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Anchoring of Consumers' Inflation Expectations: Evidence from Microdata

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PRELIMINARY AND INCOMPLETE

Abstract

In this paper we explore the degree of anchoring of inflation expectations of consumers by analysing the comovement in short- and long-run expectations. If inflation expectations are firmly anchored, a transitory shock should influence the short-run inflation expectations but not effect long-run inflation expectations. Utilizing the University of Michigan Survey of Consumer's rotating panel microstructure, we can identify and analyse to which extend individuals adjust their short- and long-run inflation expectations within six months. Our results indicate that inflation expectations became more anchored over time. Interestingly, the comovement fell substantially after 1996 which is characterised by the pre-preemptive tightening of the FED and not with the Volker Disinflation. Analysing the probability of revising long- and short-run expectations simultaneously, we find no such structural change in time. Hence, while the comovement has become smaller over time the probability of adjusting long- and short-run expectations has remained unaffected. Looking at the current economic crises the comovement dropped between 2008-09 and since then is rising again. Regarding the possible determinants of the strength of comovement we find that high inflation, higher levels of expected inflation of professional forecasters and news on inflation as well as news on fiscal deficits lead to a greater comovement and hence a lower anchoring of inflation expectations. On the other hand tighter monetary policy improves the degree of anchoring.

Keywords: Anchoring, inflation expectations, microdata.

JEL classification: E31.

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1 Introduction

To anchor inflation expectations around an implicit or explicit inflation target is one of the most important tasks of monetary policy aiming to stabilize inflation (Bernanke, 2007). Well-anchored expectations enables inflation-targeting central banks to achieve greater stability of output and employment in the short-run, while ensuring price stability in the long-run (Orphanides and Williams, 2007). Consequently, every communication of central banks includes a phrase on how well anchored inflation expectations are. Especially since the outbreak of the recent financial crisis and the ultra-expansionary monetary policy stance since then, politicians and central bankers closely monitor the degree of anchoring.

In this paper we investigate how anchored consumers' inflation expectations are by analyzing the comovement between short- and long-run inflation expectations. If inflation expectations are firmly anchored, a transitory shock should influence the short-run inflation expectations but should have no significant effect on long-run inflation expectations.

Our analysis is based on the consumers' individual inflation expectations in the US are measured with the microdata from the University of Michigan Survey of Consumers. For a sound identification of the adjustments of individual expectations over time, we use the rotating panel dimension of the survey where 40% of the respondents are re-interviewed after six months. This allows to track inflation expectations over a period of six months. As the survey captures both short- and long-run expectations as well as economic news perceived by the individuals, we can test for the strength of the comovement of short- and long-run inflation expectations and at the same time control for macroeconomic variables and news effects.

There exist a large body of literature on the anchoring of inflation expectations where our paper is related to. However, there is no unified approach to identify "anchored inflation expectations". Approaches taken in the literature range from looking at the behavior of time series like deviations of inflation expectations from an inflation target or the dispersion of inflation expectations to more elaborated strategies using advanced econometrics techniques that consider the response of high frequency financial market data.

Straightforward strategies to measure the anchoring of inflation expectations include analyzing the level, the volatility and the dispersion of expectations from survey data. Coibion and Gorodnichenko (2010) derive a rationality test for expectations under the alternative hypothesis of information frictions affecting the expectation formation process. The test may be extended to allow for an effect of anchoring due to inflation targeting or central bank independence, where the authors argue that both should reduce inflation volatility and, hence, also attention towards inflation. Doovern et al. (2012) analyze disagreement among professional forecasters and state that anchored expectations implies that mean expectations stabilize at some target level and that cross-sectional dispersion

is reduced. Both [Coibion and Gorodnichenko \(2010\)](#) as well as [Dovern et al. \(2012\)](#) report evidence that central bank independence improves the anchoring of inflation expectations.

Another strand of the literature defines expectations at different horizons as anchored if changes in expectations are insensitive to macroeconomic news. Again, inflation expectations are derived from high-frequency financial markets data, where forward rates for different maturities correspond to inflation expectations at different horizons. Studies by [Beechey et al. \(2011\)](#), [Levin et al. \(2004\)](#) and [Gürkaynak et al. \(2007, 2010\)](#) generally find that long-run expectations are more anchored, i.e. less sensitive to economic news, than short-run expectations. Similarly, inflation expectations in inflation targeting countries appear better anchored.

Under the definition closest to our approach, inflation expectations are assumed to be anchored if changes in short-run expectations have no or little impact on long-run expectations. This is measured with the inflation pass-through criterion in [Jochmann et al. \(2010\)](#) and [Gefang et al. \(2012\)](#). Both studies extract short- and long-run inflation expectations from high-frequency data on forward inflation compensation in the US and the UK bond markets. The authors test for the hypotheses of anchored, unmoored or contained expectations. Results suggest that inflation expectations are contained, where in the UK expectations seem constrained by the inflation target. Given our sound identification over time and over the cross section we can directly access the degree of comovement.

While most studies in the literature study the anchoring of inflation expectations from professional forecasters or from financial market data, in this paper we evaluate the anchoring of consumers' inflation expectations. We argue that the anchoring of consumers' expectations should be of equal importance to monetary policy makers, since through their wage-setting and consumption-saving decisions, this group has an important impact on an economy's inflation development. To our knowledge the only approach that studies the anchoring of consumers' expectations so far is the study by [Easaw et al. \(2012\)](#) who extend the epidemiological model by [Carroll \(2003\)](#) to test whether households anchor their expectations to professionals' forecasts or on the official inflation target. For a dataset of Italian consumers, the authors report that households anchor more on professionals' inflation forecast than on the ECB's inflation target.

The remainder of the paper is structured as follows...

2 The Data

We analyze microdata from the University of Michigan Survey of Consumers, which is available for the sample period January 1978 to November 2011.

For the analysis of the dynamics of individuals' inflation expectations, we exploit the fact that the Michigan Survey of Consumers includes a rotating panel: Each month, a randomly determined sub-sample of households is chosen to be re-interviewed six months after the first interview. The complete cross-section each month includes about 40% of

individuals that are interviewed for the second time.¹ Via the rotating panel structure of the survey, we are able to identify changes in expectations on an individual consumer level.

In order to identify individual changes in inflation expectations at a micro level, we follow Souleles (2004) and Pfajfar and Santoro (2013) and restrict our sample to households where the same person answered both interviews. We thus keep all pairs of observations in the rotating panel, where the interviews were six months apart and where the respondent reported the same sex, race as well as month and year of birth. Additionally, we control for the age of the respondent and only allow increases by one year between interviews. In order to rule out extreme values for inflation expectations, we further truncate our sample by excluding the upper and lower 2.5% of the distribution of both short- and long-run quantitative inflation expectations.²

For the evaluation of changes in individuals' inflation expectations, we use the questions from the survey asking for individuals' qualitative and quantitative estimates of short-run and long-run inflation expectations. The precise questions of the survey read:

- A12. "During the next 12 months, do you think that prices in general will go up, or go down, or stay where they are now?"
1. GO UP 3. STAY THE SAME 5. GO DOWN 8. DON'T KNOW
- A12b. "By about what percent do you expect prices to go (up/down) on the average, during the next 12 months?"
- A13. "What about the outlook for prices over the next 5 to 10 years? Do you think prices will be higher, about the same, or lower, 5 to 10 years from now?"
1. HIGHER 3. STAY THE SAME 5. LOWER 8. DON'T KNOW
- A13b. "By about what percent per year do you expect prices to go (up/down) on the average, during the next 5 to 10 years?"

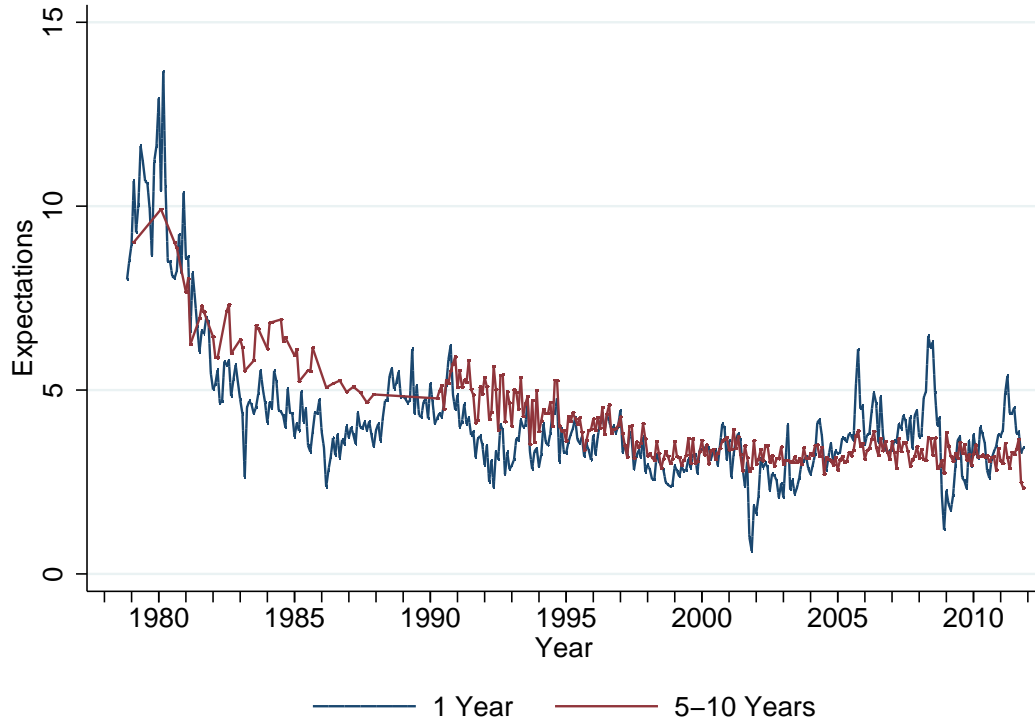
Time series of consumers' mean quantitative short- and long-run inflation expectations from the Michigan Survey are presented in Figure 1. Both short- and long-run inflation expectations declined considerably during the disinflation period in the 1980s. After a period of stabilization, it seems that short-run expectations became more volatile after 2002, while long-run expectations remained stable at around 3%.

As we are also interested in evaluating the role of news effects on the stability of inflation expectations, we employ the question in the Michigan Survey of Consumers asking for news on the economy heard by the respondent as a measure of perceived news

¹For further details on the University of Michigan Survey of Consumers, see <http://www.sca.isr.umich.edu>.

²For a detailed description of the rotating panel dimension of the Michigan Survey of Consumers and our identification of individuals in the rotating panel, see Dräger and Lamla (2012).

Figure 1: Short- and Long-run Inflation Expectations



regarding inflation and other potentially relevant topics. The wording of the question is as follows:

- A6. "During the last few months, have you heard of any favorable or unfavorable changes in business conditions?"
1. YES 2. NO

If the question is answered with "yes", an open question with two possible answers follows:

- A6a. "What did you hear? (Have you heard of any other favorable or unfavorable changes in business conditions?)"

The answers are coded into categories by the Michigan Survey of Consumers. For our purposes, we construct a dummy variable "newsheard" if respondents recalled any economic news, "newsprices" which takes on the value of 1 if the respondent reported news heard on either "falling prices/deflation", "high prices/inflation", "higher prices/inflation is good" or "lower, stable prices/less inflation" as either the first or the second piece of news heard, and zero otherwise. Additionally, we distinguish between news heard about high and low inflation or prices with the dummy variables "newsprices_high" and "newsprices_low". In order to be able to distinguish between favorable or unfavorable news regarding inflation, we further construct the dummy variables "newsprices_bad"

and “newsprices_good”. We code news on “*higher prices/inflation is good*” and on “*lower, stable prices/less inflation*” as favorably perceived by the respondent, while the other two categories are coded as unfavorable news. Furthermore we control for news on the stance of monetary policy but also on government finances. Specifically if the respondents reported news heard on “*tight money interest rates high*” and “*easier money, credit easy to get, low interest rates*” as well as “*Fiscal Policy budget deficit*”.

Furthermore, we control for a number of sociodemographic characteristics captured in the Michigan Survey of Consumers such as age and sex of the respondent as well as income quartiles and a categorical variable measuring education of the respondent in six categories. These are defined as follows: Educ1 – “*Grade 0-8, no high school diploma*”, Educ2 – “*Grade 9-12, no high school diploma*”, Educ3 – “*Grade 0-12, with high school diploma*”, Educ4 – “*4 yrs. of college, no degree*”, Educ5 – “*3 yrs. of college, with degree*” and Educ6 – “*4 yrs. of college, with degree*”.

In addition to the microdata from the Michigan Survey of Consumers, we utilize additional data. We use quarterly data of inflation expectations regarding U.S. inflation from the Survey of Professional Forecasters (SPF), which is available from 1981q3 onwards for one-year-ahead inflation forecasts, and from 1991q4 onwards for ten-years-ahead inflation forecasts. As a measure of cross-sectional dispersion and, thus, as a proxy for professional forecasters’ disagreement, we include the interquartile range from the SPF for both one-year-ahead and ten-years-ahead inflation forecasts. Finally, we account for the attention of the media to topics related to U.S. inflation with the number of articles published on U.S. inflation in the New York Times. This measure of external information is obtained from the media research institute MediaTenor and is available on a monthly basis from 1998m1 to 2011m5.³ In addition we use data on consumer inflation, oil prices and the federal funds target rate.

3 Anchored inflation expectations

To picture the time-varying degree of anchoring of expectations we run the following rolling regression of the form:

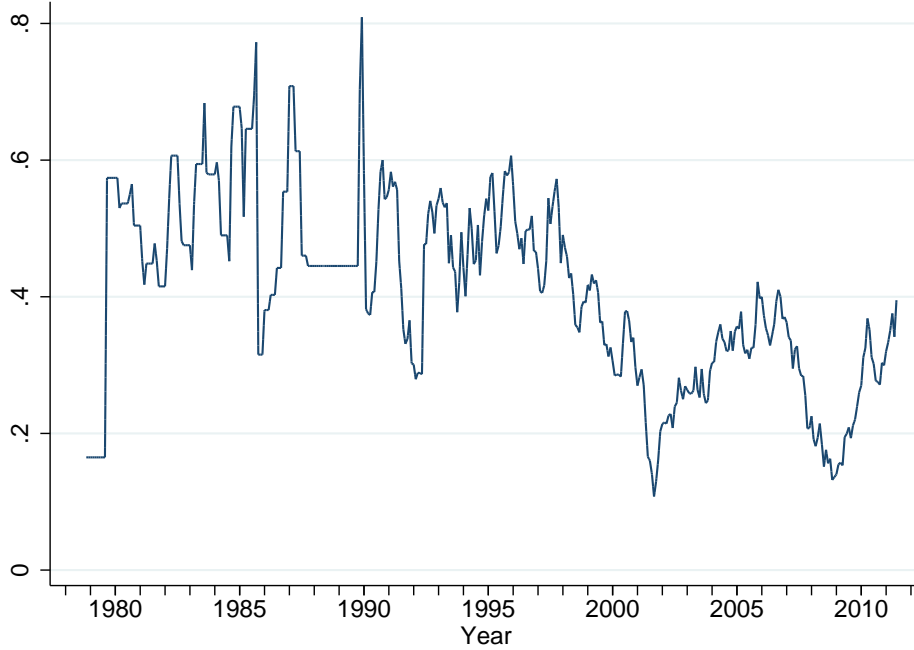
$$y_t(n) = X_t(n)\beta_t(n) + \varepsilon_t, t = 1, \dots, T$$

where $y_t(n)$ is an $(n \times 1)$ vector of observations on the response, $X_t(n)$ is an $(n \times k)$ matrix of explanatory variables, $\beta_t(n)$ is an $(k \times 1)$ vector of regression parameters and $\varepsilon_t(n)$ is an $(n \times 1)$ vector of error terms. The n observations in $y_t(n)$ and $X_t(n)$ are the n most recent values from times $t - n + 1$ to t . For our purpose we estimate the following model:

$$\Delta\pi_t^{e(5-10y)} = \alpha_t + \beta_t\Delta\pi_t^{e(1y)} + \varepsilon_t, \quad (1)$$

³This data is coded by humans following the standards of media content analysis.

Figure 2: Comovement in changes in short- and long-run inflation expectations



Note: Regression coefficient β_t from equation (1) is plotted, describing effect of a change in one-year ahead expectations on the change of 5-10 year ahead expectations.

where $\Delta\pi_t^{e(5-10y)}$ is the change in 5-10 years inflation expectations over six months and $\Delta\pi_t^{e(1y)}$ is the corresponding change in short-run inflation expectations. We are interested in the strength of the comovement between an adjustment in long-run expectations and short-run expectations. If long-run expectations are firmly anchored (this can be shown by...) the coefficient β should be statistically insignificant. We run this estimation for the whole sample but also for a rolling window of six months. Table 1 the summary statistics while Figure 2 shows the time variation of the coefficient β . As regards the summary statistics we can see that a 1% increase in short-run inflation expectations leads to an increase of 0.28% in long-run expectations on average. However, this comovement varies substantially. It can rise up to 0.62% and be as low as 0%. The table furthermore offers the amount of average observations we have in our regression which amounts to 414 on average.⁴

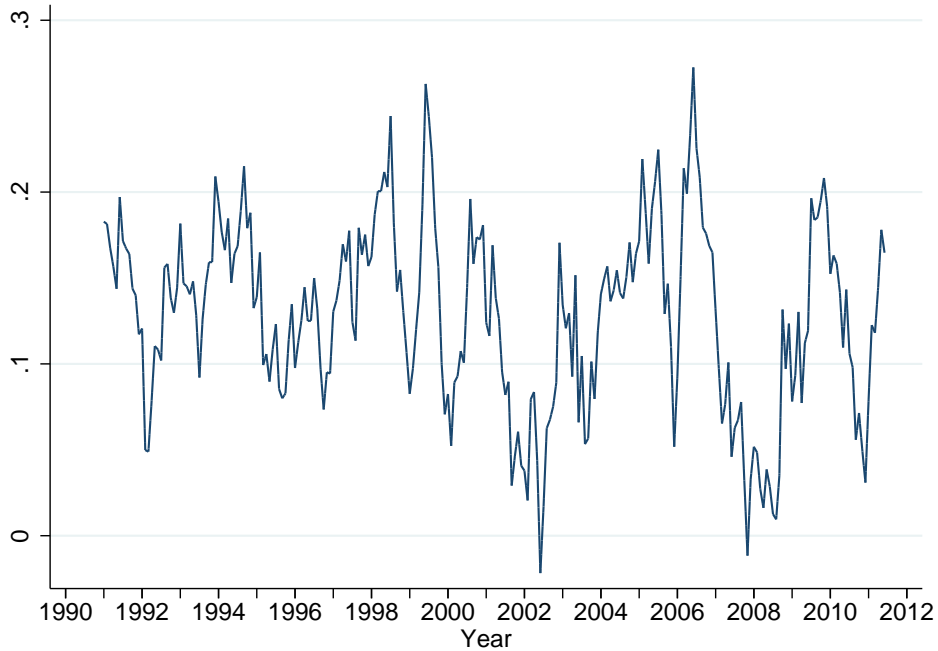
Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
β	0.273	0.137	0	0.628
standard error	0.041	0.018	0	0.166
Observations	445.8	167.5	0	795

Note: Results based on 397 regressions.

⁴⁰ Observation refer to periods before 1989m11 where the long-run forecast was not survey on a monthly frequency.

Figure 3: Probability of Comovement of short- and long-run inflation expectations



Note: Marginal effect of β_t from equation (2) is plotted, describing probability of a change in one-year ahead expectations induces a change in 5-10 year ahead expectations.

The figure shows that over the recent 30 years a decoupling of short and long-run expectations took place. Until 1996 the co-movement of inflation expectation was quite strong and fall substantially. Hence even after the Volker Disinflation until 1987 inflation rates were low but still not very well anchored. It seems that the Greenspan Fed's first preemptive actions against inflation over the years 1994 to 1996 triggered a substantial anchoring of inflation which lead to lower co-movement until mid 2000. The financial crisis, e.g. the sharp rise and fall of oil prices induced a strong decoupling as people seem to realized the transitory nature of these movements. Hence, since 2010 we see an increase in the co-movement of short- and long run expectations. The important question will be if this trend will continue and overshoot the pre-crisis level of anchoring. We furthermore analyse which determinants affect the comovement of short- and long-run inflation expectations. Given that the survey captures also news perceived by the individual consumer we can check if news on prices, the monetary policy stance and fiscal deficits influence the degree of comovement. In addition we control for macroeconomic variables like inflation, inflation volatility and monetary policy decisions.

So far we have looked at the strength of the comovement. Now we would like to know how high the probability is that short- and long-run expectations are adjusted simultaneously and whether we see a similar pattern there. Figure 3 shows the probability of a change in short-run expectations inducing an adjustment in long-run expectations.

It stems from a probit regression similar to equation (1) where the change is replaced by an indicator variable being 1 if expectations are adjusted and 0 otherwise.

$$P(Y = 1|X) = \Phi(X_i\beta) \quad (2)$$

where P is the probability of Y being 1, i.e. long-run expectations have been adjusted within six months, Φ is the Cumulative Distribution Function (CDF) of the standard normal distribution. The parameters β are estimated by maximum likelihood. Interestingly, the probability of an adjustment in short-run expectations leading to an adjustment in long-run expectations shows no downward trend. Thus this indicates that while the co-movement has decreased people keep on thinking about and adjusting short- and long-run expectations always simultaneously.

4 Determinants and News effects

In the previous sections we conclude that the anchoring of expectations changed over time. This section tries to shed light on the determinants that may affect the firm anchoring of expectations. Specifically we assess the stance of monetary policy, inflation, interest rates but also look at government debt and extraordinary policy measures but also are interested in news effects. Perceived news are captured by the survey itself. Hence we can control whether news heard regarding inflation, the monetary policy stance and the fiscal deficits change the degree of anchoring. Finally we also for control for changes in the conduct of monetary policy, like interest rate adjustments but also the degree of transparency which has greatly improved over time.

4.1 Determinants of Co-Movement

To test the influence of those determinants we firstly take the coefficient β of the equation (1) as a dependent variable. Secondly, we estimate a bi-probit model where we test which factors affect the joint probability that short- and long-run inflation expectations are adjusted simultaneously.

We estimate a bivariate probit model of the form:

$$\begin{aligned} Pr(Y_{1i} = 1, Y_{2i} = 1) &= \int_{-\infty}^{u_{1i}} \int_{-\infty}^{u_{2i}} \phi_2(X_{1i}\beta_1, X_{2i}\beta_2, \rho) du_{1i} du_{2i} \\ &= \Phi_2(X_{1i}\beta_1, X_{2i}\beta_2, \rho) \end{aligned} \quad (3)$$

where Φ_2 denotes the bivariate normal cumulative distribution function and $Y_{1i} = 1$ represents the probability that short-run expectations are adjusted and $Y_{2i} = 1$ is the probability that long-run expectations are adjusted. β_1 and β_2 are the corresponding coefficients of the determinants. Finally ρ is a ‘‘correlation parameter’’ denoting the extent

to which the two us covary. Furthermore we assume that the errors are $\{u_{1i}, u_{2i}\} \sim \phi_2(0, 0, 1, 1, \rho)$. If there is no comovement the estimated coefficients boil down to the univariate probit estimates. Afterward we calculate the bivariate predicted probability $Pr(Y_{1i} = 1; Y_{2i} = 1)$ Tables 2-?? contain the results of the bi-probit analysis.

Overall we find a strong and significant comovement in all of our regression. The parameter ρ is significant according to the Wald test in every specification. This indicates that similar factors drive the adjustment in short- and long-run expectations. Above that we can lend support that higher level of HICP inflation increases the comovement. At the same time an increase in the federal funds rate reduces the probability of comovement. This indicates that tighter monetary policy can anchor inflation expectations. Very relevant for the comovement is the level of long-run expectations of professional forecasters. This might reflect permanent shocks to the the economy or the monetary policy stance. If long-run expectations increase both expectations are adjusted upwards. Interestingly, also perceived news have explanatory power for the comovement in expectations. Mor news on prices, especially rising prices lead to a greater comovement. Remarkably also more news on public debt and fiscal deficits lead to higher comovement and hence deteriorate the anchoring of inflation expectations.

5 Conclusion

In this paper we assess the level of anchoring of inflation expectations of consumers. We analyse the anchoring of inflation expectations by looking at the comovement of short- and long-run inflation expectations. For a sound identification we employ the rotating panel microstructure of the Michigan Survey of Consumers. This allows us to track the short- and long-run expectations of individuals over six months.

Based on this setup we can report that since 1978 inflation expectations have become more anchored in the US. Interestingly, the comovement was substantially reduced not during the Volker Disinflation but in the aftermath of the 1996s pre-emptive tightening policy. Looking at the general probability of adjusting short- and long-run expectations simultaneously we find no reduction over time. Hence, while short- and long-run expectations became less associated people still adjust them jointly.

Regarding the possible determinants of the strength of comovement we find that high inflation, higher levels of expected inflation of professional forecasters and news on inflation as well as news on fiscal deficits lead to a greater comovement and hence a lower anchoring of inflation expectations. On the other hand tighter monetary policy helps to anchor expectations.

Table 2: Macroeconomic Determinants of Quantitative Co-Movement

	(1)	(2)	(3)	(4)	(5)	(6)
dd_px1	0.126*** (0.007)					
cpi	0.013*** (0.004)	0.015*** (0.003)				
cpi_volat3	0.005 (0.005)	0.007* (0.004)				
infcp1yr			-0.017** (0.007)			
infcp1yr_volat			-0.011 (0.014)			
infcp10yr			0.011** (0.006)			
infcp10yr_volat			0.037 (0.052)			
d6_cpi_d1				0.021 (0.024)		
d6_cpi_d10				0.008 (0.012)		
d6_funds_rate					-0.017*** (0.005)	
oilpriceyoy						-0.000 (0.000)
Observations	25,355	25,355	15,634	16,513	13,193	25,355
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Rho		0.218	0.218	0.218	0.218	0.218
Wald Test		285.9	285.9	285.9	285.9	285.9

Note: Marginal effects with clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Quantitative Co-Movement and News

	(1)	(2)	(3)	(4)	(5)	(6)
conf_call	0.034** (0.014)					
oilshock		-0.000 (0.000)				
newsheard			0.018*** (0.006)			
newsprices				0.018* (0.011)		
newsmoney					-0.004 (0.007)	
newsgovdebt						0.054** (0.025)
newsprivdebt						-0.018 (0.028)
Observations	14,091	25,355	25,355	25,355	25,355	25,355
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Rho	0.218	0.218	0.218	0.218	0.218	0.218
Wald Test	285.9	285.9	285.9	285.9	285.9	285.9

Note: Marginal effects with clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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