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Working Paper

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Publication date:

2008-06

Permanent link:

<https://doi.org/10.3929/ethz-a-005640674>

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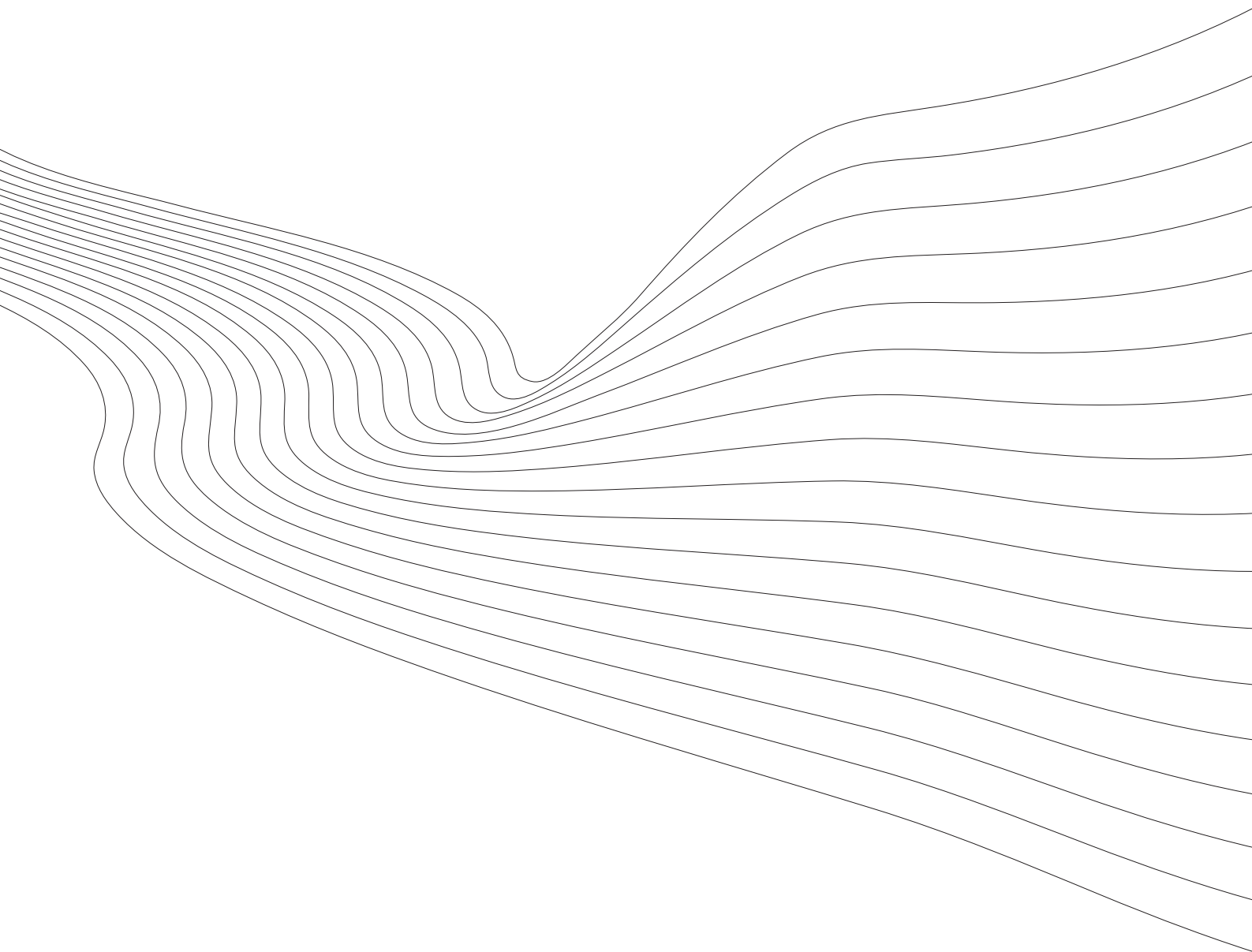
Originally published in:

KOF Working Papers 201

KOF Working Papers

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Formation

Michael J. Lamla and Sarah M. Lein



The Role of Media for Consumers' Inflation Expectation Formation*

Michael J. Lamla[†] and Sarah M. Lein[‡]

Abstract

This paper analyzes the impact of the media on consumers' inflation expectations. We distinguish two channels through which media can influence expectations. First, the intensity of news coverage on inflation plays a role (volume channel). Second, the content of these reports matters (tone channel). Employing a unique data set capturing media reports on inflation in Germany comprising 01/1998–12/2006 we are able to discriminate between these two effects. We find that the volume effect generally improves the accuracy of consumer forecasts while the tone channel induces a media bias.

JEL classification: E52; D83

Keywords: Monetary policy, expectation formation, media coverage, media bias.

*We thank Christine Benesch, Helge Berger, Gernot Doppelhofer, Michael Ehrmann, Ulrich Fritsche, Jan-Egbert Sturm, Oreste Tristani as well as the participants of the CEPR and Bank of Finland Workshop on Expectations and Business Cycles, the SSES Annual Meeting in Lausanne and the Bundesbank research seminar for helpful comments and suggestions. Financial support by the Swiss National Science Foundation (SNF) is gratefully acknowledged.

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1 Introduction

Central banks nowadays often emphasize that managing consumers' inflation expectations has become one of their most important tasks. However, still very little is known about the way consumers form their expectations. This paper attempts to shed some light on the black box of consumers' inflation expectation formation by investigating the role of media as a transmitter and filter of news.

There has been a keen interest in the literature to adequately capture expectation formation. Many recently developed models relax the assumption of perfectly informed fully rational consumers. Rather, consumers are assumed to be sporadically informed and/or inattentive.

A well-known theoretical approach by [Mankiw and Reis \(2002\)](#) develops the idea that information is sticky, which means that economic agents update their expectations only from time to time. Outside their updating periods consumers are inattentive. [Carroll \(2003\)](#) estimates the information updating frequency for the U.S. He provides evidence that consumers update inflation expectations once per year. [Doepke et al. \(2008a\)](#) show that in the euro area consumers update their expectations once every 18 months.¹ One reason for this behavior may be that updating and processing of information in the spirit of [Sims \(2003\)](#) and [Moscarini \(2004\)](#) is costly. In sum, those studies highlight two issues. First, people do not update their information set continuously. Second, they rely on certain common sources to reduce costs of information acquisition.

Our study concentrates on the latter point. We assume that consumers get their macroeconomic views from the media instead of investing time into constantly tracking the latest statistics to produce their own macroeconomic forecast. This plausible assumption follows [Carroll \(2003\)](#). He tests this hypothesis and finds that more frequent media reporting makes consumers' expectations more accurate as it triggers an updating of their beliefs. Therefore, the more media report on inflation, the more likely it is that consumers read these reports and update their beliefs with the full information rational forecast.² Hence, more reporting

¹Empirical support for the sticky information hypothesis is also provided in [Mankiw et al. \(2003\)](#) and [Doepke et al. \(2008b\)](#) for the U.S. and Europe respectively.

²A rational forecast is defined as the forecast of professional economists.

brings consumers inflation expectations closer to the rational forecast.

A point Carroll does not address is the role the content of a media statement plays. It is essential not only to focus on *how often* media report, but also to take into account *what* they report. Articles often discuss whether inflation will be rising or falling. Thus, people consuming a report adopt the opinion given in that article to update their beliefs.

Therefore, we distinguish *two* channels on how media reports may affect consumers' inflation expectations. First, in line with Carroll (2003), we show that the intensity of reporting about inflation matters. This is incorporated in our *volume* channel. If newspapers and TV broadcasts deliver more reports on inflation, the likelihood that consumers obtain new information on inflation developments increases.³ As a consequence this implies that consumers' forecast accuracy improves with higher media coverage.

Second, the *tone* channel captures the content of news reports. The tone of news gives consumers signals in which direction to revise their expectations. Thus, if the media transmit rational forecasts, the tone could in principle improve the forecast of consumers. However, the *tone* can also induce a media bias if, for instance, media exaggerate negative news relative to positive ones.⁴ Hence, the *tone* channel can deteriorate the forecast accuracy if the media report is biased.

To shed light on the importance of the volume and the tone channel we employ a very detailed media data set for Germany. We find support for both channels in Germany: the number of reports on inflation leads to a tightening of the gap between consumers and professional forecasters' expectations. The tone within the report points towards the existence of a media bias: the intensity of news that report rising inflation impairs the accuracy of consumers' expectations. The latter is especially true for the period after the euro cash changeover. Furthermore, we find that news on rising inflation have a stronger effect on expectations than news on falling inflation. News containing statements on inflation in the future or the present inflation improve the accuracy of consumers' forecasts. This is not the

³Here, we also follow Carroll and assume not every person pays close attention to all macroeconomic news; instead, individual people absorb the economic content of news stories probabilistically, such that not every person consumes every inflation report.

⁴For instance, there exists evidence that negative news are reported more often. As an anecdotal example consider the unreported recovery of 1991. It has been argued that this helped Clinton into office. For empirical evidence see also Groeling and Kernell (1998) or Lamla et al. (2007).

case when media report on past inflation: these reports impair consumers' forecasts. News transmitted via TV induce a strong media bias, which is not the case for newspapers. Furthermore, news on the title page of a newspapers' economics section improve the precision of consumers' inflation forecasts. Our findings suggest that media themselves are not just a transmitter of unbiased news. Such a media bias can have important effects on the economy, as, for instance, inflation expectations can be self-fulfilling.⁵ Furthermore, [Berger et al. \(2006\)](#) show that media cover central bank issues intensively and play an important role in the transmission of monetary policy.

The paper is organized as follows. [Section 2](#) derives the hypothesis we test. [Section 3](#) introduces the data and explains the methodology we utilize. In [section 4](#) the results are presented and discussed. [Section 5](#) concludes.

2 Hypotheses

In this section we explore theoretical and empirical evidence with respect to the role media plays in driving inflation expectations.

News reports transmit new information to a broader public. In the transmission process, both the quantity and the content of stories matter. Hence, media can influence inflation expectations of consumers via two channels.⁶

The first channel is the *volume* or quantity channel. More news reporting provides information to consumers, makes them more attentive and triggers the updating of their expectations. If consumer face costs of acquiring, absorbing and processing information, consumers rationally choose to only sporadically update their information ([Reis, 2006](#)). It is unlikely that each consumer has full understanding of macroeconomic dynamics and constantly reviews the latest statistics to produce his own inflation forecast. Also not every person is able to read every article in the continuum of news provided every day. Hence, if there are many news stories on inflation within a given month, it is more likely that a consumer reads or watches these news, and updates his information set. Therefore, our first hypothesis is: *more*

⁵See [Chari et al. \(1998\)](#) for a theoretical model and [Leduc et al. \(2007\)](#) for empirical evidence.

⁶[Doms and Morin \(2004\)](#) also incorporate both channels discussing the relationship between media reporting and consumer sentiment indicators.

media reporting brings consumers' forecasts closer to the rational forecast.

Hypothesis 1 closely follows the line of argumentation in [Carroll \(2003\)](#). Carroll assumes that the media reports the views of professional forecasters, who themselves make rational forecasts. This would imply that consumers update their expectations with the rational forecast. This assumption, however, might not be valid in general. This brings us to the second aspect we need to consider. So far we have only focussed on the consequences of changes in the intensity of the coverage. However, the content of the reports is of major importance as well. This is a point that Carroll does not take into account. However, there are good reasons to believe that also the content is of major relevance.

Generally speaking the content could improve the forecasts of consumers. However, there is remarkable evidence that this is not necessarily the case. For instance the following quotation taken from *The Economist*: “Journalists are writing us into a recession” (4th of October 2006) suggests that media may not only provide information but they might bias the impact of news on consumers' expectations in a certain direction. If the content of media reports is biased, the tone of the report impairs the accuracy of consumers' forecasts. As [Hamilton \(2004\)](#) notes, “news is a commodity, not a mirror image of reality” (p. 7). The reason for this may be the profit maximizing behavior of the media companies. In the decision process which news to transmit, media supply what is demanded: interesting and exciting stories. For instance, exaggerating bad news might be the profit maximizing choice from a media companies point of view. Hence, such news stories might well exaggerate actual developments to provide the story they need to sell. This would imply the existence of a so-called media bias.⁷ [Gentzkow and Shapiro \(2006\)](#) discuss the relevance of ownership structure for the media slant in U.S. newspapers. Moreover, in political science it is a common finding that media can transmit biased news to their consumers ([Hetherington, 1996](#)). [Shah et al. \(1999\)](#) find that the media give only little attention to the economy when it is in good shape but report extensively when it is in bad shape.⁸ [DellaVigna and Kaplan \(2007\)](#) provide evidence that the introduction of biased news reporting has significantly affected voting in the

⁷[Hamilton \(2004\)](#) discusses the choices media have about the question which news to bring into their reports. He shows that “hard news” (such as facts about government and politics) become more and more replaced by “soft news” (human interest and entertainment figures) to give more return to media outlets.

⁸In a similar fashion see also [Groeling and Kernell \(1998\)](#).

U.S. Hetherington (1996) puts forward that media consumption and attention through the mass media negatively shaped voters' retrospective economic assessments in the 1992 election. Doms and Morin (2004) show that news affect consumers perception on the economy by using the R-word index from *The Economist* measuring the frequency of the word "recession" in the media. Overall, these studies suggest that media play an important role in opinion making and also allow for the existence of a media bias.

If indeed consumers update their information sets by absorbing the content provided by the media, the existence of a media bias has consequences for expectation formations. For instance, if in a given month fifty news articles report that inflation will go up and only ten state it will go down, consumers that form their views from the media are more likely to rather revise their expectations upwards than downwards. If no media bias existed, the tone of reports should bring consumer inflation expectations closer to the rational forecast. However, if there is a media bias present, the tone of reports could push away expectations from the rational forecast. We therefore test our hypothesis 2: *the tone of media reporting impairs the accuracy of consumers' forecasts.*

3 Data and Methodology

To analyze this issue we need data for inflation expectations of consumers and the rational forecasts of professional economists as well as a measure for the intensity and content of reporting on inflation in the media in a given period.

3.1 Media Data

For the media reports we rely on data kindly provided by the media research institute Mediatenor.⁹ The data comprises articles and media releases on a monthly frequency for the time span 01/1998–12/2006 in Germany covering statements dealing with inflation which are at least five lines long in case of printed media and last at least five seconds for television broadcasts.¹⁰ The coding is based on the standards of the media content analysis. The data

⁹www.mediatenor.de

¹⁰In detail following news sources are analyzed: Daily press: Frankfurter Allgemeine Zeitung, Welt, Süddeutsche Zeitung, Frankfurter Rundschau, Tageszeitung, Bild, Neue Züricher Zeitung, Berliner, Volksstim-

contain different specifications. We are provided with the overall number of reports in that given period, the amount of reports dealing with rising or falling inflation, whether the focus of the report was mainly the present, the past or the future, if it was distributed via TV or newspaper and whether it is located on the title page or not. From this set following explanatory variables are generated.

News volume. The measure of news intensity (*Volume*) is the number of inflation reports within a given month. We divide all series by the maximum number of reports to scale the variables between zero and one.

News tone. To capture the content of the news stories, we construct a variable summarizing the number of reports on rising inflation (*TonePos*) and in a similar fashion *ToneNeg* denotes reports on falling inflation. Neutral statements with regards to inflation, i.e. statements that do not contain information regarding news on rising or falling inflation, are denoted by *VolumeNeut*. This measure might be of special interest as it allows us to test whether consumers update based on certain information on inflation or whether it may be sufficient to hear about this topic without getting additional information on certain developments. *News time dimension.* Moreover, we are able to count the news stories with regards to the time structure, i.e. whether the story is related to past (*TonePast*), present or future inflation dynamics (*ToneFor*). They are constructed the same way as the overall *Volume* measure, i.e. divided by the maximum of the specific series to rescale the measures between zero and one.

News source. We also control for news stories on inflation transmitted via TV (*VolumeTV*) and those made public via the newspaper (*VolumePaper*). Our results could be driven by a specific type of media. Controlling for the main channels we will be able to account for this.

News visibility. To distinguish between more and less visible stories in the news we create a measure that captures the number of news stories on inflation that have been on a title page (*VolumeTitle*) and those that have been on a title page in the economics section of a newspaper (*VolumeTitleEcon*). Relative to stories places elsewhere those stories might be of

mer, Sächsische, Westdeutsche Allgemeine Zeitung, Kölner Stadt-Anzeiger, Rheinischer Merkur; daily TV-News: ARD Tagesschau, Tagesthemen, ZDF Heute, Heute Journal, RTL Aktuell, SAT.1 18:30, ProSieben Nachrichten; Weekly Press: Spiegel, Focus, Die Woche, Wochenpost, Welt am Sonntag, Bild am Sonntag, Die Zeit.

special importance. Notably title stories should catch the readers attention and therefore be prone to such a media bias.

Finally, we employ simple count variables that capture how often a specific terminology is mentioned in the media. This is mainly due to robustness reasons. The count measures are obtained by searching through LexisNexis, an online database of media articles. We use two popular terms to back up our line of argumentation. First, we count the articles using the term “Teuro” (*Teuro*).¹¹ Analogously, we count the expression “euro Introduction” (*euro*). While the latter has no particular implication for inflation expectations as it just reminds the public of a particular event related to their currency, the first clearly presumes that inflation has been and/or will be rising and therefore may induce a media bias and a deviation from the rational forecast.

3.2 Inflation Expectation Data

Data on consumers’ inflation expectations are taken from the EU business and consumer survey on a monthly frequency. German consumers are being asked whether they expect prices to rise, fall or remain unchanged in the upcoming 12 months (expected inflation). To obtain quantitative measures of inflation expectations from the qualitative survey data we use the methodology proposed by Berk (1999).¹² The method assumes that expectations are normally distributed but does not impose unbiasedness. One advantage of the quantification method is that it directly links the expected inflation rates to the currently perceived inflation rates. A more detailed description is provided in the Appendix.

Inflation expectations from professional forecasters for Germany are constructed from Consensus Economics. In that survey, several professional economists are asked about the inflation prospects of the contemporary and upcoming year.¹³

¹¹ “Teuro” is a concatenation of the words “teuer”, the German equivalent for expensive, and the word euro.

¹²The inflation expectations data has been kindly provided by the Bundesbank. The calculation is described in detail in the Monthly Bulletin of November 2007 and the Appendix of this paper.

¹³Consensus Economics is a macroeconomic survey company. The survey of experts of private and public institutions in Germany asks for economists’ expectations of inflation for the rest of the current and the entire upcoming year. The consensus forecast, used in the paper as a measure of expert expectations, is the mean of these forecasts in Germany. As the time horizon used in this paper is always the 12 month ahead expectation, the data have been transformed to obtain this fixed forecast horizon. We follow the approach commonly used for this type of data and transform the forecast as follows: for month m of a given year t , the expectation

To measure the deviation of consumers from an optimal forecast we calculate the absolute value of the gap of the difference between the consumers survey (C_t) inflation expectations and those of the consensus economics professional forecasters (P_t) as $AbsGapExp_t = ABS(C_t - P_t)$.¹⁴ Our explanatory variables are, in line with Carroll, calculated by dividing the number of stories on inflation in a given month by the maximum number of inflation stories in any year. The tone variables are balance statistics.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
ExpProf	1.38	0.62	0.1	2.8	107
ExpConsBerk	1.47	0.74	0.70	3.9	107
AbsGapExp	0.56	0.44	0	2.3	107
Volume	0.35	0.16	0.1	1	107
VolumeNeut	0.2	0.12	0	1	107
ToneRisInfl	0.18	0.17	0	1	107
ToneFallInfl	0.24	0.22	0	1	107
VolumePast	0.28	0.22	0	1	71
VolumeFor	0.32	0.18	0.03	1	71
VolumeTv	0.15	0.14	0	1	107
VolumeNewspaper	0.42	0.15	0	1	107
VolumeTitleEcon	0.31	0.17	0	1	107
VolumeTitle	0.2	0.2	0	1	107
Teuro	0.09	0.18	0	1	107
EuroIntro	0.12	0.15	0.01	1	107

The summary statistics of our set of variables are given in Table 1. Concerning the variables that form our dependent variable we see that usually consumers have higher expectations than professionals. However, this effect is not statistically significant. Moreover, consumers' inflation expectations are also more volatile. With respect to the ability to forecast inflation [Mestre \(2007\)](#) shows that professional forecasters, also taken from consensus economics, outperform consumer forecasts. The latter contains even a small bias. Overall, both seem reasonable and even consumers expectations do not fare badly compared to simple parametric alternatives for forecasting inflation. To compare the forecast performance of these series in

of inflation is defined as $(13 - m)/12$ times the forecast for year t plus $(m - 1)/12$ times the forecast for year $t + 1$.

¹⁴In the original specification Carroll used the squared gap. However, as this measure might overweight specific incidences we opt to employ the absolute value. Notably, the qualitative results do not change when using the squared gap. Moreover, using the absolute distance makes our measure easier to interpret.

our sample we employ statistics measuring the forecasting accuracy. We use the mean squared error (MSE), the root mean squared error (RMSE) and the Theil’s U statistic. The results are presented in Table 2. These statistics reveal unequivocally that professional forecasters perform much better in forecasting inflation.

Table 2: Accuracy of Inflation Expectations

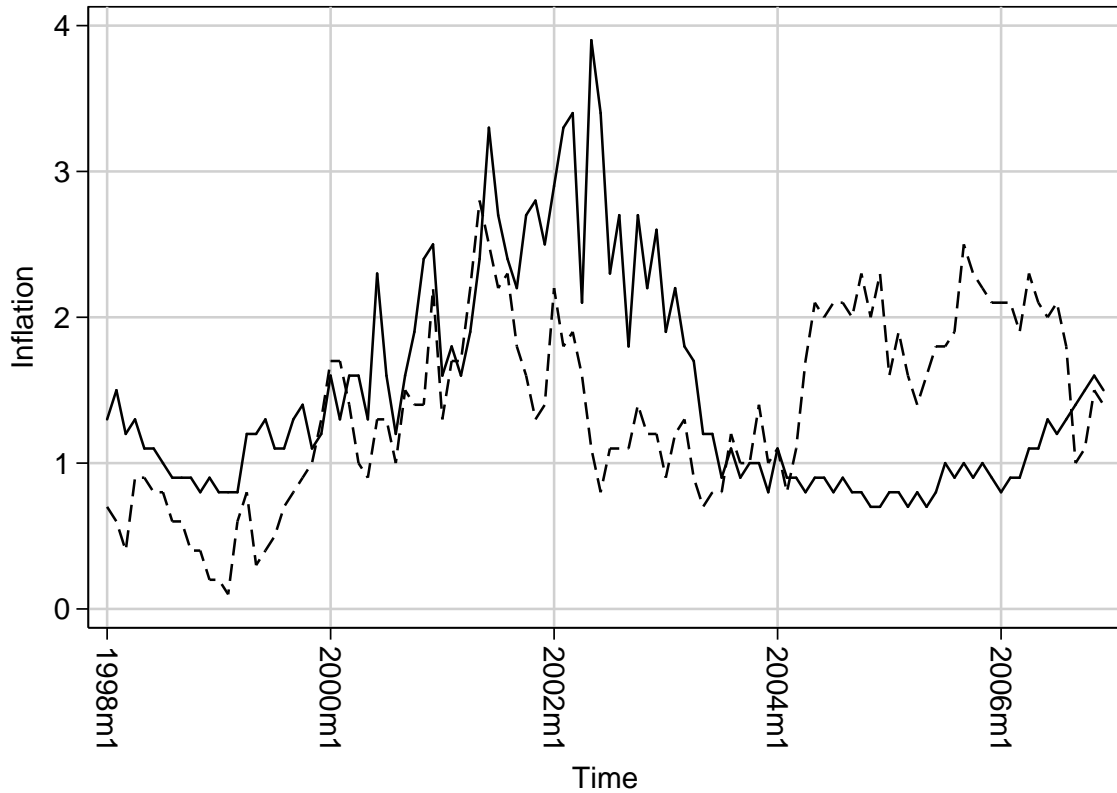
	MSE	RMSE	Theil’s U
Inflation Expectations Professional Forecasters	0.519	0.720	0.207
Inflation Expectations EU Consumer Survey	1.240	1.113	0.494

We plot the different series used in our analysis. First, we concentrate on the relationship between inflation at month t (measured by the harmonized index of consumer prices (HICP)) and inflation expectations of consumers at time t for the 12 month ahead inflation rate (i.e. the expectation for $t + 12$). Both series are plotted in Figure 1. We can observe that until mid 2001 both series were close together and then diverged rapidly and substantially. This may be due to the euro cash changeover in January 2002. In 2003 both again converged. Although in 2004 substantial price increases took place inflation expectations of consumers remain anchored until 2006 when they started moving up.

As our dependent variable is calculated as the difference between expectations of consumers as well as professionals we plot both series in Figure 2. We observe three phases. In the first period until mid 2001 consumer and professionals assessment of future inflation was about equal. This picture changed in 2001 when consumer inflation expectations increased substantially while the expectations of professional reacted moderately. After a peak in mid 2002 consumer inflation expectations began to fall again. Beginning in 2004, expectations of professionals increased while consumer expectations remain at a rather low level.

An important issue is how media coverage is related to current inflation. To picture this we include Figure 3. We can observe that in phases where high inflation was present coverage in the media increased. See for instance mid 2001 where due to bad weather prices of vegetables substantially increased, HICP jumped up and media coverage followed. Another example is the introduction of the euro in January 2002. Contrary to this we can simultaneously observe that there can be high media coverage *without* observing high inflation. Examples for this

Figure 1: Inflation and Inflation Expectations

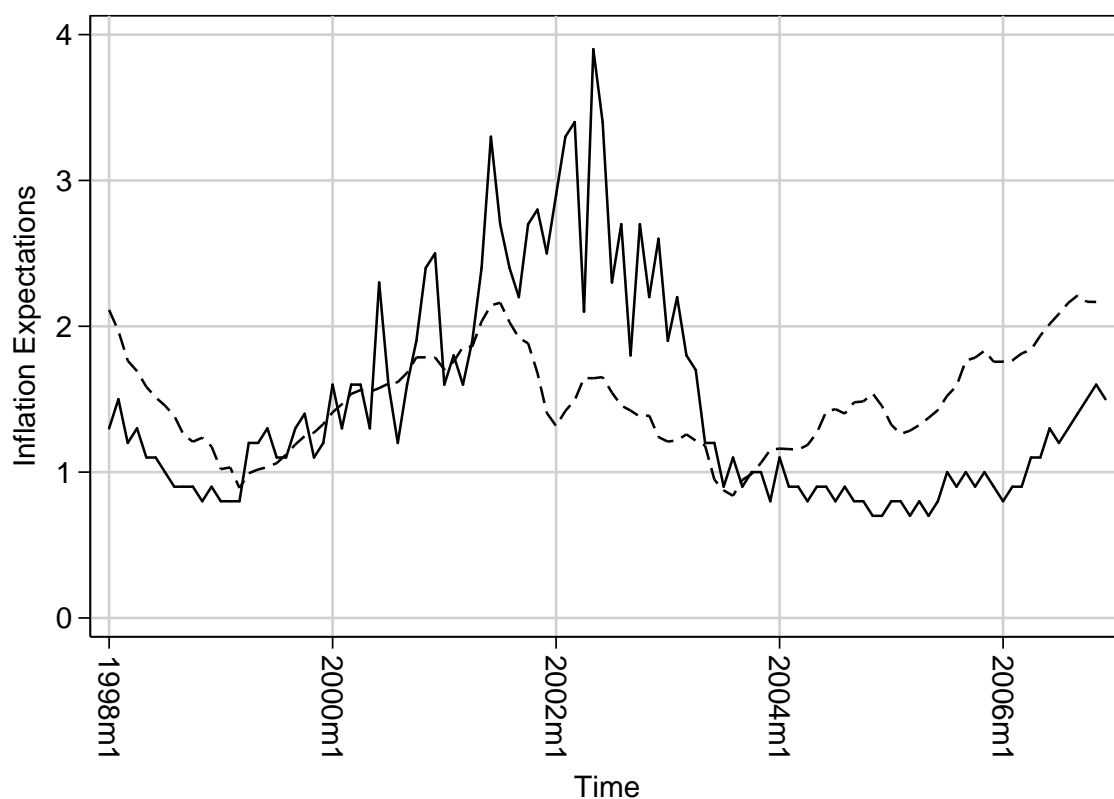


Solid line: Inflation Expectations of German consumers; dashed line: growth rate of the HICP for Germany.

phenomenon can be found in mid 2002 as well as in the beginning of 2003. Thus, media coverage not necessarily comoves with high levels of inflation.

To explore this issue further we disentangle all reports into coverage dealing with rising prices and falling prices and plot them together with HICP in Figure 4. We can observe that if inflation is rising, media reports that inflation is rising and the same vice versa. Thus, media agencies capture the overall dynamics rightly. However, the amount of reporting does not necessary match the magnitude of price changes. Comparing the spikes in 2002 and 2004 visualizes that although inflation was as high the coverage in the media was very different. Moreover, it seems that there is a higher propensity to report more on rising inflation than on falling inflation. This could be related to the argument of Hamilton that there is a certain slant to maximize circulation and in turn profits.

Figure 2: Inflation Expectations: Consumers vs. Professionals

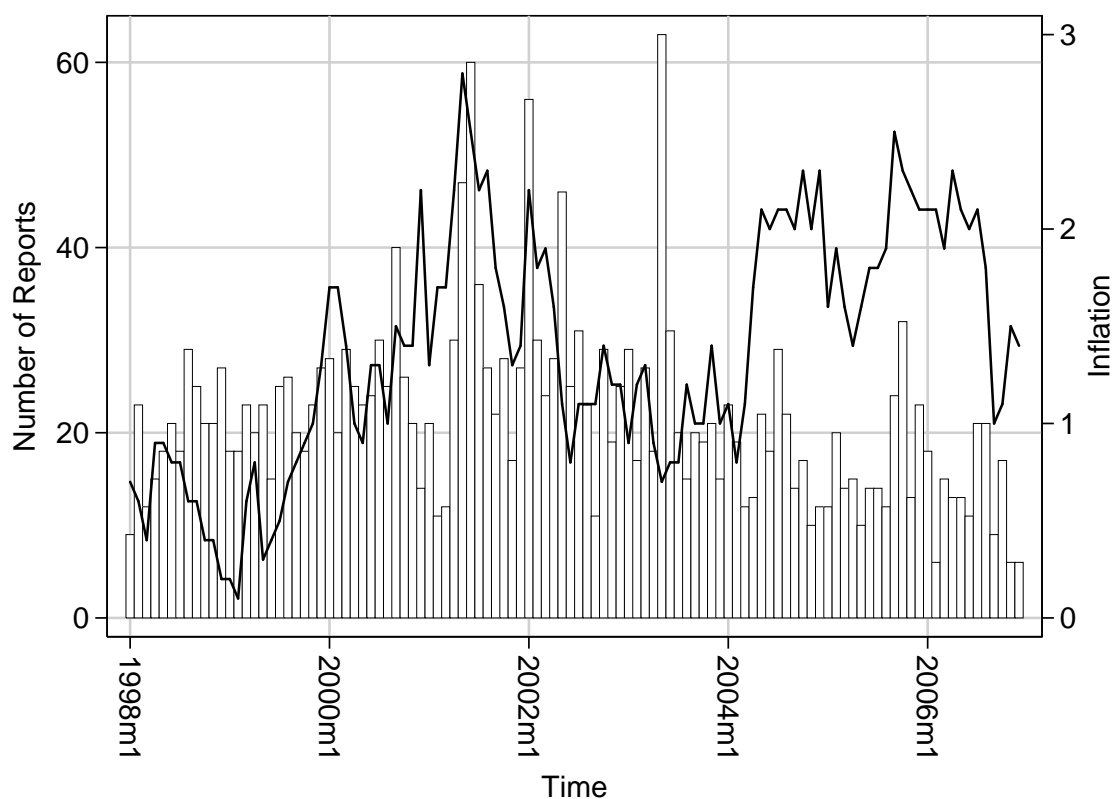


Solid line: Inflation Expectations of German Consumers; dashed line: Inflation Expectations for Germany from Consensus Economics (Professionals).

In order to validate our results we employ further measures. We count the articles dealing with the euro cash changeover and separately with the word “Teuro”. Both series are depicted in Figure 5. The left bar chart represents the amount of articles using the expression “Teuro” within a month, while the right chart counts “euro cash changeover”. The interesting observation is that while the media coverage of the euro cash changeover breaks down rapidly in February 2002, the coverage of the inflationary consequences begins becoming a dominating issue in the media. Moreover, it seems to be in the media for about one year on an above average intensity.

In the next picture we bring together these count variables with our dependent variable. Figure 6 shows that there is clear positive correlation between the amount of articles containing the word “Teuro” and the gap between consumer and professional inflation expectations.

Figure 3: Media Coverage and Inflation

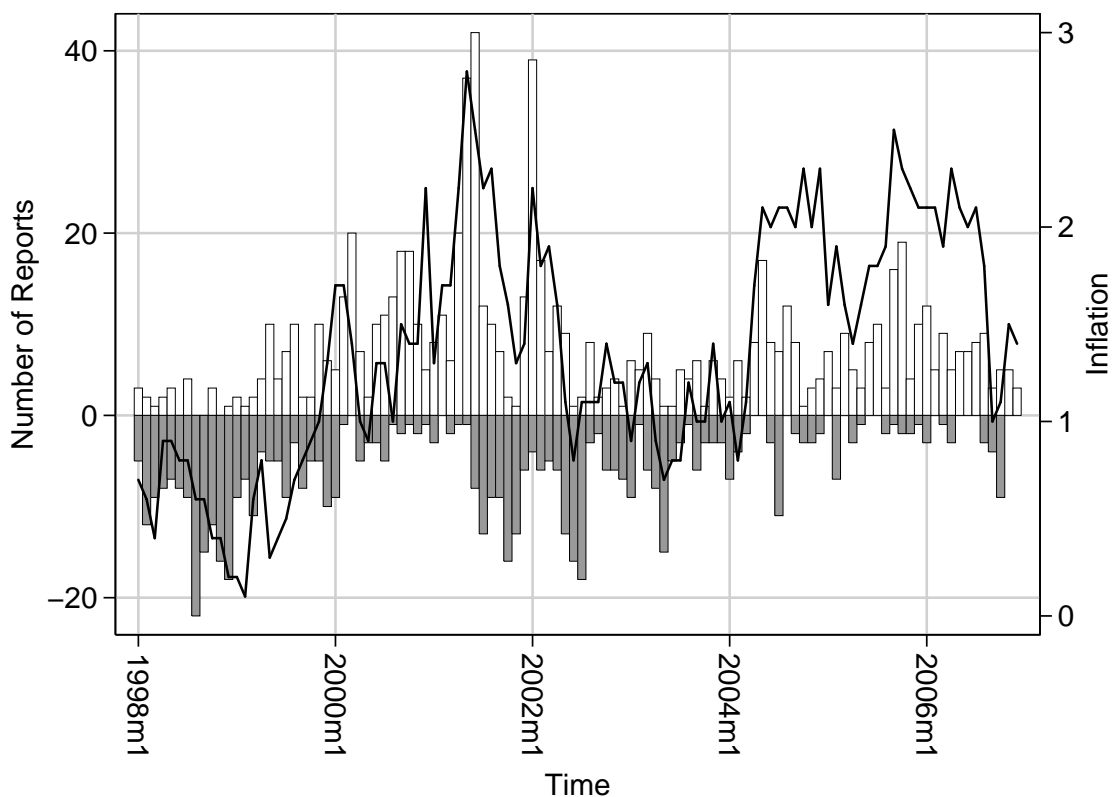


Solid line: Growth rate HICP Germany; bars: Amount of inflation reports in the German media.

This effect is especially predominant in the mid of 2002. Concerning the articles dealing with the introduction of the euro the relationship is less clear. However, it could be that more news on the changeover are associated with a lower disagreement between consumers and professional forecasters.

Finally, we plot our volume variable, representing the amount of articles dealing with inflation and our dependent variable. Figure 7 reveals that, except during the aftermath of the euro cash changeover, there may exist a negative relationship between the amount of reporting and the precision of consumers' inflation forecast. However, after the introduction of the euro coins a different picture emerges, which shows relatively high levels of reporting and a high discrepancy between the inflation expectations.

Figure 4: Media Coverage and Inflation



Solid line: Growth rate HICP Germany; bars: Amount of reports dealing with rising inflation; shaded bars: Amount of reports dealing with falling inflation.

3.3 Methodology

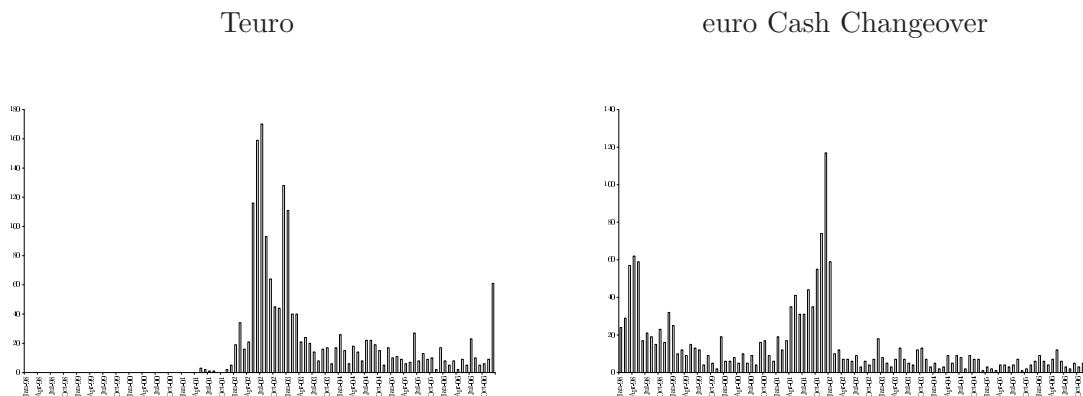
To see whether media reporting plays a role for the deviation of consumers inflation expectations from the rational benchmark, we estimate following equation via OLS controlling for serial correlation using Newey-West standard errors.¹⁵ This specification is the same as employed in Carroll (2003) except that we lag our explanatory variable by one month.¹⁶ To test for the influence of the news volume channel we estimate the Carroll equation

$$AbsGapExp_t = \alpha + \beta Volume_{t-1} + \varepsilon_t. \quad (1)$$

¹⁵Newey-West standard errors are calculated using lag 3. The lag selection is set by the formula $lag = \lfloor 4(T/100)^{2/9} \rfloor$ where T is the number of observations. This formula is suggested by Newey and West (1994).

¹⁶This has been done to reduce the possible impact of reverse causation.

Figure 5: Number of articles containing “Teuro” respectively “Euroeinführung”



Alternatively, we consider further information that might be important. Many of the articles dealing with inflation carry a certain message. For analyzing the rational behavior of consumers it is important to capture the content of those statements. Therefore, we introduce the variable *Tone* to capture the impact of the *tone* channel. Thus the above equation amends to:

$$AbsGapExp_t = \alpha + \beta Volume_{t-1} + \gamma Tone_{t-1} + \varepsilon_t \quad (2)$$

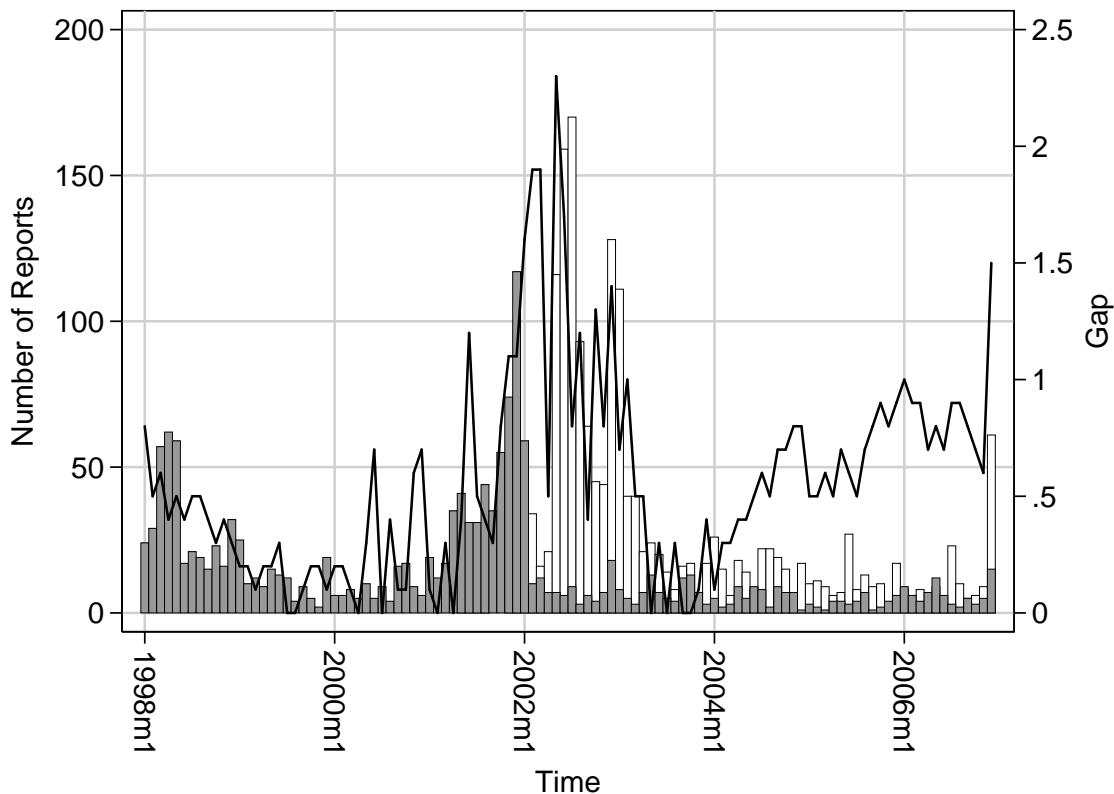
where *Tone* is measured by *TonePos*, *ToneNeg* and (*ToneNeutral*).

For $\beta < 0$ hypothesis 1 is confirmed and the gap between consumers’ and professional forecasters’ inflation expectations narrows with higher news intensity. A media bias would imply that the coefficient estimate for γ would be statistically significant different from zero. This would confirm hypothesis 2.

An interesting aspect with respect to the euro area, which was already mentioned in the introduction, is the euro cash changeover and the debate about the inflationary consequences which were attributed to it. Although the euro cash changeover discussion has not had such strong and visible impact on inflation expectations, as it had on inflation perceptions, still an effect might have also been present for inflation expectations.¹⁷ To control for that effect we

¹⁷Ehrmann (2006) shows that the gap between perceived and actual inflation widened a lot in Germany during the cash changeover. He finds that the complexity of conversion rates explains the variation in this

Figure 6: Teuro and euro introduction vs. Gap Expected Inflation



Solid line: Absolute gap inflation expectations; Bars: Amount of reports dealing containing Teuro; Shaded bars: Amount of reports dealing with the euro introduction.

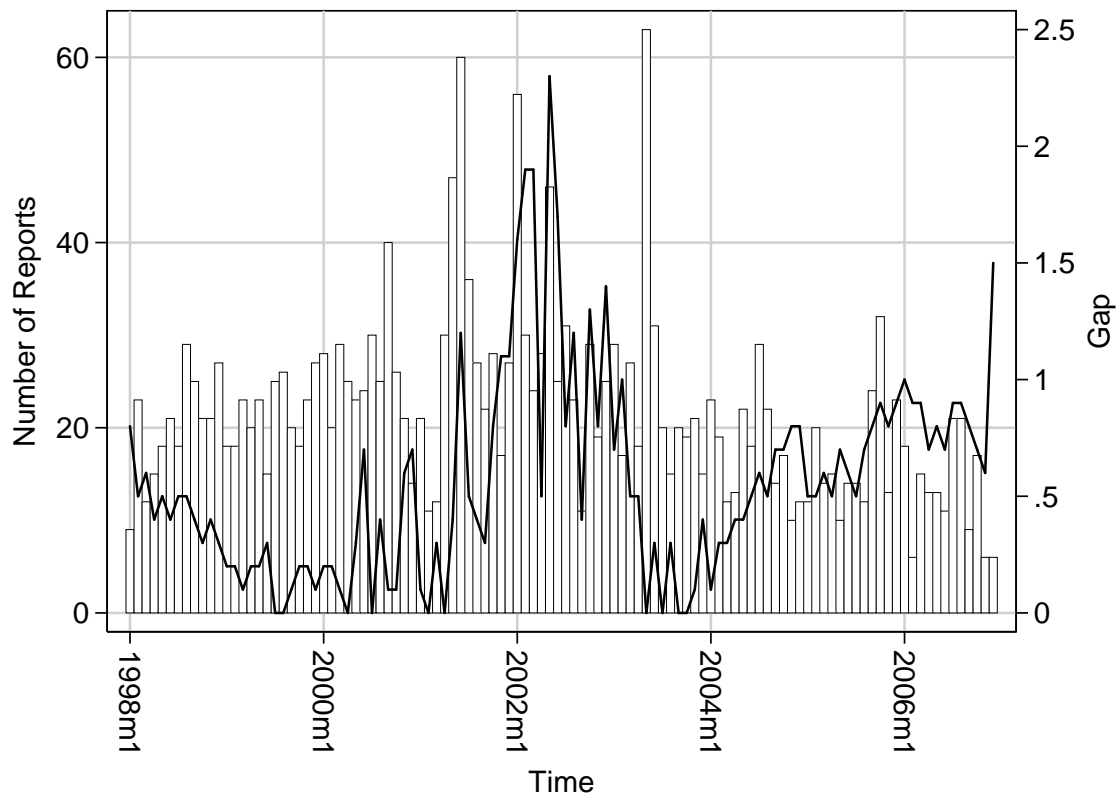
estimate a third specification

$$AbsGapExp_t = \alpha + \delta TEuro_{t-1} + \varepsilon_t, \quad (3)$$

where $TEuro$ specifies either the number of articles containing the expression “euro cash changeover” or, in a further specification, the word “Teuro”.

So far we have employed the *tone* and the *volume* of inflation reports. As expectations are gap across euro Area countries. [Lamla and Lein \(2007\)](#) provide evidence that also media reporting play an important role in explaining this discrepancy. Hence, also inflation expectations could be affected by extensive media coverage in that period. Therefore, it seems sensible to discuss how to account for the effects associated with the euro cash changeover. One obvious way would be to implement dummy variables. With this option one has to decide upon the start and end date of the effect. In order to avoid this possible pitfall we decided to utilize the coverage in the media dealing with the euro cash changeover. While this setup seems to be in line with our media focus we also considered using various dummy variables with different lengths. Even if excluding the rather broad time frame covering 01/2001 until 12/2002 the qualitative results remain.

Figure 7: Media Coverage and Gap Expected Inflation



Solid line: Absolute gap inflation expectations; Bars: Amount of reports dealing with inflation.

by definition related to future events, it seems sensible to control for that as well. To account for this, we construct the variables *VolumeFor*, and *VolumePast* representing the share of news on inflation with main focus on the present and future and the past, respectively.¹⁸ Consequently this yields to a fourth specification represented by equation 4:

$$AbsGapExp_t = \alpha + \beta_f VolumeFor_{t-1} + \beta_p VolumePast_{t-1} + \varepsilon_t. \quad (4)$$

To obtain the relative importance of the news source we distinguish between news on inflation made public via television and via newspapers and magazines. The estimation equation for this specification is defined as

¹⁸Note, as the time dimension is available since the year 2001 the number of observations is significantly reduced.

$$AbsGapExp_t = \alpha + \beta_{TV} VolumeTV_{t-1} + \beta_{Paper} VolumePaper_{t-1} + \varepsilon_t. \quad (5)$$

Finally, the visibility of a news story is most important as the likelihood of absorbing this information is affected by the likelihood of reading the news story. We analyze this issue by regressing the number of headline news stories and the number of headline stories in the economics section on the expectations gap.

$$AbsGapExp_t = \alpha + \beta_{Title} + VolumeTitle_{t-1} + \beta_{Econ} VolumeTitleEcon_{t-1} + \varepsilon_t \quad (6)$$

4 Results

This section presents and discusses the estimated coefficients for our different specifications. Table 3 summarizes the coefficient estimates of the regression setup. The table contains the results which are divided into three blocks. The first block consists of columns (1) and (2), which report the estimates of equation 1. In column (1) we use all observations but control for the euro cash changeover period by including a dummy that is equal to one for the period 06/2001–12/2002 and zero otherwise. We choose this period due to the fact that during the euro cash changeover period inflation perceptions displayed very unusual patterns in Germany, which might also feed into expectations. As the dummy variable is significant, we exclude this period in the regression reported in column (2). Indeed, we can observe that the sign of the coefficient estimate capturing the volume effect is negative. This is in line with Carroll’s hypothesis, i.e. that more media reporting improves forecast accuracy of consumers.

The second block consisting of columns (3) and (4) reports the estimates of regression equation 3 where we include the number of news stories using the terms “Teuro” respectively “euro changeover”. As expected, the number of news stories discussing a Teuro effect increases the gap between consumers’ and professional forecasters’ inflation expectations. The more neutral expression “euro changeover” does not have a significant effect. Note that if we exclude the euro changeover period the “euro changeover” variable becomes negative and

significant. Thus we can confirm, using rather simple measures compared to (1) and (2), Carroll’s hypothesis for Germany. In addition, we find also strong evidence for the deteriorating effect media can have on expectations using the variable “Teuro”.

In the third block we explore the impact of media by adding explanatory variables. Employing an explanatory variable that contains no specific information whether inflation is rising or falling column (5) reveals that these stories narrow the gap. This regression is necessary to infer whether updating described by Carroll is triggered by stories that contain a tone or by dealing with the phenomenon inflation in general. With this regression we can conclude that the updating is triggered by making the people attentive towards this topic.

We control for the *Tone* effect by checking the impact of news on rising respectively falling inflation following equation 2. Column (6) and (7) include the number of news reports on falling and rising inflation separately. In Column (6) we use all observation, while we exclude the changeover period in Column (7). The coefficient on rising inflation is positive in Column (6), indicating that news stories on rising inflation increase the expectation gap and hence drive consumers’ forecasts away from the rational benchmark. The effect seems to be largely driven by the changeover period, as this effect is no longer significant when excluding this period (Column (7)). In this case the news on falling inflation show a negative sign, indicating a decrease of the expectation gap.

The importance of the time dimension that a specific news story is related to is tested in Column (8). We find opposite effects here: whereas articles related to past inflation induce a bias in consumers’ expectations, news related to current or future inflation reduce the expectation gap. This may be explained by the evidence that people usually have a very imperfect concept of past price developments.¹⁹

In Column (9) we show the regression results for the news stories in TV and newspapers separately. Interestingly, the consumption of TV news on inflation introduces a sizeable bias, whereas the consumption of newspaper articles has the opposite but smaller effect: it reduces the expectation gap.

Also the visibility of news plays a role. As we show in Columns (10) and (11), a title news

¹⁹Cestari et al. (2007) show that people overestimate the price changes of the euro introduction by referring to price for cinema tickets up to 20 years ago.

story on inflation in the economics section reduces consumers' bias. This result is significant only for the period excluding the changeover, which indicates that even on economics section headlines reporting was different during the period 2002/2003. The insignificance of the variable capturing the effect of title page stories may be related to the media campaign around the euro introduction. As the title pages should attract the attention of consumers those stories are likely to be slanted.

Overall, our results support the findings of [Carroll \(2003\)](#) that more news triggers updating and information processing which finally transmits into an improved consumer inflation forecast (smaller gap). However, the relationship between media and inflation expectations is more complex. Our findings show that media can introduce a bias as reporting on rising inflation may be exaggerated and people may deviate from the rational forecast. Thus, we provide evidence that indeed both channels matter.

4.1 Robustness

Finally, we would like to address some general issue with respect to endogeneity and causality. One could argue that news are partly demand driven, hence that newspapers are biased towards consumers' prior opinions ([Gentzkow and Shapiro, 2006](#)).

Nevertheless, there are some good reasons that this issue does not play a crucial role in the setup chosen in this work. First, in the estimation the indicator is employed with one period lag, using data covering news of the preceding month relative to the questionnaire that establishes the inflation expectations. Thus, per definition, news of the last period cannot be demanded by expectations today.

A widely acknowledged way to deal with endogeneity issues as well as to investigate whether a specific notion of causality is present, is to employ vector autoregressions (VAR). Following this path, we also intend to tackle concerns with respect to the estimation setup using the Newey-West correction for autocorrelation. For this purpose we set up a system consisting of the variables *Volume* and *absGapExp*. In addition, in order to control for real shocks to inflation we introduce real-time figures of the Harmonized Index of Consumer Prices (HICP) for Germany as well as a set of dummy variables for each month. If media just report

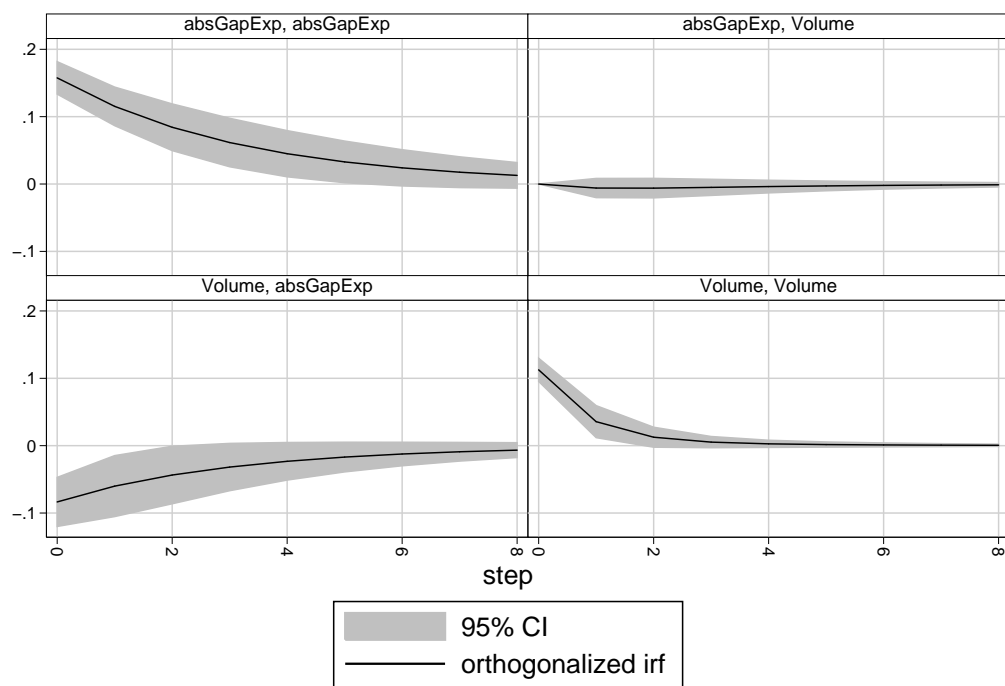
Table 3: Results - Newey West

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Volume	-0.118 (0.299)	-0.640*** (0.242)									
Dchangeover	0.588*** (0.150)										
Teuro			0.005*** (0.001)								
EuroIntro				0.006 (0.004)							
VolumeNeut					-0.567** (0.225)						
ToneRisInfl						0.765* (0.461)	-0.182 (0.403)				
ToneFallInfl						0.251 (0.293)	-0.406** (0.191)				
VolumePast								0.333* (0.173)			
VolumeFor								-0.530*** (0.176)			
VolumeTv									1.439*** (0.352)		
VolumeNewspaper									-0.542** (0.263)		
VolumeTitle										0.007 (0.164)	-0.032 (0.130)
VolumeTitleEcon										-0.262 (0.194)	-0.330** (0.165)
Constant	0.463*** (0.116)	0.629*** (0.101)	0.476*** (0.068)	0.475*** (0.084)	0.533*** (0.075)	0.359*** (0.123)	0.539*** (0.111)	0.582*** (0.115)	0.568*** (0.122)	0.636*** (0.087)	0.536*** (0.084)
Observations	106	82	106	106	82	106	82	46	106	106	82

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

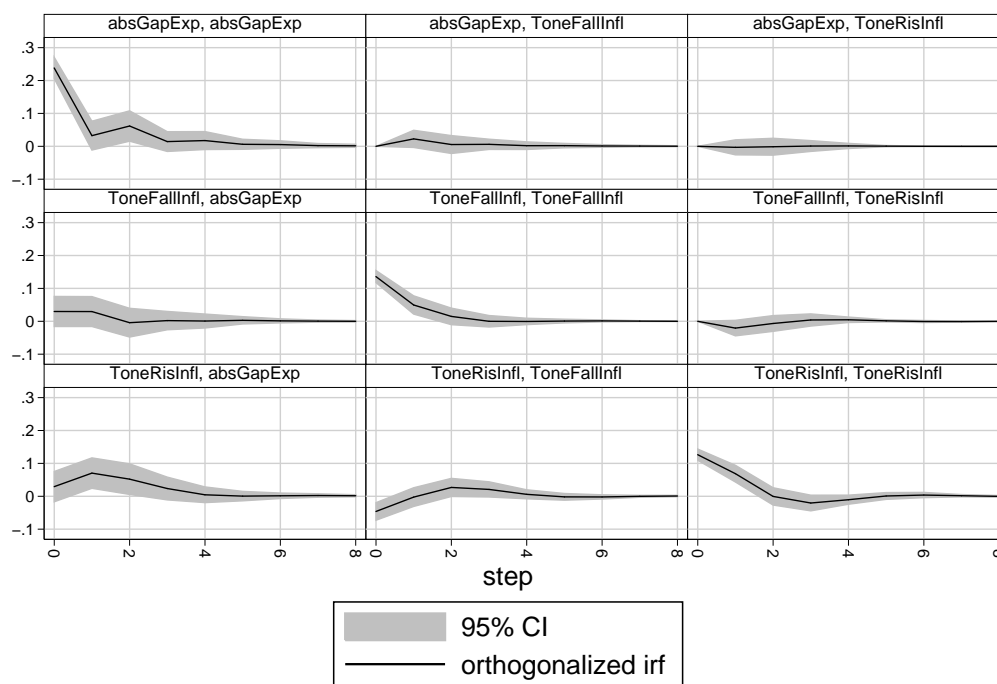
Figure 8: Vector Autoregression



Graphs by impulse variable, and response variable

Shaded area represents confidence intervals of two standard deviations.

Figure 9: Vector Autoregression - Response to Tone



Graphs by impulse variable, and response variable

Shaded area represents confidence intervals of two standard deviations.

what is happening in the real world, this would imply that no extra effect of media would be present. Figure 8 depicts the graphs of the impulse responses to specific shocks.²⁰ We observe that the the volume channel has an impact on the gap but not vice versa. This observations is backed up by Granger causality tests applied. Finally, we conduct the same exercise using the Tone measures. The results of the estimation are presented in Figure 9. We observe that news on rising inflation have a more pronounced impact, compared to news on falling inflation.

²⁰We estimated several VAR systems using various length selection criteria and orderings. Moreover, month as well as year dummies have been incorporated. However, the results remain unchanged.

5 Conclusion

In this paper we identify two channels via which media influence consumers' inflation expectations. On the one hand, the *quantity* of media reports matters. A higher intensity of reporting makes consumers more likely to pick up news on inflation, induces an update of their expectations and brings them closer to the full information rational forecast. This is what we call the *volume* channel. On the other hand, the *quality* of reporting matters. Media reports often contain an opinion or a tone, which is then taken up by consumers. This is what we label *tone* channel. If media reports are biased, i.e. if they transmit exaggerated or incomplete information, consuming these reports distorts the accuracy of forecasts.

Using a detailed media data set for Germany, we provide evidence that both channels play a role. Overall, our results support the view of [Carroll \(2003\)](#) that indeed more news lead to more updating and information processing which finally eventuates in a better inflation forecasts. Furthermore, we highlight that, contrary to the positive impact of the amount of news, the specific content of news impairs consumers' forecasts. Moreover, our results indicate the special role of the euro cash changeover. Especially, the "Teuro" debate has significantly increased the gap. Looking at further dimensions in media reporting, we show that: (i) the effect of reporting is asymmetric: news on rising inflation induce a media bias whereas news on falling inflation don't. (ii) The content of news matters with respect to the time horizon it addresses: the inflation reports that transmit a message related to the present and future significantly improve the quality of expectations, whereas reports dealing with past inflation deteriorate the rationality consumers' expectations. (iii) Articles from newspapers narrow the gap especially if they are located in the headers of economics sections. (iv) TV news induce a relatively strong media bias. Our results even remain if we control for possible endogeneity issues as well as shocks in real inflation figures.

Our findings have important implications for the discussions on modeling expectation formation, the role of media agencies and the assumptions on rationality of consumers' economic behavior: media can have the power to bias consumers' expectations. Such a media bias can have important effects on the economy, as inflation expectations can be self-fulfilling

(Leduc et al., 2007). Hence, for understanding expectation formation and inflation dynamics, the role of media and the failure to digest the optimal amount of information should clearly be taken into account. Thus, in line with Berger et al. (2006) we argue that media is an important factor for the conduct of central banking as it may affect its credibility and effectiveness.

Appendix

Quantifying consumers inflation expectations

The quantification of inflation expectations rests on the method proposed by [Berk \(1999\)](#) and is applied on the consumer survey data collected by the EU Commission. The questions and response categories are as follows:

1. Prices today compared to 12 months ago (a) risen a lot, (b) risen moderately, (c) risen slightly, (d) stayed about the same, (e) fallen f) don't know?
2. Do you expect prices over the next 12 months (a) increase more rapidly, (b) increase at the same rate, (c) increase at a slower rate, (d) to stay about the same, (e) to fall, f) don't know?

Each consumer chooses one of the six answer categories. The quantification of qualitative responses is achieved by exploiting the fact that the question regarding future price movements links the answer about the expected rate of inflation to the rate currently perceived. Each consumer answers the question about the expected inflation one year ahead on the basis of a subjective conditional probability distribution. This distribution is conditional on the information set available to the consumer at the time of the survey. Agents are then supposed to report that no change in the price level is expected if the expected future inflation rate falls within an interval centered around zero. Similarly, agents will report that no change in the rate of inflation is expected if their expectation falls within an interval centered on the price increase that they perceived to have occurred in the past year. The boundaries of both intervals, denoted as the response thresholds, are to be determined by the data. The 'don't know' category is always excluded. The distribution of the expectations is assumed to be normal. As the expectations are directly linked to the currently perceived inflation rate, [Berk](#) proposes to quantify the perceived rate of inflation using the method of [Carlson and Parkin](#)

(1975), assuming that the long-run mean of perceived inflation rates equals the long-run mean of actual inflation.

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