The ECB and the inflation monsters: strategic framing and the responsibility imperative (1998-2023)

Aurélien Goutsmedt, Clément Fontan

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Aurélien Goutsmedt[1] and Clément Fontan[2]

Aurélien Goutsmedt,

3 place Montesquieu,

1348, Louvain-la-Neuve,

Belgium

Aurelien.goutsmedt@uclouvain.be (corresponding author)

Clément Fontan,

3 place Montesquieu,

1348, Louvain-la-Neuve,

Belgium

Clement.fontan@uclouvain.be

Clément Fontan is Professor in European Economic Policies at UC Louvain.

Aurélien Goutsmedt is a F.R.S-FNRS post-doctoral researcher at UC Louvain.

[1] *F.R.S.-FNRS ; ISPOLE, UcLouvain, Louvain-la-Neuve, Belgium.*

[2] *ISPOLE & IEE, UcLouvain, Louvain-la-Neuve, Belgium.*

Abstract

The recent resurgence of inflation in Europe has led the ECB to increase interest rates and phase out asset purchase programs designed to address the effects of the Great Financial Crisis. This article investigates how the ECB adjusts its logic of responsibility throughout this series of crises. Using a topic model and in-depth analysis of speeches, we examine the ECB's strategic framing of linkages related to inflation during three historical periods: the Central Bank Independence (CBI) era (1998-2011), the secular stagnation era (2011-2021), and the new inflation era (2021-). Our findings indicate that modifications made to the CBI's linkages during the secular stagnation era shaped the ECB's framing of the new inflation era in a novel way. However, despite acknowledging difficult policy tradeoffs, which they used to downplay in the past, ECB policymakers have continued to reframe its initial imperative of responsibility in the hope of avoiding policy discussions on regime change.

Keywords: European Central Bank; Inflation; Responsibility; Topic Modeling; Framing

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1. Introduction

In June 2010, the European Central Bank (ECB) released a short pedagogical video and leaflets featuring two dreaming teenagers who travel back in time to a setting resembling the Weimar Republic.[3] There, they confront a blue inflation monster that is about to wreck the economy by unleashing banknotes falling from the sky. At that moment, the teenagers wake up from this nightmare and visit the ECB, where they learn that the inflation monster has been downsized and encapsulated by independent central bankers whose main responsibility is to ensure price stability.

Thirteen years later, Christine Lagarde, the ECB president, stated in an interview that the ECB must do more to tackle 'the inflation monster' (Arnold 2023). Since mid-2021, several factors, including demands for ecological transition, disruptions in global supply chains, and, later on, the Russian invasion of Ukraine, have significantly altered economic dynamics and driven

[3] https://www.ecb.europa.eu/ecb/educational/pricestab/html/index.en.html

prices up by more than 10%. This sharp rise in inflation compelled the ECB to increase interest rates for the first time in a decade and to announce the winding down of asset purchase programs that were designed to address the effects of the 2007-2009 Great Financial Crisis and its aftermath.

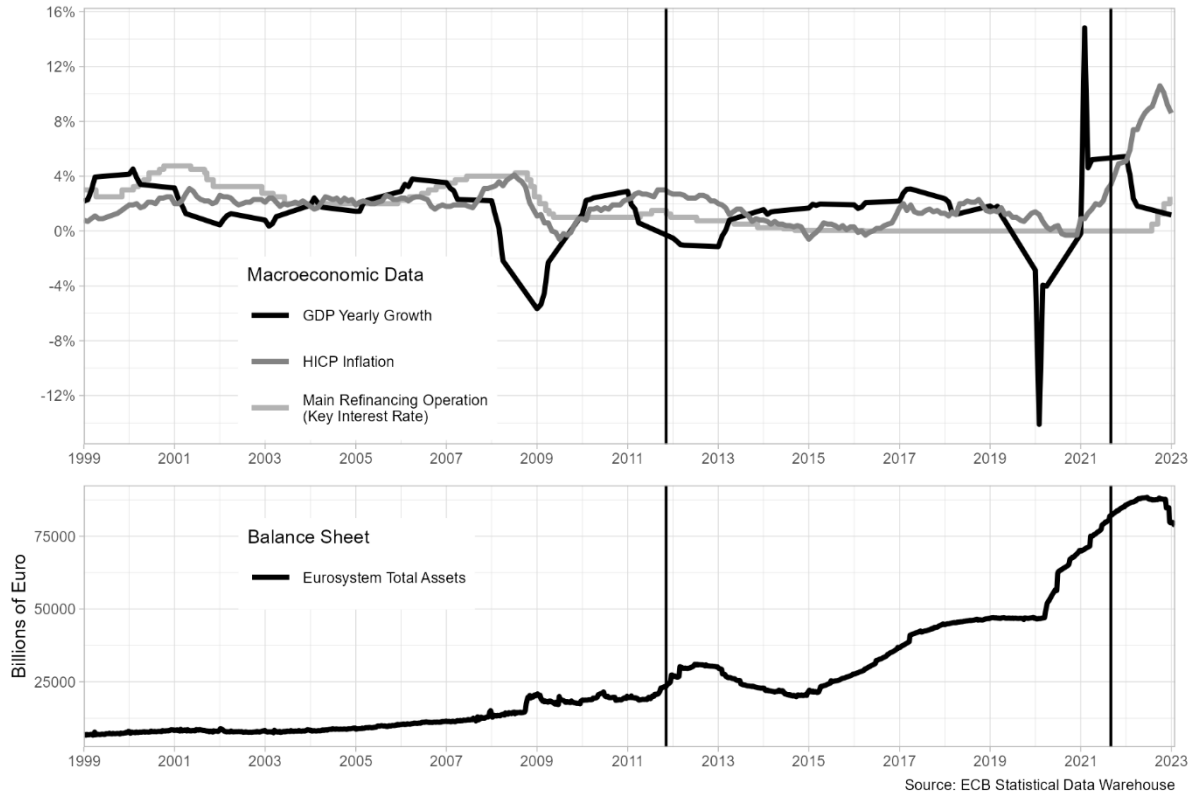
In line with the theme of this special issue, this sequence of crises provides insights into how an independent institution, in this case the ECB, adapts the logic of responsibility that underpins its legitimacy in difficult times (Mair 2013; Crespy et al., Introduction, this issue). The ECB is a paradigmatic case of a technocratic institution bound by a logic of responsibility, that is largely exempt from the norms of liberal democratic politics (van't Klooster 2018; Best 2018). Its high level of independence from political authorities is partly motivated by popular economic ideas, such as the 'Central Bank Independence template' (CBI; Dietsch et al. 2018), which influenced the negotiations on the ECB statute during the late 1980s and early 1990s.

Supporters of the CBI template argue that providing central banks with a high level of independence while limiting their objectives to price stability is an optimal institutional arrangement (Issing et al. 2001). One of the dominant macroeconomic explanations of inflation that remains today is that central banks' responsiveness to other economic objectives is inflationary: attempts to address issues such as unemployment, poverty, or financial stability would put price stability at risk. The CBI template indicates that there are no tradeoffs between different monetary policy objectives (such as growth support and inflation control) as any goal other than price stability is unattainable for central bankers in the middle and long term. In other words, the CBI template assigns central banks the role of 'guardian' against democratic demands whereby they limit the capacities of national governments by reducing the range of policy instruments, and thus, their capacity of responsiveness towards their electorates (Mair 2013, 115). The ECB's mandate prioritises the logic of responsibility over responsiveness, with price stability being its overarching objective, and support for other EU economic policies shall be provided only without prejudice to this objective.[4]

Nevertheless, since the Great Financial Crisis, the ECB has faced numerous policy challenges that extend beyond its traditional logic of responsibility and its primary goal of ensuring price stability. These challenges include dealing with financial instability, addressing weak economic growth, and more recently, confronting the climate crisis. The expansion of the ECB's balance sheet, as depicted in Figure 1, reflects this broadened role. In the context of 'secular stagnation' that characterised the decade following the crisis, the hierarchy between the different monetary policy objectives became less clear. In response, the ECB has adopted several framing strategies to connect the new tradeoffs it confronts with the CBI imperative of responsibility. However, with the resurgence of inflation since mid-2021, the question remains: has the ECB reverted to its initial framing of the principle of responsibility, or has it incorporated the changes from the secular stagnation era? In other words, is the ECB framing its approach to tackling inflation today in the same manner as it did in its 2010 cartoon?

[4] Treaty on the Function of the EU (TFEU), Article 127.

Figure 1: Evolution of the euro area macroeconomic environment and ECB policy (1999-2023)



We provide insights into the ECB's handling of its responsibility imperative during three historical sequences: the CBI template era (1998-2011), the secular stagnation era (2011-2021) and the new inflation era (2021-02/2023).

Existing research has analysed how the ECB has strategically framed the causes of the Great Financial Crisis and its monetary answer (Lombardi and Moschella 2016; Tesche 2019; Högenauer and Howarth 2016), its concerns for financial stability and macroprudential policies (Jones 2015; Schmidt 2016), or its efforts in greening the financial system (Deyris 2022; Tesche 2023). This strategic framing has allowed the ECB to reinterpret its mandate and other euro area rules to ensure greater legitimacy in policy performance, governance processes and citizens' politics (Jones 2009; Schmidt 2018). Similarly, concerned about how different audiences perceive its reputation, the ECB has intensified its communication to respond to growing contestation to its handling of the crisis (McPhilemy and Moschella 2019; Moschella, et al. 2020). These analyses share a similar finding: in their legitimation and reputational efforts, central bankers engage in strategic ambiguity whereby they obfuscate novel tradeoffs and try to subsume their new policies within the old set of justifications related to the CBI template (Johnson, et al. 2019; Van't Klooster and Fontan 2020; van't Klooster 2022a).

Our article contributes to this literature in three distinct ways. First, our analysis is the first to systematically track the ECB framing efforts on price stability, its primary economic objective that underpins its imperative of responsibility, since its creation in 1999. This enables us to

provide deeper insights into ECB framing strategies for each era and to identify the emergence and decline of specific frames. Second, our analysis of how the ECB addresses monetary policy tradeoffs in different eras allows us to connect various threads within the literature. For example, we expose how the integration of objectives such as supporting economic growth and ensuring financial stability during the secular stagnation era paved the way for recognising tradeoffs between price stability and climate objectives in the new inflation era. Third, we offer original insights into the new inflation era, which, given its recent emergence, calls for scrutiny. We observe that the ECB is now explicitly acknowledging the challenging policy tradeoffs it faces, even though it does not go as far as to question the CBI template.

Regarding the concept of strategic framing, we propose a heuristic distinction between internal and external ideational linkages. On one hand, the ECB employs different frames related to inflation to adjust its logic of responsibility in response to changing macroeconomic conditions. In doing so, the ECB can address new monetary policy tradeoffs, such as stimulating lacklustre growth during times of financial instability, all while maintaining its adherence to the CBI template. We refer to this as an 'internal linkage'. On the other hand, the ECB also employs different frames to assign responsibility for inflation to other players, such as fiscal policy or wage negotiation schemes. We refer to this as an 'external linkage'.

Our methodology relies on a combination of quantitative and qualitative approaches. To start with, we construct a corpus consisting of ECB speeches that are significantly relevant to inflation. Then, we run a topic model that identifies the different topics tackled in each speech of our corpus for two purposes. First, we compare the prevalence of different topics across the three different eras. Second, we measure the correlation between topics strictly related to inflation and price stability with other topics such as climate change, structural reforms, or financial stability. This allows us to identify how the ECB puts forward different linkages to adapt its responsibility imperative over time. Finally, we rely on the categorisation produced by our topic model to detect and read the most representative speeches for relevant topics.

2. From inflation-nutters to growth enhancers and back again: the ambiguous ECB framing of inflation

The CBI era

The 'CBI era' started in 1998, when the ECB began to operate and ended in November 2011, when the ECB stopped its interest rates hikes against risks of financial implosion and deflation. As the 2010 cartoon on the inflation monster shows, the main priority of the ECB during this era was to build its anti-inflationary credibility (Howarth and Loedel 2005; Braun, et al. 2022). This priority was in line with the imperative of responsibility associated with the CBI template, which has ideational roots dating back to the late 1970s. Monetary policies face a time inconsistency problem: if policymakers can reverse their previous commitments, economic agents anticipate inflation surprises and push prices higher, for example when negotiating

wages (Kydland and Prescott 1977; Barro and Gordon 1983). Against this issue, there are two ways to make central banks credible enough in their anti-inflationary commitments. First, central banks should adhere to strict institutional rules that limit potential policy tradeoffs with other goals than price stability and thereby restrict discretionary decision-making. Second, central banks should build an anti-inflationary reputation to 'anchor' expectations about future inflation (Drazen 2002). These macroeconomic theories gained traction in the EU in the early and mid-1990s (Goutsmedt and Truc 2023) when European policymakers were trying to find an agreement on the institutional design of the ECB (Verdun 1999; McNamara 2002). The influence of the CBI template was conducive to the ECB's high level of independence and the prioritisation of price stability over other macroeconomic objectives.

Another important factor in the design of the ECB was the influence of the Bundesbank, which was the most powerful central bank in Europe in the postwar era (Marsh 1992). While the Bundesbank was, in fact, heavily coordinating with social partners and governments to keep prices stable, it was nevertheless perceived as the most independent central bank in Europe with the best track record in terms of inflation control (Hall and Franzese 1998; Berger and De Haan 1999). This 'myth' of the Bundesbank independence as the main cause of the low inflation levels in Germany (Sturm 1995) was actively promoted by Otmar Issing, a former top Bundesbank policymaker and the first chief economist of the ECB. In particular, he insisted that the most important task for the ECB in its early years was to promote its anti-inflationary credibility, which had 'to be built over time by establishing a reputation' (Issing et al. 2001, 38).

Our contribution to this literature is to explore how these concerns about credibility and reputation were conducive to the framing of inflation and price stability. We expect that the combination of the CBI template and the Bundesbank influence led to an internal linkage whereby the ECB prioritised price stability over other potential objectives such as growth, unemployment, and financial stability. This would enable the ECB to demonstrate its alertness and commitment to maintaining low inflation, thereby hoping to 'anchor' the inflation expectations of market operators and gain their confidence in achieving the inflation target. In particular, we expect that the ECB's decision to raise interest rates between April and July 2011, despite the risks of economic recession and financial instability at the time, was justified with CBI frames (Gabor 2014; van't Klooster 2022b).

Finally, existing research has indicated that the ECB placed significant emphasis on two external linkages during this era. First, it consistently advocated for the flexibilisation of labour markets, which aligns with the traditional role of central bankers as a safeguard against higher wage demands (Epstein 2005; Fontan 2018). It also addresses the governability challenges arising from the incomplete architecture of the euro area (Braun et al. 2022). Second, the ECB was a strong proponent of the Stability and Growth Pact, which aims to ensure fiscal discipline among Member States, and remained steadfast in its opposition to potential fiscal profligacy by member states (Howarth and Loedel 2005; Heipertz and Verdun 2010). ECB policymakers believed that this stance was crucial to establishing the institution's anti-inflationary credibility, as maintaining low debt levels would reduce the risk of fiscal dominance and, in turn, inflationary pressures.

The secular stagnation era

In November 2011, the ECB began to alter its policy stance due to the potential threats to financial stability and growth potential. As a result, it decided to decrease its key interest rates, which remained near zero for over a decade, alongside inflation levels. Moreover, the ECB started to implement large asset purchase programs, which were designed to stabilise specific market segments and, later, to revive growth in the euro area (Gabor and Ban 2016). The ECB was also assigned new macro and micro-prudential objectives, raising concerns about potential tradeoffs between the objectives of price stability and financial stability. Against this background, we expect the ECB to revise the internal linkages of the CBI template, resulting in a shift towards granting more autonomy to other objectives, such as financial stability and supporting growth, rather than subordinating them to price stability (Johnson et al. 2019).

Despite the ECB's unprecedented monetary expansion, inflation and growth rates remained low in the euro area until 2021. This gave rise to a debate over whether the European Union was experiencing a secular stagnation, characterised by structural forces that permanently hindered the return to substantial growth and higher inflation levels (Teulings and Baldwin 2014; Van Doorslaer and Vermeiren 2021). Following this ongoing discussion and persistent lacklustre growth in the EU throughout the decade, the ECB revised its monetary policy strategy in the summer of 2021.[5] The ECB adopted a 'symmetric 2% inflation target', meaning that it is equally undesirable for inflation to rise above or remain below the target. Furthermore, the ECB has introduced the principle of proportionality, which prioritises, among a set of instruments equally conducive to price stability, those that also assist in achieving its secondary objectives. This new strategy is not merely a technical adjustment to the evolving macroeconomic landscape; we anticipate that it signifies shifts in internal linkages. In fact, this revision should mark a significant departure from the Central Bank Independence (CBI) template, which precluded tradeoffs between price stability and other objectives, as well as from the 2011 'signalling' interest rate hike (Grunewald and van 't Klooster 2023).

In accordance with our expectations about this shift in internal linkages, we anticipate the ECB to adjust the external linkages related to price stability. During the CBI era, policymakers emphasised budget cuts and structural reforms aimed at increasing the flexibility of labour markets. This remained true during the first half of the 2010s when the ECB was playing a central role in the implementation of austerity policies in the euro area periphery (Fontan 2018). However, since 2015, the ECB's calls for structural reforms and budget cuts have started to vanish (Braun et al., 2022). In fact, one of the main lessons that the ECB should have learned between the 2007-2009 crisis and the Covid-19 crisis is that fast and substantial fiscal spending measures can ease its stabilisation burden without causing inflation, while more flexible labour markets can hinder wage growth and, consequently, economic growth (Ferrara 2019; Quaglia and Verdun 2023).

Finally, since 2018, the ECB has incorporated risks related to the climate catastrophe into its policy purview. This shift in focus can be attributed to various factors, including the advocacy

[5] https://www.ecb.europa.eu/home/search/review/html/index.en.html

efforts of think-tank-based 'field arbitrageurs' who have urged central banks to intervene against the risk of a carbon bubble (Quorning 2023), the engagement of small groups of insiders within national central banks who brought the issue to Frankfurt's headquarters (Siderius, 2022), as well as the strategic nominations of 'climate-friendly' board members by governments and pressure from NGOs (Deyris 2022). However, criticisms have been raised against the new climate objectives on the grounds that they might undermine the ECB's responsibility towards price stability. To address these concerns, in July 2021, the ECB presented an action plan that integrates climate change considerations into its monetary policy strategy.[6] Crucially, the action plan draws an internal linkage between the objective of price stability and climate change.

The new inflation era

In the summer of 2021, when the ECB unveiled its new monetary policy strategy and climate action plan, inflation started to rise again. A year later, it reached double-digit numbers for the first time since the 1970s. After deliberating on whether the inflation was temporary or permanent, the ECB ultimately concluded that it was permanent and raised interest rates. Additionally, it announced the phase-out of its asset purchases, starting in the summer of 2022.

This creates a dilemma for ECB policymakers. On the one hand, the resurgence of inflationary pressures should compel them to adhere to the imperative of responsibility developed during the CBI era. On the other hand, disregarding the new linkages that were forged during the secular stagnation era could be detrimental to their reputation and legitimacy.[7] As a result, we anticipate that the ECB approaches the new inflation era by incorporating linkages from both the CBI and secular stagnation era, without a clear indication of which ones ultimately prevail.

3. Methodology

We analyse the ECB framing strategies with a two-step approach: 1) a topic modelling approach that allows us to identify and measure the evolution of various themes in a corpus of 817 speeches, and 2) an in-depth reading of the speeches and excerpts of speeches that are the most representative of each topic. Our online appendix provides details on the two steps of our methodology.[8]

Topic modelling is an unsupervised machine learning method used to unveil latent themes (the *topics*) within a large corpus of text data. It measures the co-occurrence of words and expressions in the paragraphs of the speeches included in our corpus and is tasked with identifying *k* distinct topics.[9] It provides two measures. First, topic modelling assigns *k* values

[6] https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210708_1~f104919225.en.html

[7] Careful about their regulatory reputation, independent institutions favour discourse and policy stability and refrain from abrupt changes (Carpenter 2010).

[8] See https://zenodo.org/records/10043949.

[9] In our study, words and expressions mean unigrams (like "price"), bigrams ("price stability") and trigrams ("maintain price stability").

to each word or expression, indicating the strength of their association with the respective *k* topics. To understand the content of a given topic, we look at the words and expressions that have the highest values for that topic.[10] Second, each paragraph is given *k* values measuring the strength of its association with the *k* topics (i.e. each paragraph has one value per topic). Topic modelling is a 'mixed-membership' clustering method (Grimmer et al., 2022, 236): a document (here the speeches' paragraphs) does not exclusively belong to one category, but is rather associated with many categories to varying degrees of 'intensity'. This approach enhances human interpretability since a given paragraph is a mixture of various topics.[11] It enables us to observe how various topics coalesce together in paragraphs, an essential step in analysing the framing of inflation.

Existing research has employed topic modelling on ECB discourse in various ways. Some contributions applied topic modelling on datasets that include all ECB speeches to analyse the general structure of its communication and the emergence of novel topics (Johnson et al. 2019; Cross and Greene 2020; Moschella et al. 2020) or to isolate and trace the evolution of specific topics over time (Diessner and Lisi 2020). Topic modelling is also used to observe power struggles surrounding specific topics between the ECB and national central banks (Moschella and Diodati 2020) as well as to explore how the European Parliament holds the ECB accountable (Ferrara et al. 2022).[12]

In this article, we run a topic model and interpret its results to analyse the ECB's strategic framing efforts related to its core responsibility: maintaining inflation under control.[13] We follow three steps. First, we build a corpus of speeches from the Executive Council members that deal substantially with inflation from June 1998 to February 1st, 2023.[14] Second, we differentiate between two categories of topics: those about inflation and price stability—i.e. topics in which 'inflation' and 'price stability' are among the 5 expressions most associated with a topic—and the other topics. This simple distinction allows us to reveal the specific terminology used by ECB policymakers to discuss inflation-related issues over time ('expectations', 'inflationary risk', 'credibility', 'supply shocks', etc.), compared to other peripheral topics mentioned in the context of inflation. Third, we provide two measures: *(i)* the prevalence of each topic over time, allowing us to discern shifts or patterns in the ECB's

[10] For example, the words with the highest values associated with topic 14 are "price stability", "stability" "objective" and "maintain price stability". This indicates that topic 14 is about the ECB's objective of price stability.

[11] For instance, a paragraph may be strongly associated with *both* a topic on price stability and one on fiscal policy.

[12] Ferrara et al. (2022) do not look at ECB's public speeches but at European Parliament hearings of ECB presidents.

[13] Unsupervised method has been already used on different objects to identify frames: Klüver and Mahoney (2015) use K-means clustering method to attribute to different European interest groups' documents a cluster (consider as a "frame); Fligstein et al. (2017) use topic modeling to uncover various frames used by the Federal Open Market Committee to talk about monetary policy.

[14] We select ECB's speeches that display mentions of "inflation" a number of times at least twice the number of pages of the speech. We include in this calculation all the terms that are composed of the chain of characters "inflation", i.e. "disinflation, "inflationary", etc. See the online appendix ("2. Step 1: Creating the corpus") for further details on how we have tested different thresholds.

attention over time; *(ii)* we calculate similarity measures to detect which non-inflation topics exhibit greater similarity to the inflation topics over different periods.[15]

To run our topic model, we rely on a usual algorithm: the Latent Dirichlet Allocation (Blei et al. 2003). We tokenise our paragraphs in unique words, bigrams, and trigrams, remove stop words and rare words, and lemmatise the remaining words.[16] After assessing quantitatively and qualitatively different models, we decided to explore further a model with 120 topics.[17] We examine the words most associated with each topic to gain an initial understanding of the topics' content and we identify 14 topics that deal substantially with inflation and price stability (Table 1).

However, the examination of the 'top words' offers only a superficial understanding of a topic's content. In fact, topic modelling serves a dual purpose in the research process: accompanying the discovery process and measuring (Nelson 2020; Grimmer et al. 2022). In addition to the measures outlined above, topic modelling offers the advantage of a computational 'pre-reading' of our corpus, streamlining its complexity and providing systematic categories for structuring it. We use this categorisation to pinpoint the most significant and representative speeches and speech excerpts. We then conduct a thorough reading and analysis of this sample of speeches that characterise each topic.[18]

4. Empirical analysis

We analyse the ECB strategic framing of inflation for each era in three steps. First, we study the prevalence of the fourteen topics directly related to inflation and price stability in each era (Table 1). Second, we rank non-inflation topics according to their correlation with these inflation topics for each era (Table 2). Third, we read the speech excerpts that are the most representative of each topic identified during the two previous steps, for all eras.

The CBI era

The analysis of topic prevalence delivers a striking result: among the inflation topics, the five topics that are the most prevalent during the CBI era are the only five topics with 'price stability' in their top words (Figure 2; Table 1). Topics 14 and 40 are related to the internal linkages underlying the CBI template and topic 80 indicates how the ECB talked about the 2007 inflation

[15] The emergence of new topics in speeches do not necessarily indicate new framing strategies about inflation. For example, central bankers could mention fiscal issues in paragraphs that are unrelated to inflation. Similarity measures help us to monitor how the evolution of peripheral topics is linked to the evolution of framing strategies related to inflation. Table 2 lists the relevant topics with the highest correlation for each of our three periods. See online appendix ("4.2 Calculating similarities") for details on similarity measures.

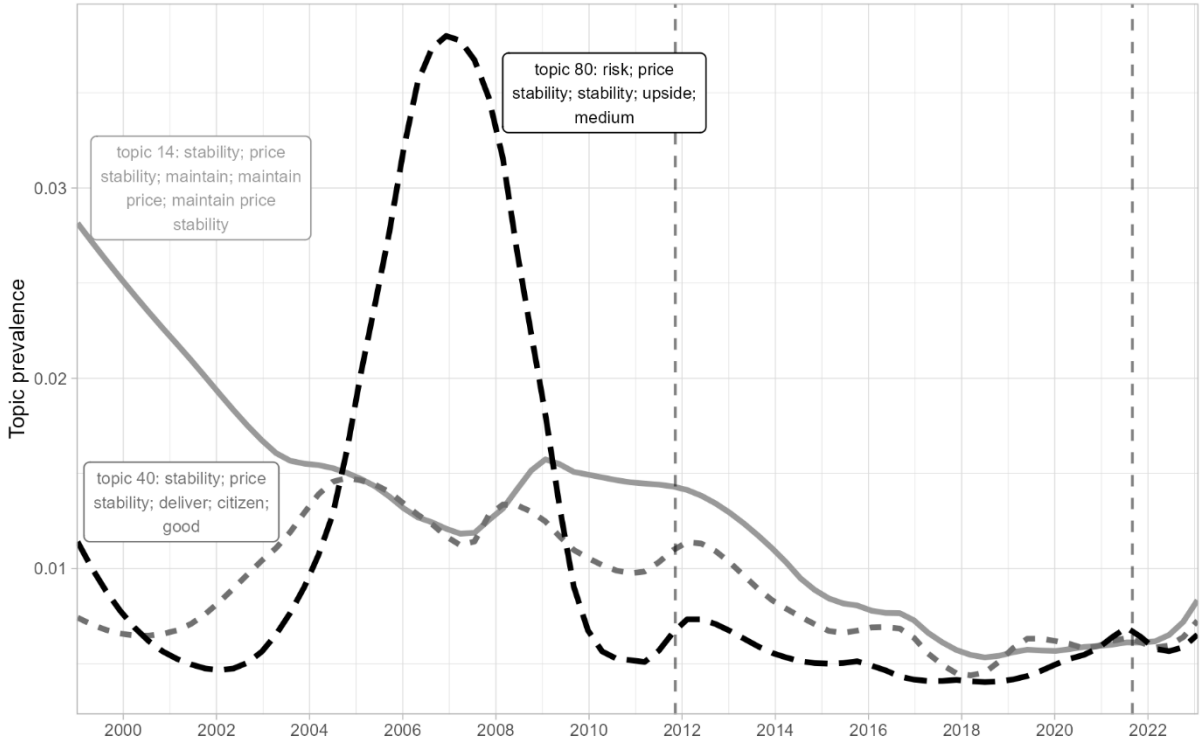
[16] The choice of pre-processing steps may be crucial for the results produced by a topic model (Denny and Spirling 2018). We discuss our choices at length in the Appendix (section "Step 2.b: Evaluating different models").

[17] See details about quantitative and qualitative validation in the online appendix ("Step 2.b").

[18] Online appendix ("5 Information on all the topics") lists all the topics, their top words, as well as the most representative speeches and paragraphs for each period.

surge.[19] The correlation of non-inflation topics with topics directly related to inflation also confirms our expectations for the CBI era as the two first topics refer to two expected external linkages: fiscal issues (topic 63) and structural reforms (Topic 16). In other words, when the ECB talked about inflation in this era, it essentially did so with the linkages associated with the CBI template.

Figure 2: Topics on price stability[20]



Speech excerpts from these topics outline the centrality of one internal linkage of the CBI era: the prioritisation of price stability as a necessary condition to achieve other macroeconomic objectives (Topic 14). For example, Jean-Claude Trichet, the second ECB president, underlines that:

> Price stability, and economic growth and employment, rather than being substitutes, are complements in a relationship which makes price stability a necessary condition for sustainable growth and job creation. (Trichet 2006, 2)

Jürgen Stark, the ECB chief economist from 2006 to 2011, detailed the theoretical underpinning of this prioritisation of price stability. In the midst of the worst financial crisis experienced since 1929, Stark was adamant that 'price stability is the best contribution we can make to financial

[19] Two other prevalent topics refer to technical specifications related to the CBI model: inflation targeting (topic 102) and the definition of medium term inflation (topic 49). See online appendix for details.

[20] For each date of publication of a speech, we average the strength of association between the paragraphs published at this date and the topics we are interested in. We thus obtain the prevalence of these topics over time. The figures with topics are built by estimating the relationship between dates and prevalence, using a local polynomial regression with a "span" value of 0.2. The result is a smoothed representation of the data allowing us to observe the overall trend of various topics. See the online appendix ('Step 3: Analysing the results') for further explanations.

stability' (Stark 2009, 10). He also quoted Kydland and Prescott's (1977) and Barro and Gordon's (1983) articles to underline that 'any blurring of responsibilities can potentially lead to a loss of credibility for the central bank' (Stark 2011, 2–3). These direct references to the theoretical foundations of the CBI template may appear at odds with the objective of financial stabilisation, which was the main policy priority for all central banks in advanced economies in 2011. However, they provide justifications for the rise in interest rates conducted by the ECB at that time.

In the same vein, ECB policymakers detail how the CBI template addresses the issue of time inconsistency by providing a framework that 'anchors' the confidence of economic operators in sustained low inflation in the future (Topic 40):

> The degree of confidence in all economic constituencies, (...) is a key factor to foster growth and job creation. A central bank is an anchor of confidence. We, in the ECB and in the eurosystem, are doing all what is necessary to preserve and consolidate confidence: confidence in our currency, confidence in our capacity to deliver price stability, confidence in the stability of our monetary and financial environment (Trichet 2004, 4).

When inflation surged in 2007, policymakers maintained their efforts to establish the ECB's anti-inflationary reputation (Topic 80). They stated they were monitoring potential inflationary factors, such as surging food and oil prices, while also accentuating the presence of 'more fundamental' factors at play. These included 'stronger than currently expected wage developments [that] would pose significant upward risks to price stability' (Trichet and Papademos 2007, 2). This insistence on wages resonates with the criticisms put forth by 1980s macroeconomic theories advocating for the CBI template.[21]

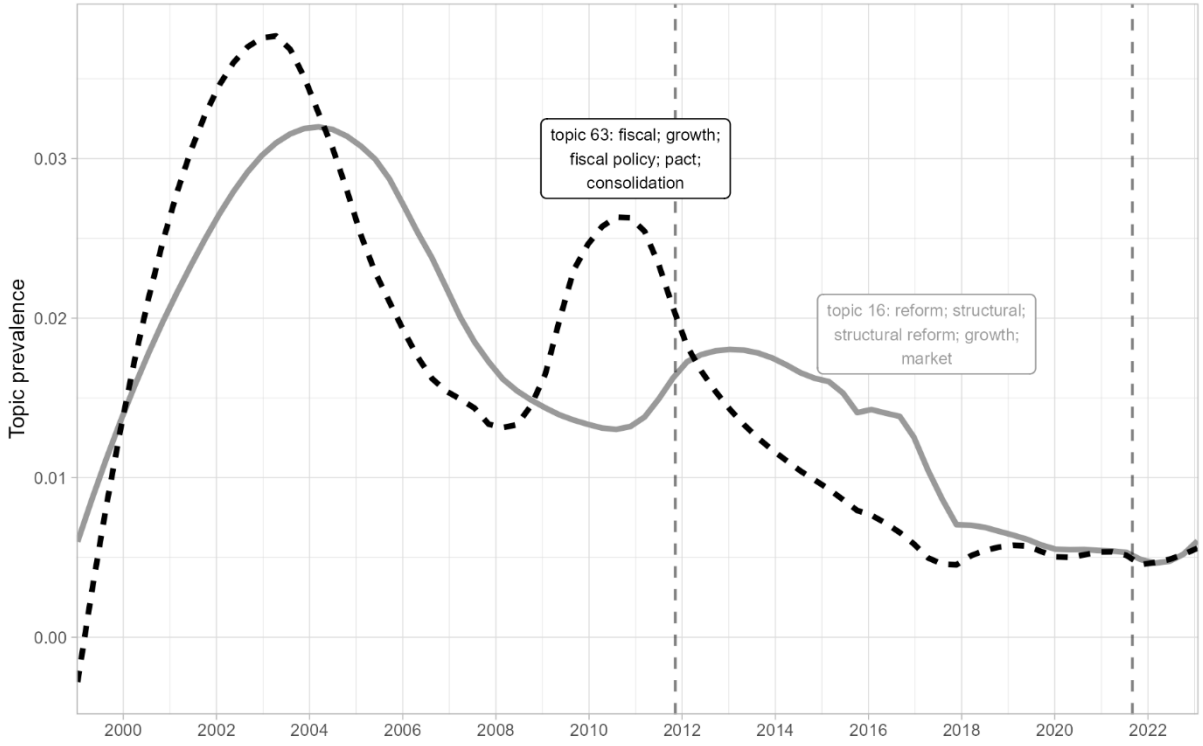
Turning to external linkages, ECB policymakers attributed responsibility for this inflation surge to other players' actions. Trichet and ECB vice-president, Lucas Papademos, called on 'all parties concerned [to] meet their responsibilities' and stressed 'the importance of avoiding wage developments that would eventually lead to inflationary pressures and harm the purchasing power of all euro area citizens' (*ibid.*). They also criticised wage-indexation schemes and the related risks of 'wage-price spiral' (Trichet and Papademos 2008, 3). In the same vein, the external linkages related to fiscal policy and the SGP rules (Topic 63) as well as structural reforms (Topic 16) were prevalent during the CBI era (Figure 3).

The evolution of Topic 63 reflects central bankers' desire to be perceived as guardians of market discipline of the euro area in all circumstances. In fact, the fiscal 'topic' has two prevalence peaks: one between 2003 and 2005 when France and Germany breached the SGP rules and one in 2010, when the bailout of the banking system caused large budget deficits. Regarding structural reforms, they were framed as the main solution to the issues of weak growth and unemployment in the euro area.[22]

[21] See also the prevalence of Topic 7 on wages during this period.

[22] 'Stepping up structural reforms in these areas is indispensable for improving the euro area's unsatisfactory growth potential and its ability to create employment' (Issing 2004, 2).

Figure 3: Topics on fiscal issues and structural reforms



In sum, during the CBI era, central bankers put forward internal and external linkages that allowed them to frame their anti-inflationary role in alignment with the imperative of responsibility, as defined by Peter Mair (2013). They argued that their independence from political authorities and their anti-inflation commitments were necessary to maintain credibility and 'anchor' market expectations of price stability, a prerequisite for achieving any other macroeconomic goal. The persistence of this framing in 2011 is in line with the ECB's decision to raise interest rates despite acute financial instability risks. It confirms past research on the stickiness of the CBI template at the ECB during the first years of the crisis, by comparison with other central banks (Gabor 2014; Braun et al. 2022; Van't Klooster 2022b). Wim Duisenberg, the first ECB president, summarises well how the ECB's framing of inflation in this era reflects the division of labour under the CBI template:

> Although monetary policy cannot lift the euro area's growth potential, the benefits of price stability for growth are evident, as stable prices provide the proper environment for structural reforms to work. While the ECB will maintain its commitment to the maintenance of price stability, other policy-makers should assume responsibility for increasing the growth potential of the euro area. This, in turn, is the best allocation of responsibilities to contributing to sustainable non-inflationary growth (Duisenberg 2001, 2).

The secular stagnation era

The framing of inflation shifted between the CBI and the secular stagnation era. To start with, the prevalence of topics that were aligned in the closest way with the CBI template displays a

steep decline (Figure 2). Conversely, the emergence of other topics indicates new policy tradeoffs faced by central bankers during the secular stagnation era (Figures 4 and 5; Table 1).

Figure 4: Topics related to the ECB's new monetary instruments

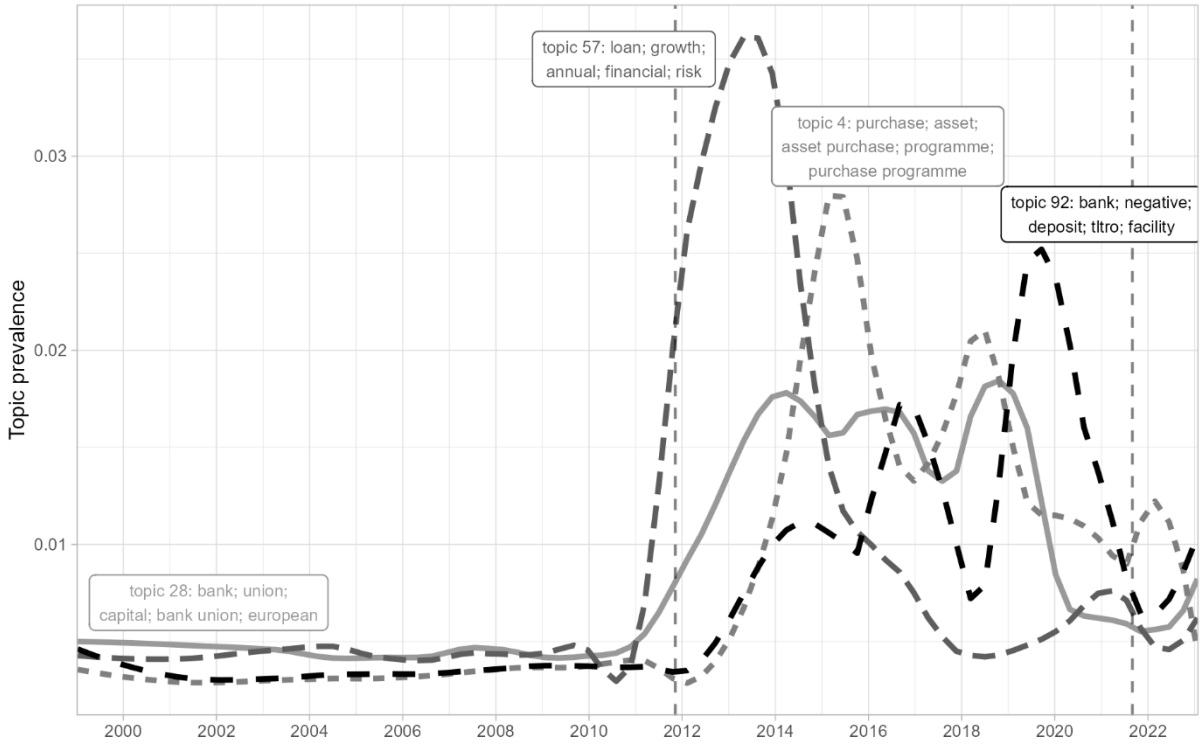
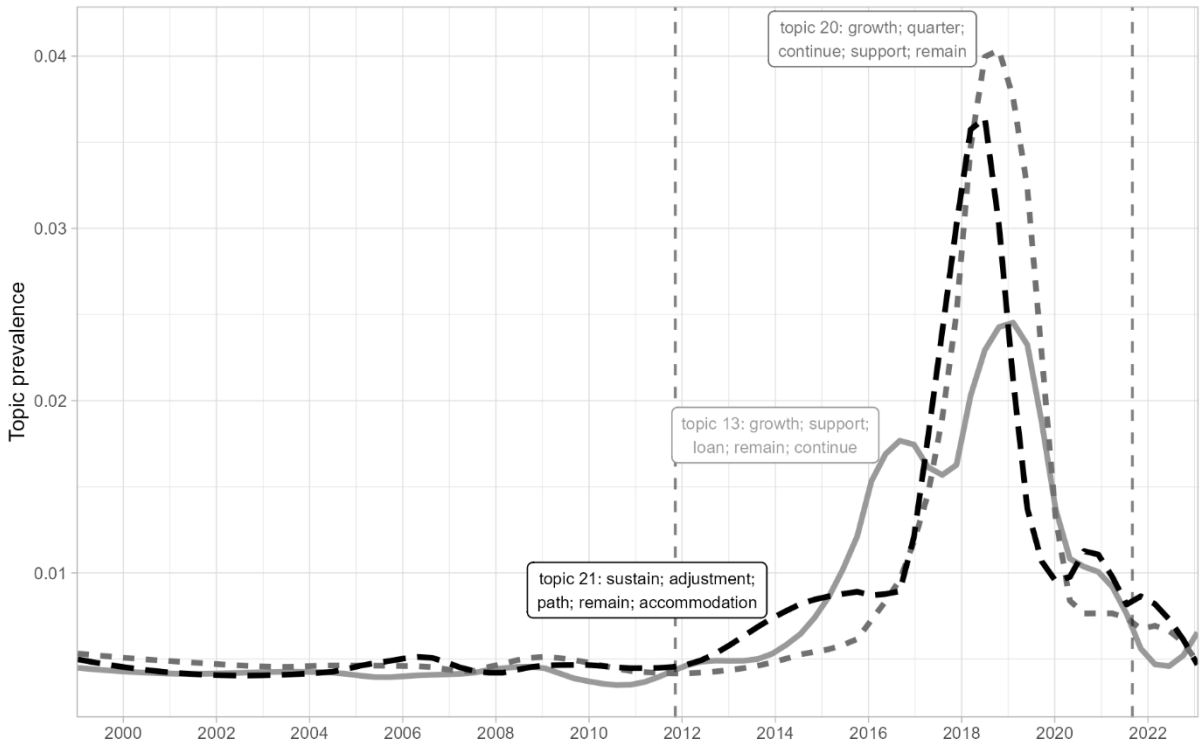


Figure 5: Topics related to lacklustre growth



Topics with the highest correlation to inflation during this era (Table 2) relate to financial stability issues and how the ECB answered them with new monetary instruments (Topics 57, 84, 46, 28, 4, 92) as well as the persistent lacklustre growth and its implications for the ECB role (Topics 13, 20 and 21).

The emergence of these topics signifies that ECB policymakers reframed CBI linkages in response to two policy challenges posed by the new macroeconomic environment. The first significant challenge to the CBI framing was about its main internal linkage, that is, the prioritisation of price stability over other objectives. To start with, central bankers recognised that price stability alone was 'not a sufficient condition of financial stability' (Draghi 2015, 3) and that they had an active role to play in stabilising systemic market segments. Moreover, the most prevalent topic (Topic 46) during the secular stagnation era relates to issues around the transmission mechanisms of monetary policy and how central bankers could make sure that their decisions have an impact on credit provision and, thereby, growth.[23] In other words, the objectives of financial stability and growth support started to gain autonomy to the extent that they were not directly subordinated to the price stability objective.

The second challenge to the previous era was the 'missing inflation puzzle', which questioned crucial mechanisms underlying the CBI template. In fact, the most prevalent topic among the 14 inflation topics for this era (Topic 47) relates to the secular stagnation debate.[24] Vitor Constancio, the former ECB vice-president, directly quotes the concept to outline why low inflation remained persistent in the euro area (Constâncio 2016, 5–6). ECB policymakers hoped for 'self-sustained' inflation, that is, inflation reaching the 2% target without constant monetary stimulus (Constâncio 2017, 6; Draghi 2017a, 4). These discussions were also linked to the Phillips Curve, which describes the negative correlation between the levels of inflation and unemployment (Topic 1). Indeed, the validity of the relationship between these two variables was questioned, as inflation did not seem to pick up when unemployment started to decline (Constâncio 2018, 7–10).

ECB policymakers looked for factors explaining low inflation levels despite monetary expansion and lower unemployment levels. First, Peter Praet underlined that 'to achieve a sustained adjustment in the path of inflation, wage growth has to be stronger' (Praet 2017, 5). He was also concerned that 'higher employment levels (do not) feed through into wage dynamics' (*ibid.*). Mario Draghi outlined the factors explaining this broken relationship, including weakened trade unions and the disappearance of wage indexation schemes (Draghi 2017a, 5). Second, Vitor Constancio pointed out that low inflation was also caused by 'fiscal policy mistakes made in 2011-12', which should 'not be repeated so that we do not suffer from avoidable double dip recessions' (Constâncio 2018, 12).[25] In other words, central bankers

[23] 'This recalibration of our asset purchases ... helps to maintain the necessary degree of accommodation and thereby to accompany the economic recovery in an appropriate way' (Draghi 2017c, 4).

[24] Topic 47 refers to 'underlie; headline; headline inflation; core; measure'. For example, 'the strengthening of economic activity has yet to find correspondence in inflation developments: underlying inflation and domestic price pressures remain subdued' (Praet 2017, 5).

[25] Constancio explained that 'the negative demand shock could be the delayed result of the fiscal policy tightening since 2010, or possibly the consequence of weakened economic sentiment after two recessions' (Constâncio 2018, 5).

recognised that the policy recommendations to other players that were formulated during the CBI era (fiscal moderation and structural reforms) were conducive to persistent undershooting of the inflation target during the secular stagnation era (Draghi 2017b, 3–4).

The analysis of the challenges posed by the secular stagnation era led the ECB to reformulate external linkages in its framing of inflation and review its monetary policy strategy. First, as already underlined by Braun et al. (2022), ECB policymakers changed the policy message addressed to other actors as they called for both fiscal (Schnabel 2020, 4–5) and wage expansion (Praet 2017, 5) from 2015 onwards. For example, Luis de Guindos, the current ECB Vice-President, called for reforming the SGP for fiscal policy to have a role to play in answering shocks (de Guindos 2019, 3).

Second, the analysis of the causes of secular stagnation and low inflation led to discussions on the adoption of a 'symmetric' inflation target under and above 2% (Draghi 2016). A few years later, during its 2021 monetary strategy review, the ECB incorporated this new symmetric target in its monetary policy framework. Moreover, this review introduced 'proportionality tests', whereby the price stability objectives would be balanced against potential negative side effects, such as financial instability (Grunewald and van't Klooster 2023). This new strategy reflects the main shift in internal linkage, where price stability alone is no longer considered sufficient for achieving other macroeconomic objectives. In other words, ECB policymakers acknowledge now monetary policy tradeoffs, marking a significant departure from the CBI template.

However, we should not overestimate the extent of change in the framing of the ECB's main imperative of responsibility. Some core elements of the CBI template remained during the secular stagnation era. For example, the anchoring of market expectations was framed as a key element in how the ECB impacts the real economy. In the same vein, Peter Praet was adamant that 'over the longer-term, however, monetary policy cannot increase growth' (Praet 2015, 6) since growth is influenced by supply side rather than demand side factors.

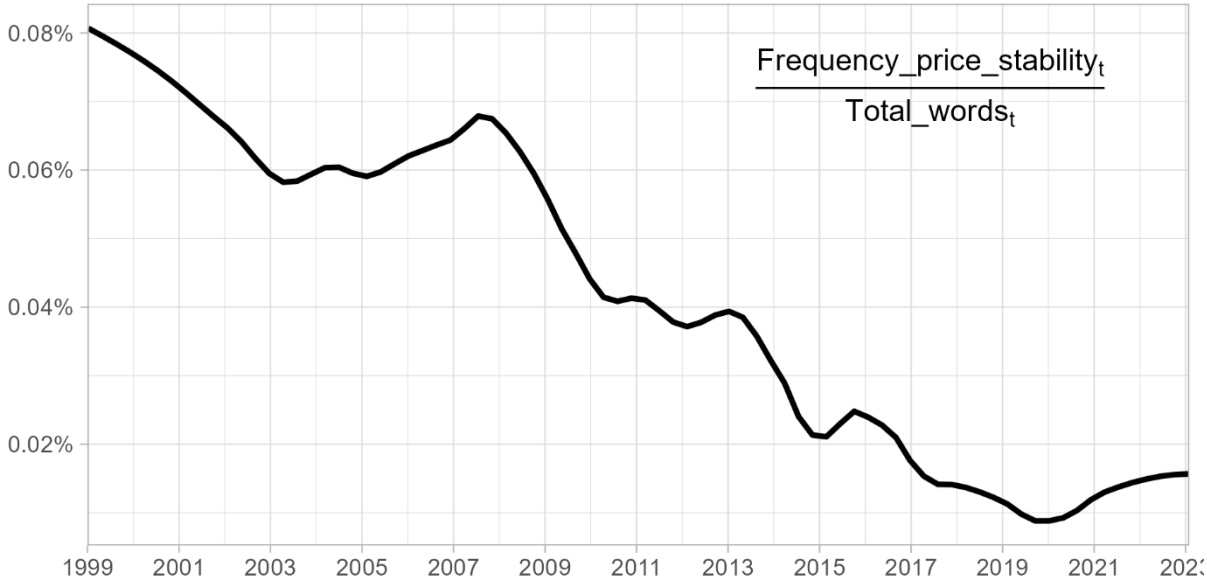
In sum, the ECB's strategic reframing of inflation helps to adjust its principle of responsibility to the secular stagnation era. Eventually, these changes were institutionalised in the 2021 monetary strategy review, which would have been unlikely if the CBI framing had persisted. Some key linkages from the CBI era, such as price stability as a sufficient condition to reach other economic objectives, were abandoned to be substituted by new ones that recognise the role that monetary policy can play in terms of financial stability and support for growth. But other core elements of the CBI template remained in place, such as the necessity to anchor market expectations. Shortly before inflation started to pick up again, Isabel Schnabel summarised this articulation:

> Inflation may not be a serious threat to society at the current juncture. But the factors that motivated central bank independence four decades ago, and the safeguards that were put in place to protect it, remain important pillars of stability and prosperity. (Schnabel 2020, 6)

The new inflation era

The evolution of the prevalence of the 14 topics directly related to inflation shows a clear change in the framing of inflation (Table 1). The five topics about price stability that were prevalent during the CBI era do not pick up after 2011 (Figure 2). The change in frequency of the mention of price stability corroborates this observation (Figure 6).

Figure 6: Change in the frequency of use of the expression 'price stability'



Conversely, out of the 14 inflation topics, most of the topics that have a higher prevalence during the new inflation era emerge at the start of this era (Table 1; Figure 7).[26] This change in topics is obviously related to the new sources of inflation such as bottlenecks in the supply chains and the rise in energy costs (Topic 67). More interestingly, two prevalent topics refer to the changes made during the secular stagnation era, which were institutionalised during the 2021 monetary strategy review: the 'medium-term inflation outlook', which allows the recognition of policy tradeoffs (Topic 30) and the symmetric target (Topic 58). But some crucial linkages of the CBI era, such as 'anchoring' expectations and inflation targets, remain prevalent during the new inflation era (Topics 35 and 60).

The ten topics that have the highest correlation to the new inflation era also reflect this mixed influence (Table 2). On the one hand, these topics refer to novel tradeoffs between monetary tightening and support for ecological transition (Topic 51) as well as novel inflationary factors (i.e. the effects of Covid-19, war and climate change; Topics 12, 15 and 88). On the other hand, fears of the old blue inflation monster reemerge as ECB policymakers turn back their attention to usual suspects, such as wages and fiscal policies (Topics 91 and 103).

The topics' most representative paragraphs confirm these quantitative tendencies. Starting with internal linkages, the framing of inflation is affected by the changes made during the secular

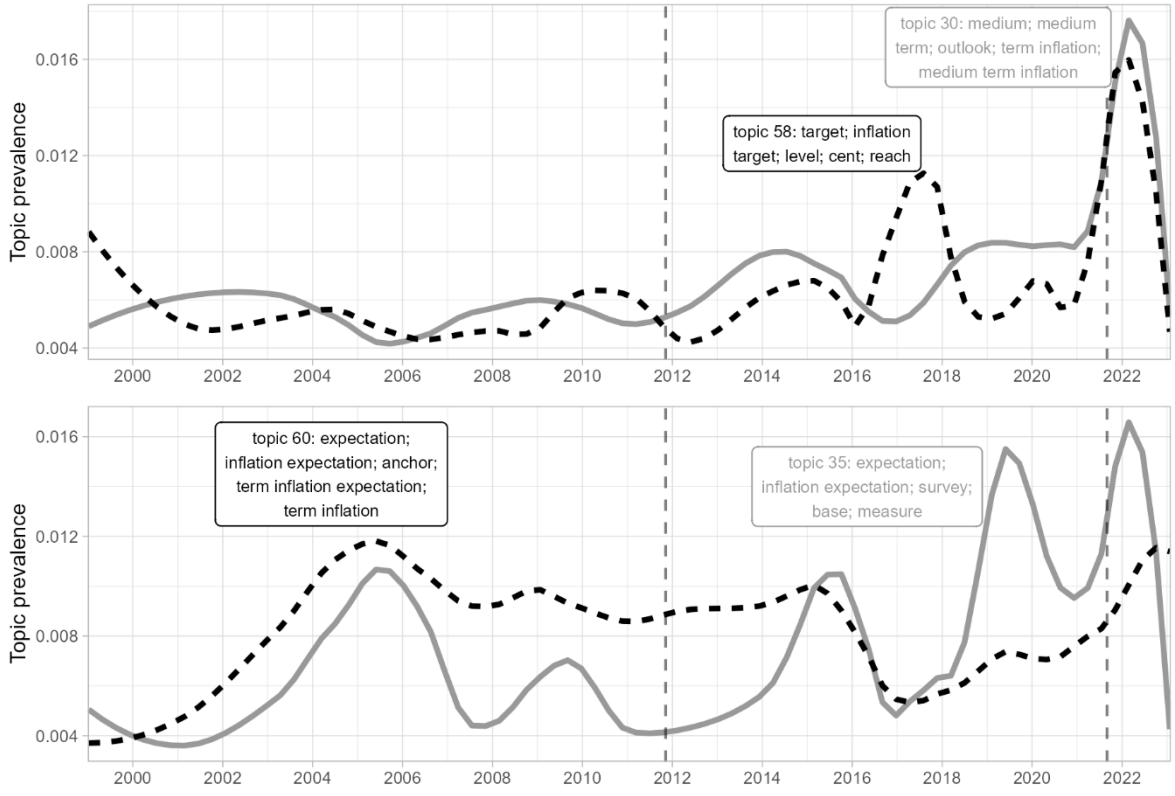
[26] Topics 30, 58, 67. Topics 35, 47 and 60 have a high prevalence during the new inflation era but they were also prevalent during the CBI or the secular stagnation eras.

stagnation era (in particular, the 2021 strategic review and climate action plan) without abandoning key frames from the CBI template.

First, the prevalence of topics 30 and 58 is indicative of how ECB policymakers rely on the 2021 strategic review to be more flexible in face of inflation risks than during the CBI era. In particular, they stressed the importance of 'flexibility' and 'optionality'. For example, Philip Lane, the ECB chief economist since 2019, underlined in March 2022, a few months before the ECB started to raise interest rates again in July, that 'in current conditions, it is especially important to remain data-dependent and for optionality to be two-sided' (Lane 2022, 25). In June 2022, Lagarde and de Guindos also emphasised that 'under stressed conditions, flexibility will remain an element of monetary policy whenever threats to monetary policy transmission jeopardise the attainment of price stability' (Lagarde and de Guindos 2022, 2). When the ECB opted to raise interest rates, Fabio Panetta, a member of the executive board since 2020, was keen to point to potential negative side effects, and thus tradeoffs between different monetary objectives:

> We are normalising our monetary policy to keep inflation expectations anchored and bring inflation back to 2% over the medium term. But we cannot ignore the sizeable challenges that we are facing. (...) Our policy stance must (...) [avoid] an excessive focus on short-run developments and fully taking into account the risks emanating from the domestic and global economic and financial environment (Panetta 2022, 15).

Figure 7: Prevalent inflation topics during the new inflation era



Second, since the end of the secular stagnation era, the ECB has put forward a new internal linkage whereby the fight against climate change contributes to the objective of price stability. In the words of Isabel Schnabel, making the ECB's 'monetary policy framework climate change-proof' (Schnabel 2023, 4) is necessary to avoid 'fossilflation' and 'greenflation'. (Schnabel 2022a). For example, investment in green technology today will result in lower energy prices in the future. But Isabel Schnabel also points out a tradeoff between these greening efforts and the ECB's answer to current inflation:

> These developments now risk being reversed by the marked rise in global interest rates over the past year. Since fossil fuel-based power plants have comparably low upfront costs, a persistent rise in the cost of capital may discourage efforts to decarbonise our economies rapidly. (Schnabel 2023, 1)

However, ECB policymakers do not go as far as questioning the CBI's prioritisation of price stability as a necessary condition for reaching other objectives, including the green transition: 'restoring price stability in a timely manner provides the conditions under which the green transition can thrive sustainably' (Schnabel 2023, 6). The theoretical mechanisms underlying her reasoning directly refer to the internal linkages related to the issue of time inconsistency and the CBI logic of responsibility:

> A central bank that is perceived as being committed to protecting its mandate can contain inflation at a lower economic cost, since the expectation that adequate policy action will be taken is itself stabilising. Such credibility is vital for the conduct of monetary policy. (Schnabel 2022b, 6)[27]

Turning to external linkages, ECB policymakers underlined that euro area authorities needed to move away from the fiscal-monetary policy mix of the secular stagnation era to come back to the division of labour of the CBI era. In Schnabel's (2022c, 1) words, 'governments must avoid an overly expansionary stance that fuels inflationary pressures and adds to the historically high public debt burden', while the ECB 'must remain determined to bring inflation back to target in a timely manner, so as to prevent current high inflation from becoming entrenched in expectations.' But, in line with changes made during the secular stagnation era, she also brings some nuance by acknowledging that fiscal policy has a role to play 'to protect the most vulnerable parts of society from the consequences of the energy and food price shocks' and foster investments in green energy utilities.[28]

In sum, in the new inflation era, ECB policymakers face difficult tradeoffs. These tradeoffs are closely linked to changes in the framing of inflation since the end of the CBI era. Indeed, the integration of new policy goals and the missing inflation puzzle led to a wider and more flexible understanding of the imperative of responsibility attached to the ECB, by comparison with the CBI era. But the current ECB answer to inflation clashes with the new linkages put forward

[27] The evolution of topic 60 about 'anchoring inflation expectations' (Figure 7), which is prevalent during both the CBI and the new inflation era but not during the secular stagnation era, corroborates this finding.

[28] These citations come from the most representative speeches in topic 103 for the last period. This topic picked up first in late 2019 and during the Covid period: prevalent speeches in this period defended the need for active and expansive fiscal policies to sustain economic growth and help EU countries to recover.

during the secular stagnation era; the impact of rising interest rates on green investment may be the best example. This is part of what Daniela Gabor (2022) calls '*Zugzwang* central banking,' where every possible move worsens the situation. Gabor argues that abandoning the CBI template and increasing policy coordination with governments may be the best way out of this dilemma, but it is unlikely that central bankers will advocate for this approach as it would compromise their privileged statute of independence. A speech given by Christine Lagarde on 'new challenges in a changing world' is indicative of this dynamic:

> As we head into 2023, a changing world brings with it new challenges, but also opportunities. ... But some things never change: namely, the ECB's commitment to price stability. We will play our part in Europe's next chapter by bringing inflation back to our 2% target. (Lagarde 2023, 3)

Conclusion

Today, the ECB does not strategically frame its handling of 'inflation monsters' in the same way as it did in the 2000s. From its creation through the aftermath of the 2007-09 Financial Crisis, the ECB's framing priority was to establish its anti-inflationary reputation by mobilising key linkages from the CBI template. However, during the secular stagnation era, the ECB had to adjust its policy stance and frame inflation differently to align the CBI imperative of responsibility with the challenges of the time.

With the adoption of the Climate action plan and the monetary strategy review in 2021, this new framing became institutionalised. The hierarchical framing of price stability as the sole monetary objective disappeared, giving way to new linkages that acknowledge the role monetary policy can play in terms of financial stability, supporting growth, and addressing climate objectives. However, some core elements of the CBI template, like the need to anchor market expectations, were not affected by this reframing.

In 2021, as inflation began to rise for the first time in a decade, ECB policymakers articulated linkages from both eras. This allowed them to justify raising interest rates while avoiding discussions about a regime change. On one hand, ECB policymakers acknowledged the policy tradeoffs among various macroeconomic objectives, explicitly recognising the tough choices they faced. For example, the challenges presented by rising interest rates created a difficult policy tradeoff with the transition to greener energy systems. On the other hand, certain key elements from the CBI template persisted. Notably, the linkages made between central bank independence, anchoring inflation expectations, and maintaining a sustained path of inflation in the medium and long term remain central in how the ECB frames inflation today.

This articulation is likely to become untenable because of the growing disparity between the framing of economic challenges in the early 1990s and the CBI template as a solution, compared to the contemporary policy challenges arising from the unfolding environmental crisis and acute geopolitical tensions. More coordination between economic authorities is probably needed to face these new challenges. In other words, without substantial regime change and new sources

of legitimacy, ECB policymakers might find themselves in situations of '*Zugzwang*' central banking in the future.

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Appendix

Table 1: List of all topics

Topic	Topic on Inflation	Total Prevalence	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
Topic 67: energy; supply; rise; cent; energy price	TRUE	0.0151 (1)	0.0044 (114)	0.0058 (107)	0.0351 (1)
Topic 14: stability; price stability; maintain; maintain price; maintain price stability	TRUE	0.01 (10)	0.0158 (6)	0.0074 (68)	0.0067 (68)
Topic 80: risk; price stability; stability; upside; medium	TRUE	0.0099 (13)	0.0187 (3)	0.0051 (118)	0.0059 (91)

Topic	Topic on Inflation	Total Prevalence	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
Topic 35: expectation; inflation expectation; survey; base; measure	TRUE	0.0095 (17)	0.006 (82)	0.0088 (39)	0.0136 (12)
Topic 30: medium; medium term; outlook; term inflation; medium term inflation	TRUE	0.0092 (20)	0.0055 (91)	0.0073 (72)	0.0147 (10)
Topic 60: expectation; inflation expectation; anchor; term inflation expectation; term inflation	TRUE	0.009 (22)	0.0089 (45)	0.0076 (63)	0.0106 (19)
Topic 47: underlie; headline; headline inflation; core; measure	TRUE	0.0084 (38)	0.0046 (107)	0.0097 (29)	0.0108 (17)
Topic 119: oil; increase; oil price; commodity; impact	TRUE	0.0083 (42)	0.0092 (41)	0.0067 (91)	0.0091 (25)
Topic 58: target; inflation target; level; cent; reach	TRUE	0.0083 (42)	0.0052 (97)	0.0069 (84)	0.0129 (13)
Topic 68: hicp; hicp inflation; annual; inflation rate; annual hicp inflation	TRUE	0.0082 (52)	0.0103 (33)	0.0074 (69)	0.007 (62)
Topic 102: stability; price stability; definition; objective; define	TRUE	0.0081 (54)	0.0118 (17)	0.007 (82)	0.0055 (101)
Topic 40: stability; price stability; deliver; citizen; good	TRUE	0.008 (57)	0.0115 (19)	0.0064 (98)	0.0062 (83)
Topic 49: medium; medium term; stability; price stability; short	TRUE	0.008 (57)	0.0115 (20)	0.0063 (102)	0.0061 (87)
Topic 108: pressure; inflationary; inflationary pressure; time; downward	TRUE	0.0078 (73)	0.0077 (61)	0.0065 (96)	0.0091 (24)
Topic 78: paper; journal; economics; review; reserve	FALSE	0.0137 (2)	0.0108 (29)	0.0159 (2)	0.0143 (11)
Topic 115: speech; series; paper; european; bulletin	FALSE	0.0126 (3)	0.0058 (87)	0.0117 (11)	0.0203 (5)
Topic 43: percentage; note; chart; observation; late	FALSE	0.0124 (4)	0.005 (100)	0.0086 (44)	0.0237 (2)

Topic	Topic on Inflation	Total Prevalence	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
Topic 16: reform; structural; structural reform; growth; market	FALSE	0.0118 (5)	0.02 (2)	0.0104 (23)	0.005 (115)
Topic 63: fiscal; growth; fiscal policy; pact; consolidation	FALSE	0.011 (6)	0.0211 (1)	0.007 (79)	0.005 (116)
Topic 46: bank; lend; credit; loan; bank lend	FALSE	0.0107 (7)	0.0053 (96)	0.0161 (1)	0.0106 (18)
Topic 39: bank; central; central bank; major central; dimension	FALSE	0.0106 (8)	0.012 (16)	0.0115 (14)	0.0083 (37)
Topic 52: raise; meet; normalisation; basis; interest	FALSE	0.0105 (9)	0.0045 (111)	0.0057 (111)	0.0212 (3)
Topic 79: shock; demand; supply; aggregate; aggregate demand	FALSE	0.01 (10)	0.0064 (78)	0.0084 (48)	0.0153 (8)
Topic 88: change; transition; climate; energy; green	FALSE	0.01 (10)	0.0039 (116)	0.0058 (109)	0.0203 (4)
Topic 91: labour; wage; labour market; unemployment; market	FALSE	0.0098 (14)	0.0077 (60)	0.0089 (38)	0.0127 (14)
Topic 15: pandemic; pepp; support; emergency; purchase	FALSE	0.0097 (15)	0.0032 (120)	0.01 (24)	0.0158 (7)
Topic 4: purchase; asset; asset purchase; programme; purchase programme	FALSE	0.0096 (16)	0.0034 (119)	0.015 (3)	0.0103 (20)
Topic 85: development; growth; remain; continue; stability	FALSE	0.0095 (17)	0.0176 (4)	0.0052 (117)	0.0057 (95)
Topic 61: hand; slide; firm; chart; leave	FALSE	0.0093 (19)	0.0046 (108)	0.0083 (49)	0.0149 (9)
Topic 32: financial; stability; financial stability; risk; prudential	FALSE	0.0091 (21)	0.011 (24)	0.0087 (41)	0.0077 (46)
Topic 117: analysis; decision; forecast; information; policy decision	FALSE	0.009 (22)	0.0144 (9)	0.0059 (106)	0.0068 (67)
Topic 90: european; union; monetary union; europe; european union	FALSE	0.009 (22)	0.0109 (27)	0.0087 (42)	0.0074 (57)
Topic 74: projection; staff; macroeconomic; ecb staff; macroeconomic projection	FALSE	0.0089 (25)	0.0067 (72)	0.0097 (30)	0.0103 (21)

Topic	Topic on Inflation	Total Prevalence	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
Topic 103: fiscal; fiscal policy; support; stabilisation; economy	FALSE	0.0089 (25)	0.0052 (98)	0.0098 (27)	0.0117 (16)
Topic 11: remain; growth; continue; development; quarter	FALSE	0.0088 (27)	0.0164 (5)	0.0048 (120)	0.0052 (110)
Topic 69: council; govern; govern council; decision; decide	FALSE	0.0088 (27)	0.0106 (31)	0.009 (36)	0.0069 (66)
Topic 112: income; household; consumption; house; real	FALSE	0.0088 (27)	0.0055 (92)	0.0086 (45)	0.0124 (15)
Topic 10: risk; bank; financial; credit; institution	FALSE	0.0087 (30)	0.0096 (38)	0.0084 (46)	0.0082 (38)
Topic 12: war; economy; impact; ukraine; time	FALSE	0.0087 (30)	0.0046 (105)	0.0056 (112)	0.0158 (6)
Topic 84: purchase; continue; asset; ecb interest rate; ecb interest	FALSE	0.0087 (30)	0.0038 (117)	0.0137 (5)	0.0087 (31)
Topic 64: remain; medium; expect; medium term; support	FALSE	0.0086 (33)	0.0149 (7)	0.0055 (114)	0.0053 (108)
Topic 1: model; curve; phillips; phillips curve; estimate	FALSE	0.0086 (33)	0.0064 (76)	0.0108 (18)	0.0085 (32)
Topic 29: european; eu; commission; level; supervisory	FALSE	0.0085 (35)	0.0109 (25)	0.008 (54)	0.0067 (70)
Topic 42: trade; service; good; increase; import	FALSE	0.0085 (35)	0.0105 (32)	0.0072 (74)	0.0077 (47)
Topic 118: interest; interest rate; cut; key; negative	FALSE	0.0085 (35)	0.0071 (68)	0.0108 (19)	0.0076 (52)
Topic 99: decision; communication; public; transparency; policy decision	FALSE	0.0084 (38)	0.0128 (13)	0.0069 (85)	0.0056 (97)
Topic 2: global; globalisation; international; domestic; economy	FALSE	0.0084 (38)	0.0102 (35)	0.0074 (67)	0.0075 (53)
Topic 109: continue; quarter; remain; real; analysis	FALSE	0.0084 (38)	0.0081 (51)	0.0121 (10)	0.005 (117)

Topic	Topic on Inflation	Total Prevalence	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
Topic 9: country; convergence; member; eu; process	FALSE	0.0083 (42)	0.0145 (8)	0.0053 (116)	0.005 (114)
Topic 94: financial; market; integration; financial integration; cross	FALSE	0.0083 (42)	0.0134 (10)	0.0062 (103)	0.0054 (103)
Topic 8: central; central bank; bank; objective; banker	FALSE	0.0083 (42)	0.011 (23)	0.0081 (52)	0.0059 (89)
Topic 59: market; liquidity; money; money market; collateral	FALSE	0.0083 (42)	0.0089 (44)	0.0084 (47)	0.0076 (49)
Topic 87: change; structural; economy; set; factor	FALSE	0.0083 (42)	0.0082 (48)	0.0078 (56)	0.009 (26)
Topic 33: output; potential; gap; estimate; growth	FALSE	0.0083 (42)	0.0075 (62)	0.009 (34)	0.0083 (36)
Topic 21: sustain; adjustment; path; remain; accommodation	FALSE	0.0083 (42)	0.0045 (110)	0.013 (9)	0.0073 (58)
Topic 92: bank; negative; deposit; tltro; facility	FALSE	0.0083 (42)	0.0035 (118)	0.0138 (4)	0.0076 (50)
Topic 114: real; interest; interest rate; nominal; equilibrium	FALSE	0.0082 (52)	0.0056 (89)	0.0115 (15)	0.0076 (51)
Topic 77: treaty; independence; institutional; mandate; independent	FALSE	0.0081 (54)	0.0117 (18)	0.0073 (73)	0.0052 (111)
Topic 20: growth; quarter; continue; support; remain	FALSE	0.0081 (54)	0.0047 (104)	0.0133 (6)	0.0064 (77)
Topic 24: growth; remain; loan; development; annual	FALSE	0.008 (57)	0.0127 (14)	0.0061 (104)	0.0053 (106)
Topic 44: financial; market; financial market; impact; volatility	FALSE	0.008 (57)	0.0109 (26)	0.0064 (99)	0.0066 (75)
Topic 25: growth; real; gdp; real gdp; gdp growth	FALSE	0.008 (57)	0.0092 (40)	0.0073 (70)	0.0075 (54)
Topic 100: investment; increase; reduce; firm; capital	FALSE	0.008 (57)	0.0082 (49)	0.0088 (40)	0.007 (63)

Topic	Topic on Inflation	Total Prevalence	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
Topic 19: guidance; future; policy rate; path; condition	FALSE	0.008 (57)	0.0054 (93)	0.0098 (25)	0.0089 (27)
Topic 51: bond; market; yield; government; sovereign	FALSE	0.008 (57)	0.0049 (101)	0.009 (35)	0.01 (22)
Topic 28: bank; union; capital; bank union; european	FALSE	0.008 (57)	0.0046 (106)	0.0133 (7)	0.0061 (85)
Topic 81: development; money; analysis; growth; aggregate	FALSE	0.0079 (66)	0.013 (12)	0.0058 (108)	0.0049 (119)
Topic 48: conference; challenge; issue; address; discuss	FALSE	0.0079 (66)	0.0107 (30)	0.0068 (88)	0.0061 (86)
Topic 34: crisis; financial; financial crisis; pre; pre crisis	FALSE	0.0079 (66)	0.0072 (64)	0.0086 (43)	0.0078 (45)
Topic 54: activity; economic activity; quarter; expect; remain	FALSE	0.0079 (66)	0.0072 (65)	0.0076 (62)	0.0088 (29)
Topic 76: european; parliament; report; committee; european parliament	FALSE	0.0079 (66)	0.0072 (66)	0.008 (55)	0.0084 (34)
Topic 31: recovery; support; economic recovery; continue; remain	FALSE	0.0079 (66)	0.006 (81)	0.0107 (20)	0.0069 (65)
Topic 53: germany; people; german; draghi; saver	FALSE	0.0079 (66)	0.0058 (86)	0.0116 (12)	0.0063 (81)
Topic 23: single; currency; single currency; single monetary; single monetary policy	FALSE	0.0078 (73)	0.0133 (11)	0.0055 (113)	0.0046 (120)
Topic 75: country; differential; dispersion; difference; average	FALSE	0.0078 (73)	0.0123 (15)	0.0055 (115)	0.0057 (94)
Topic 65: asset; asset price; bubble; boom; credit	FALSE	0.0078 (73)	0.0113 (22)	0.0066 (92)	0.0056 (96)
Topic 7: cost; wage; labour; competitiveness; growth	FALSE	0.0078 (73)	0.0108 (28)	0.0057 (110)	0.0069 (64)

Topic	Topic on Inflation	Total Prevalence	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
Topic 36: strategy; policy strategy; monetary policy strategy; ecb monetary; ecb monetary policy	FALSE	0.0078 (73)	0.0097 (37)	0.0064 (97)	0.0074 (56)
Topic 18: debt; government; public; fiscal; finance	FALSE	0.0078 (73)	0.0091 (42)	0.0077 (57)	0.0067 (69)
Topic 101: demand; growth; domestic; expect; factor	FALSE	0.0078 (73)	0.007 (69)	0.0083 (50)	0.008 (42)
Topic 5: good; time; question; lot; discussion	FALSE	0.0078 (73)	0.0059 (84)	0.011 (16)	0.0066 (73)
Topic 107: yield; risk; curve; market; premia	FALSE	0.0078 (73)	0.0051 (99)	0.0095 (31)	0.0089 (28)
Topic 120: condition; finance; finance condition; favourable; favourable finance condition	FALSE	0.0078 (73)	0.0048 (103)	0.0107 (21)	0.0079 (44)
Topic 116: growth; productivity; productivity growth; labour; population	FALSE	0.0077 (84)	0.0103 (34)	0.007 (83)	0.0058 (93)
Topic 56: increase; average; period; level; decline	FALSE	0.0077 (84)	0.008 (52)	0.0071 (76)	0.0079 (43)
Topic 96: transmission; mechanism; channel; economy; transmission mechanism	FALSE	0.0077 (84)	0.0063 (79)	0.0082 (51)	0.0085 (33)
Topic 62: country; national; individual; development; shock	FALSE	0.0076 (87)	0.0099 (36)	0.0071 (77)	0.0059 (90)
Topic 106: risk; uncertainty; downside; outlook; downside risk	FALSE	0.0076 (87)	0.0065 (75)	0.0075 (65)	0.0088 (30)
Topic 41: economy; emerge; global; market; advance	FALSE	0.0075 (89)	0.0079 (56)	0.0076 (61)	0.007 (61)
Topic 72: challenge; conclude; environment; conclusion; time	FALSE	0.0075 (89)	0.0079 (57)	0.0072 (75)	0.0075 (55)
Topic 13: growth; support; loan; remain; continue	FALSE	0.0075 (89)	0.0042 (115)	0.0132 (8)	0.0051 (112)
Topic 113: evidence; empirical; research; study; time	FALSE	0.0074 (92)	0.0091 (43)	0.0066 (93)	0.0064 (80)

Topic	Topic on Inflation	Total Prevalence	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
Topic 82: ensure; measure; time; continue; support	FALSE	0.0074 (92)	0.0071 (67)	0.007 (80)	0.0081 (40)
Topic 66: negative; fall; deflation; zero; positive	FALSE	0.0074 (92)	0.006 (83)	0.0098 (26)	0.0063 (82)
Topic 3: dynamic; range; percent; macroeconomic; wide	FALSE	0.0074 (92)	0.0055 (90)	0.0067 (90)	0.0099 (23)
Topic 86: european; central; european central bank; european central; board	FALSE	0.0074 (92)	0.0054 (94)	0.0089 (37)	0.008 (41)
Topic 105: instrument; mandate; tool; unconventional; measure	FALSE	0.0074 (92)	0.0045 (113)	0.0109 (17)	0.0067 (72)
Topic 89: cash; banknote; eurosystem; changeover; national	FALSE	0.0073 (98)	0.0115 (21)	0.0051 (119)	0.0054 (102)
Topic 27: economy; cycle; business; lead; time	FALSE	0.0073 (98)	0.0064 (77)	0.0073 (71)	0.0083 (35)
Topic 50: response; action; policy response; policy action; reaction	FALSE	0.0073 (98)	0.0061 (80)	0.0077 (58)	0.0081 (39)
Topic 93: short; short term; interest; interest rate; term interest	FALSE	0.0072 (101)	0.0075 (63)	0.0077 (59)	0.0064 (79)
Topic 97: country; government; italy; france; greece	FALSE	0.0072 (101)	0.0069 (70)	0.0091 (33)	0.0055 (99)
Topic 111: crisis; bank; debt; sovereign; sovereign debt	FALSE	0.0072 (101)	0.0046 (109)	0.0105 (22)	0.0065 (76)
Topic 55: time; experience; lead; history; lesson	FALSE	0.0071 (104)	0.0083 (47)	0.007 (78)	0.0061 (88)
Topic 98: question; view; issue; concern; debate	FALSE	0.0071 (104)	0.008 (54)	0.0077 (60)	0.0055 (100)
Topic 45: stance; policy stance; monetary policy stance; accommodative; level	FALSE	0.0071 (104)	0.0058 (85)	0.0081 (53)	0.0073 (59)
Topic 57: loan; growth; annual; financial; risk	FALSE	0.0071 (104)	0.0045 (112)	0.0116 (13)	0.0051 (113)

Topic	Topic on Inflation	Total Prevalence	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
Topic 26: framework; macroeconomic; maker; policy maker; policy framework	FALSE	0.007 (108)	0.0095 (39)	0.0063 (100)	0.0053 (107)
Topic 37: market; expectation; participant; market participant; agent	FALSE	0.007 (108)	0.0087 (46)	0.0068 (87)	0.0055 (98)
Topic 95: balance; sheet; balance sheet; bank; credit	FALSE	0.007 (108)	0.0049 (102)	0.0094 (32)	0.0067 (71)
Topic 38: unite; federal; reserve; difference; federal reserve	FALSE	0.0069 (111)	0.0079 (55)	0.0063 (101)	0.0066 (74)
Topic 6: measure; standard; policy measure; monetary policy measure; impact	FALSE	0.0069 (111)	0.0056 (88)	0.0097 (28)	0.0053 (104)
Topic 110: december; month; january; key; march	FALSE	0.0069 (111)	0.0054 (95)	0.0075 (66)	0.0077 (48)
Topic 73: rule; economy; simple; change; approach	FALSE	0.0068 (114)	0.0078 (58)	0.0068 (89)	0.0058 (92)
Topic 70: current; situation; environment; risk; future	FALSE	0.0068 (114)	0.0066 (73)	0.0065 (95)	0.0072 (60)
Topic 22: operation; refinance; refinance operation; main; eurosystem	FALSE	0.0067 (116)	0.0077 (59)	0.0075 (64)	0.0049 (118)
Topic 104: role; play; level; key; good	FALSE	0.0067 (116)	0.0069 (71)	0.0069 (86)	0.0062 (84)
Topic 83: sector; private; private sector; economy; good	FALSE	0.0067 (116)	0.0066 (74)	0.007 (81)	0.0064 (78)
Topic 17: exchange; exchange rate; development; external; account	FALSE	0.0066 (119)	0.0081 (50)	0.0065 (94)	0.0053 (105)
Topic 71: money; issue; payment; account; currency	FALSE	0.0064 (120)	0.008 (53)	0.0059 (105)	0.0053 (109)

Table 2: Highest similarity per period

Order	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
1	**Topic 63**: fiscal; growth; fiscal policy; pact; consolidation (0.99)	**Topic 78**: paper; journal; economics; review; reserve (1)	**Topic 43**: percentage; note; chart; observation; late (0.7)

Order	Prevalence (1999-2011)	Prevalence (2011-2021)	Prevalence (2021-2023)
2	**Topic 16**: reform; structural; structural reform; growth; market (0.92)	**Topic 46**: bank; lend; credit; loan; bank lend (0.9)	**Topic 115**: speech; series; paper; european; bulletin (0.62)
3	**Topic 85**: development; growth; remain; continue; stability (0.75)	**Topic 84**: purchase; continue; asset; ecb interest rate; ecb interest (0.8)	**Topic 52**: raise; meet; normalisation; basis; interest (0.57)
4	**Topic 11**: remain; growth; continue; development; quarter (0.74)	**Topic 4**: purchase; asset; asset purchase; programme; purchase programme (0.78)	**Topic 88**: change; transition; climate; energy; green (0.54)
5	**Topic 64**: remain; medium; expect; medium term; support (0.67)	**Topic 13**: growth; support; loan; remain; continue (0.75)	**Topic 78**: paper; journal; economics; review; reserve (0.4)
6	**Topic 9**: country; convergence; member; eu; process (0.67)	**Topic 92**: bank; negative; deposit; tltro; facility (0.73)	**Topic 15**: pandemic; pepp; support; emergency; purchase (0.33)
7	**Topic 94**: financial; market; integration; financial integration; cross (0.59)	**Topic 28**: bank; union; capital; bank union; european (0.73)	**Topic 12**: war; economy; impact; ukraine; time (0.31)
8	**Topic 117**: analysis; decision; forecast; information; policy decision (0.55)	**Topic 20**: growth; quarter; continue; support; remain (0.69)	**Topic 61**: hand; slide; firm; chart; leave (0.31)
9	**Topic 24**: growth; remain; loan; development; annual (0.52)	**Topic 109**: continue; quarter; remain; real; analysis (0.66)	**Topic 91**: labour; wage; labour market; unemployment; market (0.26)
10	**Topic 75**: country; differential; dispersion; difference; average (0.51)	**Topic 115**: speech; series; paper; european; bulletin (0.61)	**Topic 79**: shock; demand; supply; aggregate; aggregate demand (0.26)
11	**Topic 99**: decision; communication; public; transparency; policy decision (0.49)	**Topic 57**: loan; growth; annual; financial; risk (0.6)	**Topic 46**: bank; lend; credit; loan; bank lend (0.25)
12	**Topic 78**: paper; journal; economics; review; reserve (0.49)	**Topic 21**: sustain; adjustment; path; remain; accommodation (0.58)	**Topic 103**: fiscal; fiscal policy; support; stabilisation; economy (0.24)
13	**Topic 89**: cash; banknote; eurosystem; changeover; national (0.48)	**Topic 53**: germany; people; german; draghi; saver (0.52)	**Topic 112**: income; household; consumption; house; real (0.23)
14	**Topic 23**: single; currency; single currency; single monetary; single monetary policy (0.47)	**Topic 114**: real; interest; interest rate; nominal; equilibrium (0.51)	**Topic 51**: bond; market; yield; government; sovereign (0.22)
15	**Topic 81**: development; money; analysis; growth; aggregate (0.46)	**Topic 1**: model; curve; phillips; phillips curve; estimate (0.47)	**Topic 4**: purchase; asset; asset purchase; programme; purchase programme (0.21)