292 | 5,166 | 5,166 | 5,290 |
| $R^2$ | 0.0034 | 0.0064 | 0.0150 | 0.0241 | 0.0194 | 0.0096 | 0.0087 | 0.0037 |
| Adjusted $R^2$ | 0.0025 | 0.0055 | 0.0141 | 0.0232 | 0.0184 | 0.0087 | 0.0077 | 0.0027 |

Table A8: **High-frequency market reactions to leaks vs. attributable communication (by GovC member group)**

This table presents linear regression estimates of the marginal impact for statements attributable to individual policy-makers relative to anonymous leaks. Market impacts are measured as the size of movements in overnight index swap (OIS) rates and the EURO STOXX 50 over a given event window. The dependent variable in all regressions is the absolute change in an OIS rate or the stock index return, $|\Delta y_{-5,+30}|$ (in basis points), over an event window starting 5 minutes before the release of the respective news report and ending 30 minutes after the release. Changes in interest rates or stock index returns are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. In all estimations, the baseline corresponds to anonymous leaks. Statements attributable to individual policy-makers are flagged by the dummy variables *President*, *Executive Board*, *Voting I* or *Voting II*, depending on the role of a policy-maker on the ECB Governing Council. Voting group I and voting group II differentiate between economically large and small countries in the euro area. The actual classification of countries (and their NCBs) into voting groups took effect in 2015, and is applied retroactively for the time prior to 2015. To account for differences in the distribution of leaks and attributable statements over time, all estimations include year, month, weekday and hour-of-day fixed effects. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | $|\Delta$1M$|$ | $|\Delta$3M$|$ | $|\Delta$6M$|$ | $|\Delta$1Y$|$ | $|\Delta$2Y$|$ | $|\Delta$5Y$|$ | $|\Delta$10Y$|$ | $|\Delta$STOXX$|$ |
|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Variables* | | | | | | | | |
| President | -0.1291*** | -0.1052*** | -0.0960** | -0.1727*** | -0.2115*** | -0.1559** | -0.2135*** | -5.222*** |
| | (0.0458) | (0.0387) | (0.0399) | (0.0534) | (0.0667) | (0.0648) | (0.0653) | (1.823) |
| Other Executive Board members | -0.1091** | -0.1204*** | -0.1315*** | -0.2185*** | -0.2453*** | -0.2136*** | -0.2029*** | -2.786 |
| | (0.0436) | (0.0353) | (0.0364) | (0.0493) | (0.0617) | (0.0537) | (0.0590) | (1.711) |
| Voting I | -0.1238*** | -0.1185*** | -0.1721*** | -0.2319*** | -0.2785*** | -0.2115*** | -0.1870*** | -4.484*** |
| | (0.0444) | (0.0364) | (0.0369) | (0.0548) | (0.0640) | (0.0547) | (0.0617) | (1.731) |
| Voting II | -0.1168*** | -0.0984*** | -0.1353*** | -0.2146*** | -0.2600*** | -0.1775*** | -0.1730*** | -3.874** |
| | (0.0436) | (0.0361) | (0.0366) | (0.0497) | (0.0624) | (0.0570) | (0.0602) | (1.706) |
| *Fixed-effects* | | | | | | | | |
| Year, Month, Weekday and Hour | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Fit statistics* | | | | | | | | |
| Observations | 3,724 | 4,695 | 5,228 | 5,442 | 5,487 | 2,253 | 2,273 | 5,115 |
| $R^2$ | 0.1444 | 0.0878 | 0.1263 | 0.1572 | 0.1820 | 0.1709 | 0.1374 | 0.1251 |
| Within $R^2$ | 0.0042 | 0.0036 | 0.0070 | 0.0052 | 0.0056 | 0.0091 | 0.0065 | 0.0026 |

Table A9: **High-frequency market reactions to leaks vs. attributable communication over the monetary policy cycle**

This table presents linear regression estimates of the marginal impact of statements attributable to individual policy-makers relative to leaks. Market impacts are measured as the size of movements in overnight index swap (OIS) rates and the EURO STOXX 50 during a given event window. The dependent variable in all regressions is the absolute change in an OIS rate or the stock index return, $|\Delta y_{-5,+30}|$ (in basis points), over an event window starting 5 minutes before the release of the respective news report and ending 30 minutes after the release. Changes in interest rates or stock index returns are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. For each observation, precisely one of the three dummy variables *Far from meeting*, *Quiet period* or *Post meeting* takes a value of one to control for the timing of the event relative to monetary policy meetings. In all estimations, the baseline corresponds to leaks falling into the post-meeting period, covering the four days after a monetary policy announcement. Statements attributable to individual policy-makers are flagged by the dummy variable *Attributable*. The interactions with the *Attributable* dummy estimate the marginal change in market movements for attributable events relative to placebo events during the respective period. To account for differences in the distribution of leaks and attributable statements over time, all estimations include year, month, weekday and hour-of-day fixed effects. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | $\|\Delta 1M\|$ | $\|\Delta 3M\|$ | $\|\Delta 6M\|$ | $\|\Delta 1Y\|$ | $\|\Delta 2Y\|$ | $\|\Delta 5Y\|$ | $\|\Delta 10Y\|$ | $\|\Delta STOXX\|$ |
|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Variables* | | | | | | | | |
| Far from meeting | -0.0733 | -0.0267 | 0.1672* | 0.2089 | -0.1106 | -0.2127 | -0.2700 | -2.760 |
| | (0.1864) | (0.1274) | (0.0900) | (0.1348) | (0.2688) | (0.1862) | (0.2050) | (6.336) |
| Quiet period | -0.0795 | -0.0708 | -0.0122 | -0.0717 | -0.3473 | -0.2969 | -0.2638 | 0.6373 |
| | (0.1958) | (0.1302) | (0.0892) | (0.1263) | (0.2678) | (0.1864) | (0.2114) | (6.622) |
| Far from meeting × attributable | -0.1173*** | -0.1297*** | -0.2241*** | -0.3445*** | -0.3373*** | -0.2088*** | -0.1669** | -2.157 |
| | (0.0442) | (0.0457) | (0.0525) | (0.0757) | (0.0835) | (0.0676) | (0.0681) | (1.953) |
| Quiet period × attributable | -0.0710 | -0.0978 | -0.0536 | -0.0897 | -0.1607* | -0.0693 | -0.1777* | -7.784*** |
| | (0.0853) | (0.0600) | (0.0559) | (0.0648) | (0.0858) | (0.0896) | (0.1054) | (2.979) |
| Post meeting × attributable | -0.1826 | -0.1193 | -0.0179 | -0.0801 | -0.3790 | -0.2945* | -0.3399* | -5.230 |
| | (0.1793) | (0.1197) | (0.0752) | (0.1151) | (0.2590) | (0.1771) | (0.1987) | (6.091) |
| *Fixed-effects* | | | | | | | | |
| Year, Month, Weekday and Hour | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Fit statistics* | | | | | | | | |
| Observations | 3,724 | 4,695 | 5,228 | 5,442 | 5,487 | 2,253 | 2,273 | 5,115 |
| $R^2$ | 0.1449 | 0.0882 | 0.1266 | 0.1590 | 0.1837 | 0.1746 | 0.1398 | 0.1249 |
| Within $R^2$ | 0.0048 | 0.0040 | 0.0074 | 0.0074 | 0.0076 | 0.0135 | 0.0093 | 0.0024 |

Table A10: **Market reactions to policy rate leaks and pre-trends in market expectations**

This table presents linear regression estimates for the model in equation (5), but focuses on the sub-sample of leaks related to policy rates. The dependent variable in all regressions is the change in an OIS rate, $\Delta y_{-5,+30}$ (in basis points), over an event window starting 5 minutes before the release of a news report on a monetary policy leak and ending 30 minutes after the release. Changes in interest rates are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. For every maturity, observations related to actual leaks are combined with 5,000 randomly sampled placebo events. The variable *Trend* measures the prevailing market trend in the run-up to a respective leak, computed as the yield change over the preceding seven days until directly before the 30-minute event window. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | Δ 1M | Δ 3M | Δ 6M | Δ 1Y | Δ 2Y | Δ 5Y | Δ 10Y |
|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| *Variables* | | | | | | | |
| Intercept | -0.0072 | -0.0140** | -0.0067 | -0.0055 | -0.0115 | -0.0116 | -0.0123 |
| | (0.0093) | (0.0067) | (0.0060) | (0.0069) | (0.0094) | (0.0098) | (0.0112) |
| Trend | -0.0120 | -0.0160*** | -0.0042 | -0.0012 | 0.0006 | 0.0021 | 0.0026 |
| | (0.0081) | (0.0057) | (0.0040) | (0.0037) | (0.0032) | (0.0038) | (0.0027) |
| Leak | 0.0617 | 0.0042 | 0.0646 | 0.1271 | 0.0505 | -0.1578 | -0.1002 |
| | (0.0684) | (0.0670) | (0.0722) | (0.1099) | (0.1335) | (0.2380) | (0.1564) |
| Trend × Leak | -0.0737** | -0.0500* | -0.0325* | 0.0037 | 0.0131 | -0.0131 | 0.0016 |
| | (0.0337) | (0.0264) | (0.0183) | (0.0221) | (0.0182) | (0.0582) | (0.0254) |
| *Fit statistics* | | | | | | | |
| Observations | 5,095 | 5,119 | 5,130 | 5,137 | 5,138 | 5,049 | 5,050 |
| $R^2$ | 0.0144 | 0.0170 | 0.0063 | 0.0015 | 0.0007 | 0.0007 | 0.0007 |
| Adjusted $R^2$ | 0.0139 | 0.0165 | 0.0057 | 0.0009 | 0.0002 | 0.0001 | $7.11 \times 10^{-5}$ |

Table A11: **Market reactions to UMP leaks and pre-trends in market expectations**

This table presents linear regression estimates for the model in equation (5), but focuses on the sub-sample of leaks related to unconventional monetary policy. The dependent variable in all regressions is the change in an OIS rate, $\Delta y_{-5,+30}$ (in basis points), over an event window starting 5 minutes before the release of a news report on a monetary policy leak and ending 30 minutes after the release. Changes in interest rates are calculated as the change between the median observation during the 10 minutes before the event window and the median quote during the 10 minutes after the event window. For every maturity, observations related to actual leaks are combined with 5,000 randomly sampled placebo events. The variable *Trend* measures the prevailing market trend in the run-up to a respective leak, computed as the yield change over the preceding seven days until directly before the 30-minute event window. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | Δ 1M | Δ 3M | Δ 6M | Δ 1Y | Δ 2Y | Δ 5Y | Δ 10Y |
|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| *Variables* | | | | | | | |
| Intercept | -0.0072 | -0.0140** | -0.0067 | -0.0055 | -0.0115 | -0.0116 | -0.0123 |
| | (0.0093) | (0.0067) | (0.0060) | (0.0069) | (0.0094) | (0.0098) | (0.0112) |
| Trend | -0.0120 | -0.0160*** | -0.0042 | -0.0012 | 0.0006 | 0.0021 | 0.0026 |
| | (0.0081) | (0.0057) | (0.0040) | (0.0037) | (0.0032) | (0.0038) | (0.0027) |
| Leak | 0.0522 | 0.0010 | 0.0115 | -0.0341 | -0.0989 | 0.0471 | 0.1387 |
| | (0.0442) | (0.0411) | (0.0536) | (0.0598) | (0.0794) | (0.1080) | (0.1037) |
| Trend × Leak | 0.0052 | 0.0136 | -0.0019 | -0.0296 | -0.0398** | 0.0013 | 0.0213 |
| | (0.0216) | (0.0142) | (0.0221) | (0.0218) | (0.0161) | (0.0348) | (0.0188) |
| *Fit statistics* | | | | | | | |
| Observations | 5,099 | 5,112 | 5,120 | 5,124 | 5,124 | 5,107 | 5,108 |
| $R^2$ | 0.0043 | 0.0091 | 0.0011 | 0.0014 | 0.0019 | 0.0003 | 0.0016 |
| Adjusted $R^2$ | 0.0037 | 0.0085 | 0.0005 | 0.0008 | 0.0013 | -0.0003 | 0.0010 |

Table A12: **Post-meeting leaks and the effectiveness of the ECB's policy communication (unpredictable component of leaks and attributable communication)**

This table presents coefficient estimates for the regression model in equation (8), but considers only the "unpredictable" part of post-policy announcement leaks in the spirit of Tillmann (2021). The dependent variable is the high-frequency change in an OIS interest rate on policy announcement days, measured from directly before the start of the official ECB policy announcement until the end of trading hours. Δ *2Y decision* is the high-frequency response in the 2Y OIS rate to the monetary policy announcement, i.e. the change from the median quote during the 13:25-13:35 CET window (before the press release) to the median quote during the 15:40-15:50 CET window (after the press conference). *Post-meeting leak* is the residual from a first-stage logistic regression model (unreported). The logistic model regresses a dummy variable that takes a value of one if there is at least one leak between the end of the monetary policy announcement window and the end of trading hours on the announcement day on a set of potential predictors. These predictors include the dissent index of Tillmann (2021), an indicator variable for policy change at the policy meeting, the number of pre-meeting leaks, the number of pre-meeting attributable statements as well as an indicator variable for the release of new macroeconomic projections. *Post-meeting attributable* is defined in the same way, but for statements attributable to individual policy-makers. Heteroskedasticity-robust standard-errors in parentheses. Significance codes: ***: 0.01, **: 0.05, *: 0.1

| Dependent Variables: | | Δ 2Y day end | | | Δ 5Y day end | | | Δ 10Y day end | |
|---|---|---|---|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| *Variables* | | | | | | | | | |
| Intercept | 0.0662 | 0.0483 | 0.0510 | -0.3864* | -0.4700** | -0.4501** | -0.2491 | -0.3678 | -0.3178 |
| | (0.1363) | (0.1346) | (0.1373) | (0.1999) | (0.1913) | (0.1774) | (0.2761) | (0.2674) | (0.2571) |
| Δ 2Y decision | 1.163*** | 1.169*** | 1.169*** | 1.082*** | 1.177*** | 1.171*** | 0.7734*** | 0.9011*** | 0.8925*** |
| | (0.0394) | (0.0393) | (0.0399) | (0.1045) | (0.0893) | (0.0717) | (0.1442) | (0.1233) | (0.0803) |
| Post-meeting leak | | -0.4870* | -0.4992* | | 0.5594** | 0.5624** | | 0.8609 | 0.8879 |
| | | (0.2496) | (0.2640) | | (0.2358) | (0.2817) | | (0.5672) | (0.6153) |
| Δ 2Y decision × Post-meeting leak | | -0.2057*** | -0.2090*** | | -0.3754*** | -0.3335*** | | -0.5002*** | -0.4190*** |
| | | (0.0462) | (0.0505) | | (0.0934) | (0.0882) | | (0.1350) | (0.0959) |
| Post-meeting attributable | | | -0.0166 | | | 0.0302 | | | 0.1303 |
| | | | (0.1061) | | | (0.3093) | | | (0.4702) |
| Δ 2Y decision × Post-meeting attributable | | | -0.0112 | | | 0.1344 | | | 0.2680** |
| | | | (0.0268) | | | (0.0927) | | | (0.1257) |
| *Fit statistics* | | | | | | | | | |
| Observations | 213 | 213 | 213 | 95 | 95 | 95 | 98 | 98 | 98 |
| $R^2$ | 0.8763 | 0.8780 | 0.8780 | 0.7881 | 0.8123 | 0.8169 | 0.4882 | 0.5414 | 0.5645 |
| Adjusted $R^2$ | 0.8758 | 0.8762 | 0.8751 | 0.7858 | 0.8061 | 0.8066 | 0.4829 | 0.5268 | 0.5408 |

# F Additional figures

Figure A1: **Time trends in leaks (normalized results)**

This figure plots the annual counts of all Eurosystem leaks related to the topics "policy rates", "UMP", "economic growth", "inflation" and "euro exchange rate". The left panel normalizes yearly leaks by the number of ECB Governing Council members. The right panel normalizes yearly leaks by the number of Governing Council member-policy meeting combinations. The number of ECB policy meetings per year is 12 before 2015, and 8 since.

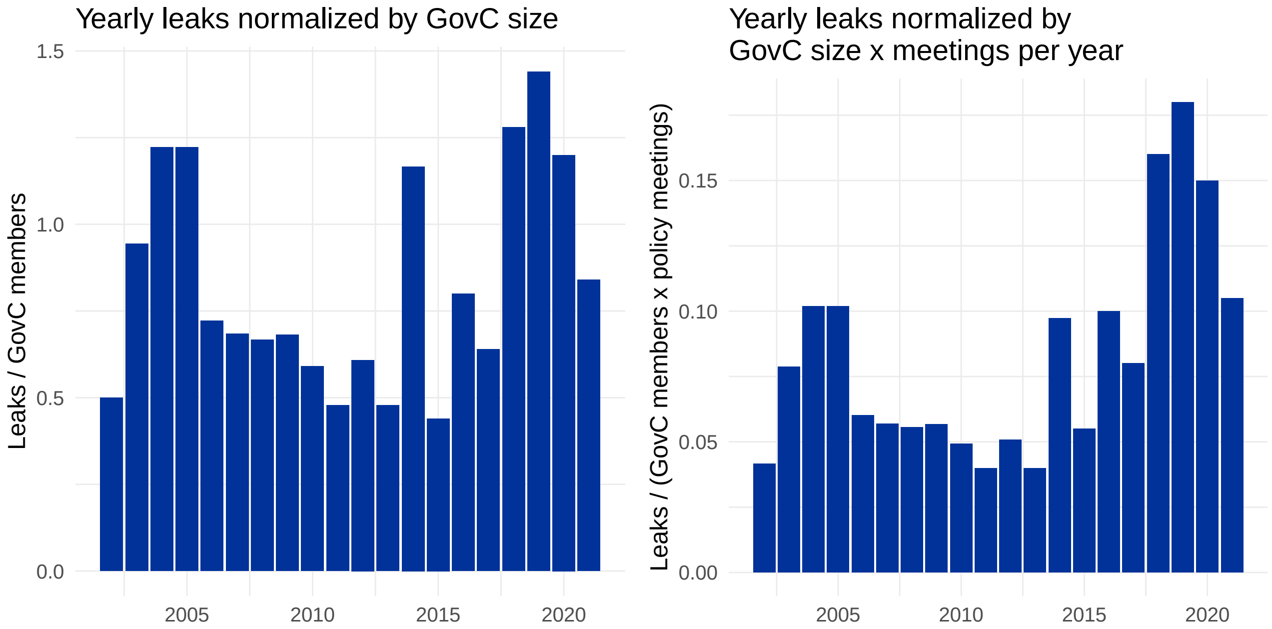


Figure A2: **Distribution of leaks around policy meetings by topic**

This figure plots the distribution of leaks around policy meetings for three types of leaks – leaks related policy rates, unconventional policy tools (UMP) and economic conditions. The latter category comprises leaks about economic growth, inflation and the euro exchange rate. The vertical axis measures the distance to the policy meeting in calendar days. On the policy announcement day, a leak is classified as 'before meeting' if it occurs before the ECB's press release (13:45 CET) and as 'after meeting' otherwise. The area shaded in gray indicates the ECB's monetary policy quiet period.

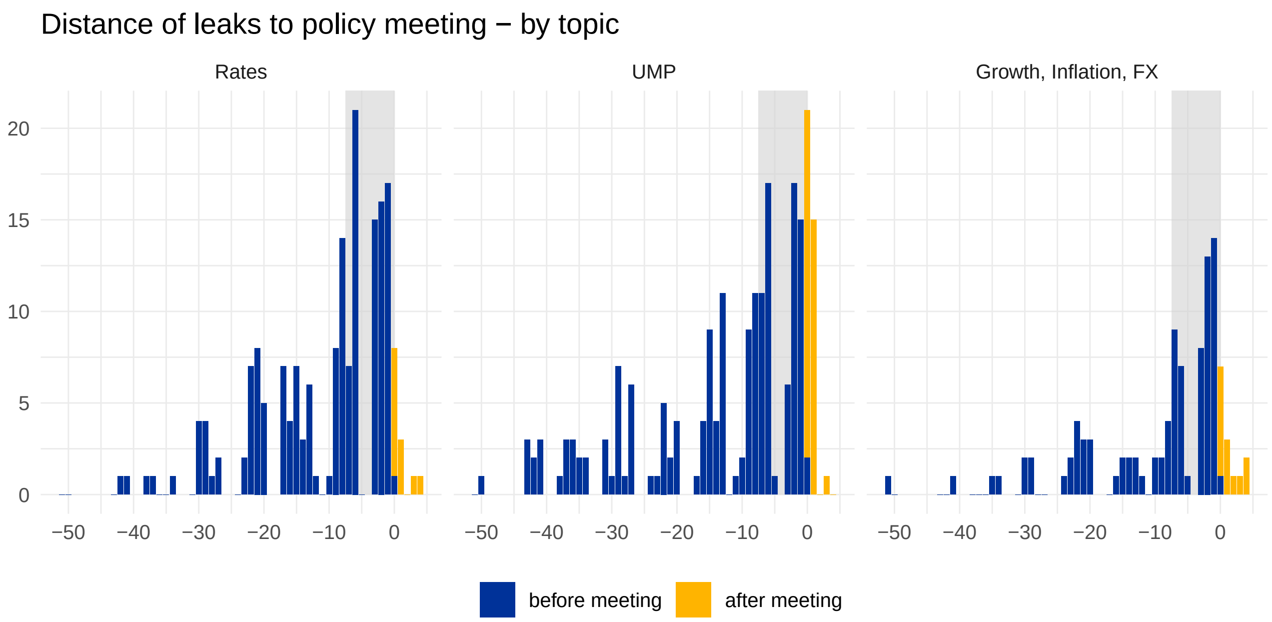

Figure A3: **Attributable communication events around leaks**

This figure shows the distribution of statements attributable to individual policy-makers in 36-hour windows around anonymous leaks, aggregated across all leaks in our sample. The figure distinguishes three different sub-periods of the monetary policy meeting cycle: a period far away from both the previous and the next policy meeting, the quiet period (covering the seven days before policy decisions) and a post-meeting period from the announcement of the monetary policy decision on Thursdays up to and including the Monday after. Both attributable communication and leaks refer to monetary policy-relevant topics, i.e. to one of the topics "policy rates", "UMP", "economic growth", "inflation" or "euro exchange rate". The data covers the period January 2002 until December 2021.