Leibniz University Hannover
School of Economics and Management
Institute of Money and International Finance

Seminar Monetary Economics Using Microdata
(Belegnummer:)

Thema:

Google inflation? The Formation of Households´ Inflation Expectations since 2013

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1 Introduction

This thesis wants to analyze the formation and updating behavior of inflation expectations of US households from 2012-today, particular in the last two years. By combining aggregated and micro data from the Survey of Consumers Expectations and data from Google Trends about search terms like "inflation" it will be possible to determine when households update their knowledge and therefore their short-term expectations.

After a presentation of the theoretical background to inflation expectations we conduct a short descriptive analysis of the one-year expectations from the last ten years as a whole and two sub-sets. This analysis also focus on differences between certain age cohorts and other properties provided by the SCE. After the presentation of the SCE data set we exercise similar operations for the results from the Google Trends data.

After the descriptive analysis we conduct further analyses by combining both data sets to show the relationship between Google searches and changes in inflation expectations. We look at correlation between expectations and uncertainty, google searches and the actual CPI and in a second model the relationship between google searches and micro-data.

Research question: - Under which circumstances and how often do households update their inflation expectations?

Used Papers:

Afunts(2022): - ukraine war has risen inflation expectations of german households, both short- and long-term - used the Bundesbank Online Panel of Households (BOP-HH) with about 6,000 respondents in January, February, and March 2022

Brainard(2022): - inflation bears high risks - stable and low inflation key for economy and labor market

Bernanke(2007): - explains risks of inflation, benefits of low stable inflation - gives an definition what anchored expectations mean

2 Theoretical Background

2.1 Literature

- a quick overview about the literature

Bernanke(2007):

- inflation makes pricing and investing processes more difficult, messes with taxing and accounting rules
- inflation leads to less public confidence in the economy and economic plicy
- low inflation "promotes growth, efficiency and stability", what is good for productivity and therefore employment
- inflation expectations determine actual inflation
- in 2007 inflation less respondive to supply shocks than in the past
- surveys a good tool to measure expectations, short and long-term

Carvalho(2021):

- long-term expectations are endogenous, short-term makes the long-term ones

Corsello(2019):

- uses data from ECB's Survey of Professional Forecasters, professionals!!!
- analysis with the low inflation right before covid19
- hhs expectations are dependent on movements for energy and food prices

Coibion et al. (2020):

- there are important differences between expectations of professionals and normal people
- people in high income countries are inattentive towards inflation, people in countries like iran, turkey, that have high inflation rates pay attention
- ordinary people see inflation only in the volatility of consumed goods, like petrol, therefore more volatility in expectations for uninformed agents
- ordinaries people inflation expectations are not anchored
- high qualtity of hhs surveys, therefore good tool for analysis
- news about inflation, monetary policy ore statements by the CB dont have any effects on normal people only on informend specialists

- when people get an information treatment about inflation, their views change, expectations change strongly
- expectations and real inflation often differ drastically from one another, as seen in a lot of surveys
- economic environment is key for views about inflation
- S.5: "economic agents update their beliefs depending on the strengths of their priors and signals"
- shopping experience are important for formation of expectations ("Tomaten sind teuer geworden") –> Cavallo et al (2017) checken
- but some goods are more important –> gasoline very important, co movements between expectations and gasoline prices
- news about inflation can have an effect, but that is very disputable
- people dont know shit about monetary policy. but when they know, they update their expectations towards the real value and towards professional forecasts
- Summary for formation of expectations: people are very different in their knowledge depending on their living experiences, economic environment. the successful monetary policy in advanced countries has led to inattention by households about inflation or inflation goals

D'Acunto (2022):

- P.1:"household inflation expectations are biased upwards, dispersed across individuals, and volatile in the time series"
- Inflation expectations important for CBs
- outside crises expectations are anchored
- old models: expectations are formed rational, but that is outdated
- hhs look at grocery prices to form their expectations: increases are more important than decreases (Luca:loss aversion??)
- lifetime experiences are important: if you had lived in a country and time with high infaltion, your perception about future rates are likely higher
- hhs have higher expectations than professionals (upward biased)
- shopping prices main sources for expectations. Problem: groceries more volatile, dont represent core inflation

- the higher the volatility of your grocery products, the higher your expectations
- prices signals are important
- before covid: young people did not live trough high inflation, had lower expectations than old people how suffered through high inflation
- professionals are much more in line with actual inflation, because they have to deal with it, its their job, cognitive task
- media did not play a significant role for formation in the past

Dräger,Lamla (2012):

- dont know that much about formation of inflation expectations
- looking at updating behavior of people in the michigan survey
- Idea is to look at the participants that are interviewed twice six months later. Have they changed their expectations or not?
- findings: updating on quantitative questions every 8 months, qualitative every 16 months about one-year-ahead inflation. in recessions updating behavior increases, therefore adjustments about the expectations are correlated with the business cycle. long-term less often adjusted than short-term

Dräger & Lamla (2017): - volatility in inflation leads to updating of expectations - hearing news about inflation increases probability of updating - uses again the rotating structure of the panel to analyze updating - updating about every 8 to 16 months for (quanti/quali) short-term, and 8 to 36 months for long-term expectations –> anchoring for at least half a year - quantitative changes only small when qualitative expectations stay the same - differences in EU and US are maybe driven by different types of available surveys - long-term more anchored - professionals change their expectations, that triggers consumers - information has no long-term effect - imperfect information plays important role for formation of expectations about inflation

Dräger and Lamla (2018):

- analyzing co-movement of short and long-term inflation expectations
- older people react more and change their expectations, therefore are less anchored
- illustrates different measurement strategies for anchoring
- uses data from the MSC

- expectations for older cohorts remain more volatile, but in general everything gets more stable -> anchoring, but for older people much more fragile, because they experienced high inflation in the 70s
- younger cohorts react stronger to news and price changes

Dräger and Nghiem (2018):

- approximately 50% of respondents believed that inflation over the previous twelve months had been 5% or above, at a time when actual inflation was 0.3%.

Ha et al.(2022):

- expectations in EMDE, emerging countries, are less anchored and different than in delevoped countries
- anchoring has increased, like in advanced economies

Lucas(1975):

- modelling of business cycle
- imperfect information about prices and the economy is embedded into the model
- in this behavior of the agents, their information about prices come from the market clearing prizes of the last periods, so their experiences in the past P.1123: "the history of prices [. . .] observed by an individual is his source of information on the current state of the economy and [. . .] of information on future price."
- agents know about business cycles

Powell(2022):

- P.1: "The labor market is very strong, and inflation is much too high."
- rise of inflation greater than expected
- supply-side frictions cause present inflation
- things can change quickly when shit hits the fan
- long-term inflation still anchored!
- risk: long tenures of high inflation can increase long-term expectations (what would mean deanchoring)
- anchoring long-term expectations critical for CB policy

Weber(2021):

- inflation expectations are essential for economics
- your perception of future prices influences todays buying decisions. if this holds true expectations about future matter today
- explains upward bias
- expectations are formed by price signals when we go shopping. although its only a small portion, groceries or gasoline are very important for formation of expectations
- the more often you purchased a good, the more important price changes are for your infl. expectations
- other important factors: news coverage, media and cognitive abilities
- explains MSC and SCE surveys
- upward bias differs between demographic groups: the poorer, the higher
- detects pos. correlation between short and long-term expectations. that would mean that expectations are not anchored (or not anchored in the sense of bernanke, or the inflation goal of 2%)
- media and news coverage not that important. news about inflation, goals of CB dont reach consumers, more at coibion

2.2 Our Hypotheses

- H_1 : There is a positive correlation between aggregated inflation expectations and uncertainty, Google searches and the actual inflation.
- H_2 : There is a positive correlation between Google searches and updating behavior of individual consumers.

3 Data

3.1 Our Dataset

- we look at the survey data provided by the Survey of Consumer Expectations of the New York FED
- Q8v2,Q8v2part2,Q9 are relevant for the expectations

D'Acunto (2022): - explains Survey of Consumer Expectations (SCE) - shortcoming:

only a small time series because not that old. “anchors” answers with their questions - but overall good material - disagreements increase volatility seen in covid19 2020 data - looking at IQR - only in the covid19 crisis short/long-term expectations differ

- a plot of consumer expectations for one-year expectations of the last ten years give a first expression

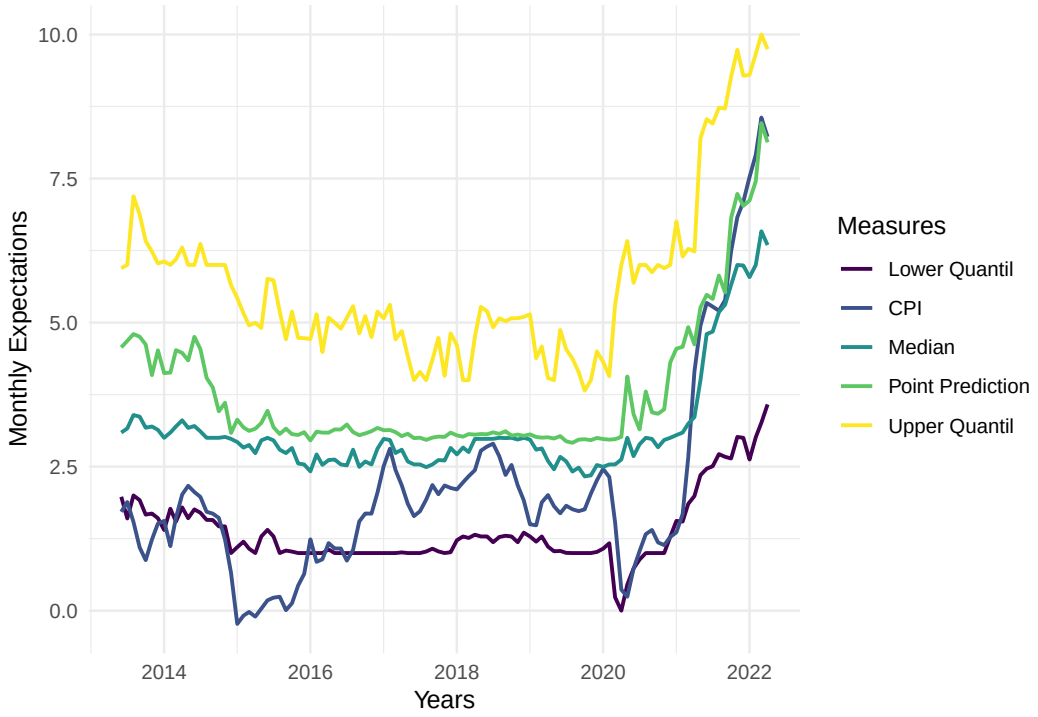

Figure 1: Short-term Expectations from 2013-present

- we see different pattern of behavior which allwos us to split the data in two time intervals.
- we will analyze them in the next chapter descriptive statistics

Table 1: Summary for expectations from 2013-2020

Measure	Mean	Volatility
Median	2.8139	0.2571
Point Prediction	3.3510	0.5623
Uncertainty	2.4658	0.2735
CPI	1.5714	0.7864

Table 2: Summary for expectations from 2020-present

Measure	Mean	Volatility
Median	4.1441	1.4169
Point Prediction	5.1335	1.6749
Uncertainty	3.6013	0.5268
CPI	3.7927	2.8292

3.2 Descriptive statistics

- we now look more into detail of the inflation expectations dataset
- we also look at uncertainty, describe it
- we can see two different phases for inflation expectations: from June 2013 until April 2020 and from May 2020 until today
- first phase: stable expectations with median and point predictions at around 2.5-3.0% inflation
- second phase: sudden increase in expectations with a peak at arond 6.5% in the last months
- we see higher values for average median, point estimate, volatility and uncertainty and therefore a wider range in the second sample

3.3 Some Demographic Differences

-we look at two major differences at the demographic level of our data set, namely sex and age

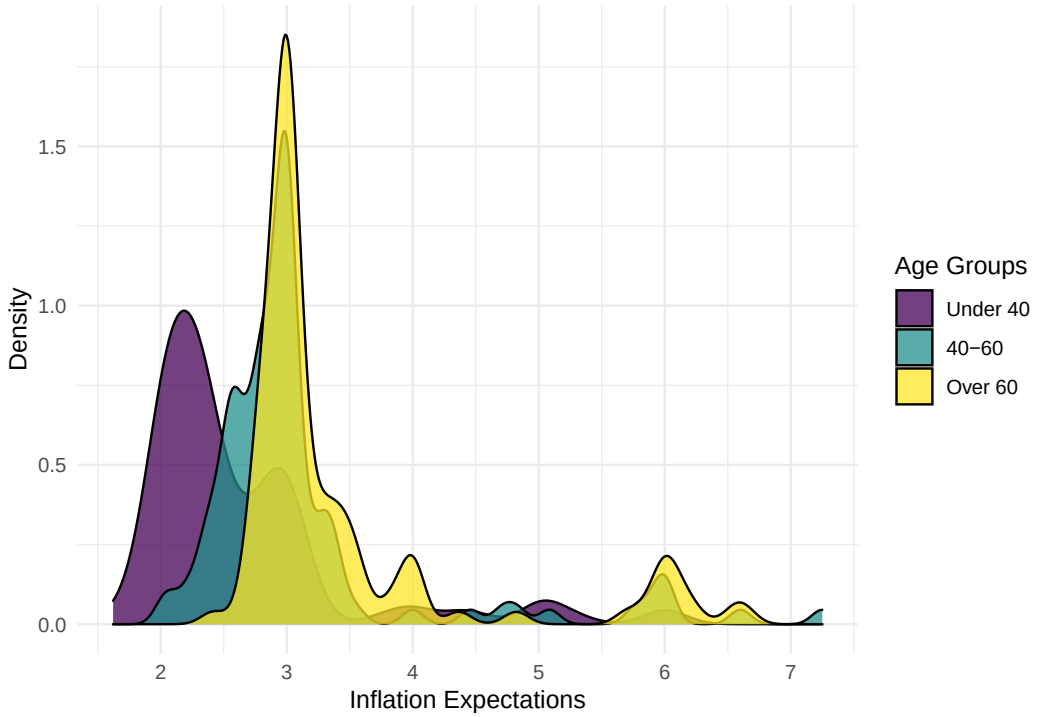

Figure 2: Distribution function for Age Groups

- the next dataset contains the google searches for inflation or inflation rate in the US
- google trends for the US show stable behavior until second half of 2021, after that huge increase
- inflation and inflation rate are very similar in their relative search frequency
- we will later combine these data with the SCE data set in some regression models

We are now able to look at first results for our two hypothesis:

- H_1 : There is a positive correlation between aggregated inflation expectations and uncertainty, Google searches and the actual inflation.
- H_2 : There is a positive correlation between Google searches and updating behavior of individual consumers.

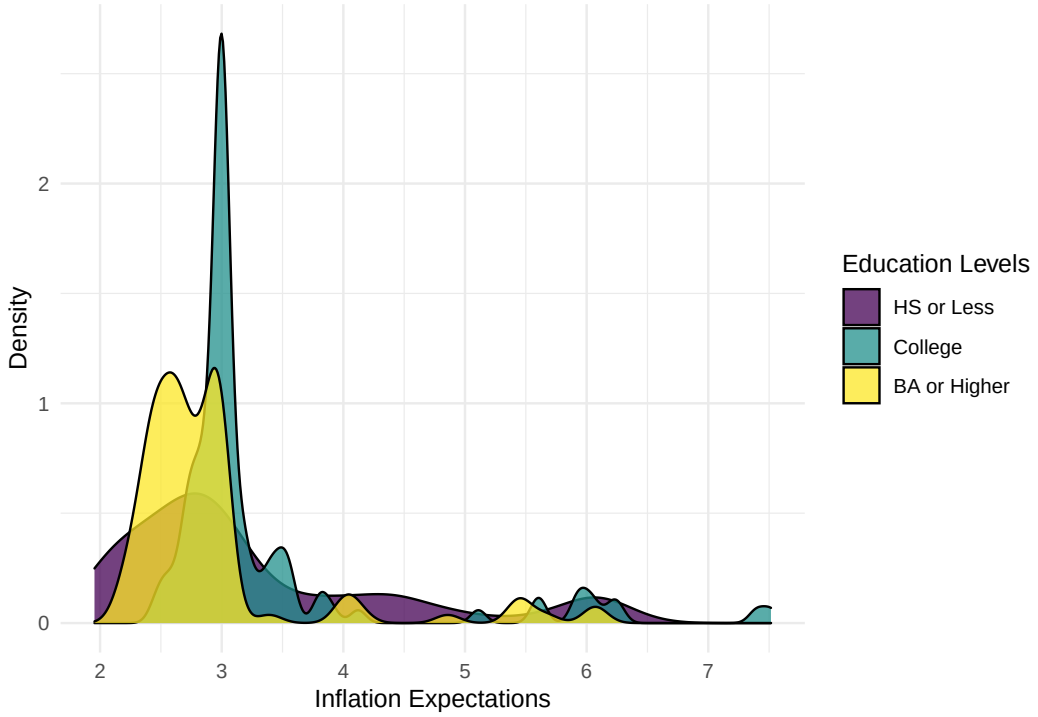

Figure 3: Distribution function for Education Groups

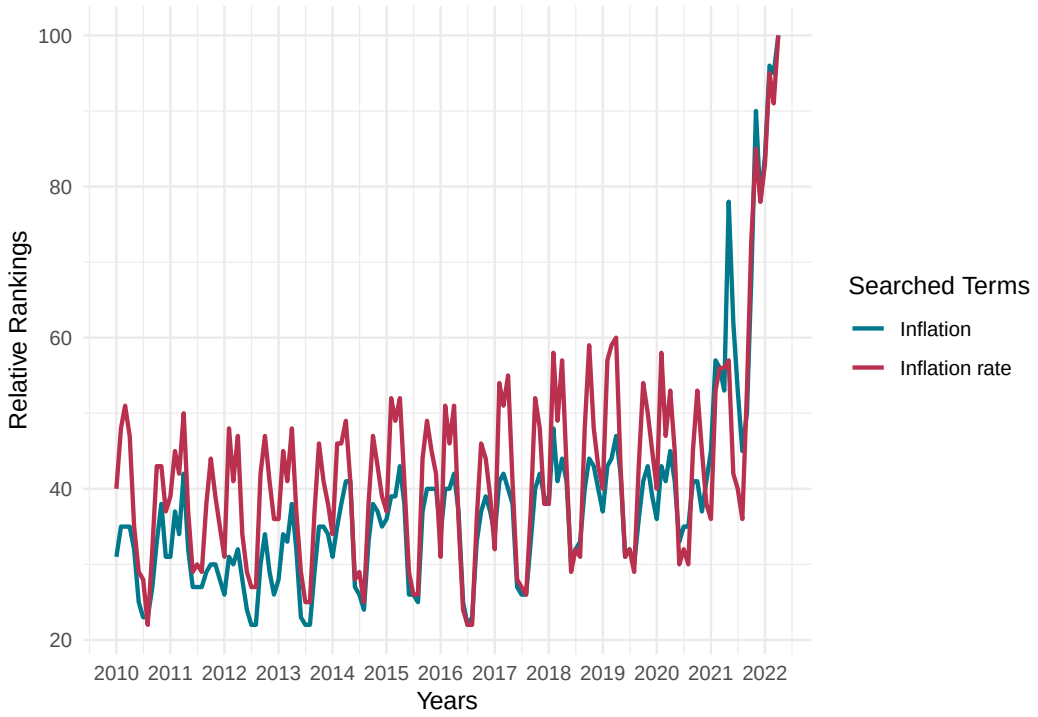

Figure 4: US Google Trends Results for Inflation/Inflation rate from 2010-present

Without regression we can still see higher volatility in inflation expectations and higher spreads between the upper and lower quantil. This implies higher uncertainty leads to higher inflation expectations. The time series for Google Searches shows a similar behavior like the SCE time series for Inflation expectations. This hints to a link between searching behavior and a rise in inflation in the last two years. In the next chapter we will first introduce the microdata for the SCE survey, compute aspects of updating behavior and proof our hypothesis with several regressions.

Table 3: Summary for Updating Frequency

Measure	Mean	Volatility
Updating Frequency	0.5356	0.2345

4 Results

4.1 Updating Behavior

Before we continue to explore the relationships between expectations and different variables within our data we have to take a look at the microdata of the SCE. To analyze individual behavior, for example in updating their exceptions and its relationship with google searches or inflation expectations this thesis uses a similar approach as in the paper "Updating inflation expectations: Evidence from micro-data" by Dräger & Lamla (2017). Dräger et al. use microdata from the Survey of Consumers conducted by the University of Michigan (MSC) from 78-2011. In this survey some participants are questioned a second time, whichs allows Dräger & Lamla (2017) to show individual updating behavior by computing updating shares and updating frequency. For the updating frequency Dräger & Lamla (2017) receive eight or 16 months for the quantitative and qualitative questions targeting at inflation expectations in the short run. Dräger & Lamla (2017) demonstrate 74.1 in updating share for the quantitative and 38.2 for the qualitative answer, with higher spreads for the qualitative answer. The crises of 2001 and 2008 also increased shares significantly. Dräger & Lamla (2017) conclude that updating behavior depends on the business cycle fluctuations, with higher shares and frequency around crises and lower adjustments for stable conditions and long-term expectations.

This thesis validates these finding by analyzing the updating behavior of individuals within the SCE. For this, the focus is layed on the quantitative answers that are aggregated to the already established point prediction.

After combining all available microdata published by the SCE the updating frequency of all participants is presented in Table 3 and Figure 5. The average updating frequency is determined as 0.4505. With an average tenure of 7.45 months, households update their expectations every 4 months. Figure 5 shows the density function for the whole sample distinguished for the three age categories. Other demographic differences like education and income result in similar distributions. As clearly seen

all age groups follow a general pattern with only minor differences. There is a significant part of participants that do not upgrade their expectations at all. This behavior is shown by around 20% in the whole sample with participants usually updating more often. If all observations without updating are ignored the updating frequency increases to 0.53556 and therefore every 5 months.

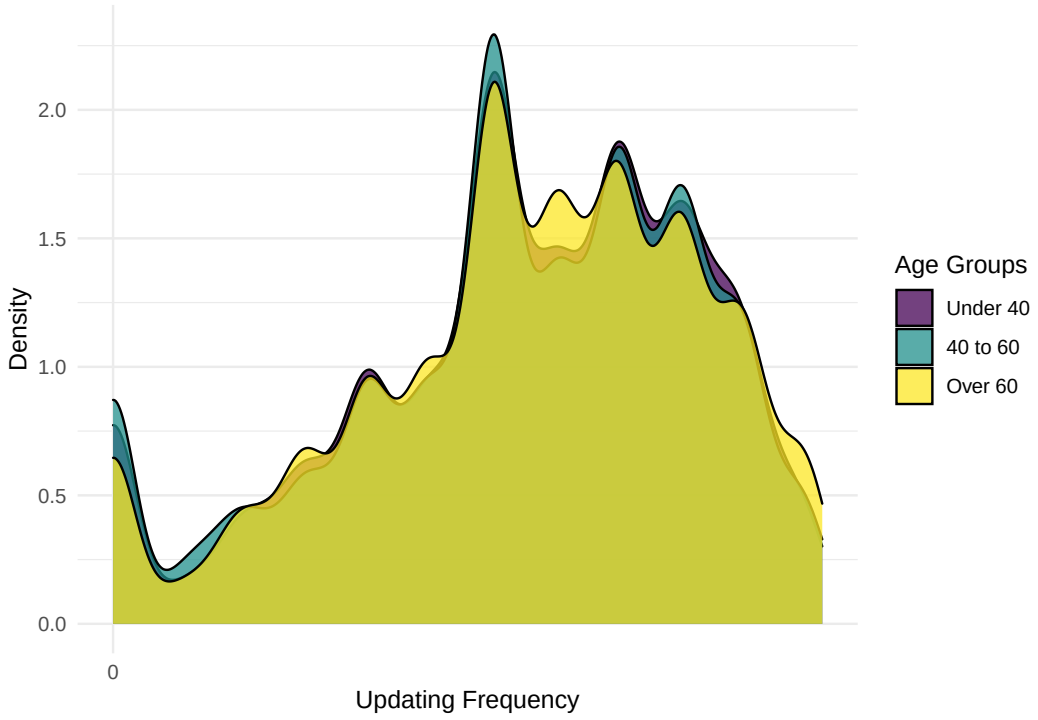

Figure 5: Distribution of Updating Frequency from the Micro-data

Figure 6 shows the updating share over the whole sample again for the three different age groups. Over the full sample the average updating share is 0.5706. All three age groups show similar behavior with old participants with slightly higher updating shares. The microdata reveal an updating spike at the beginning of the Covid19-Crises but cannot show a possible manifastation of increasing updating due to the lack of data after July 2021. In Chapter 5 we will discuss in more depth the limitations of the provided microdata.

Comparing the results from the SCE with the findings of Dräger & Lamla (2017), fewer participants update their expectations every month, but with a higher frequency. The next chapter deals via the use of regression models with the relationships between updating behavior, searching behavior and expectations.

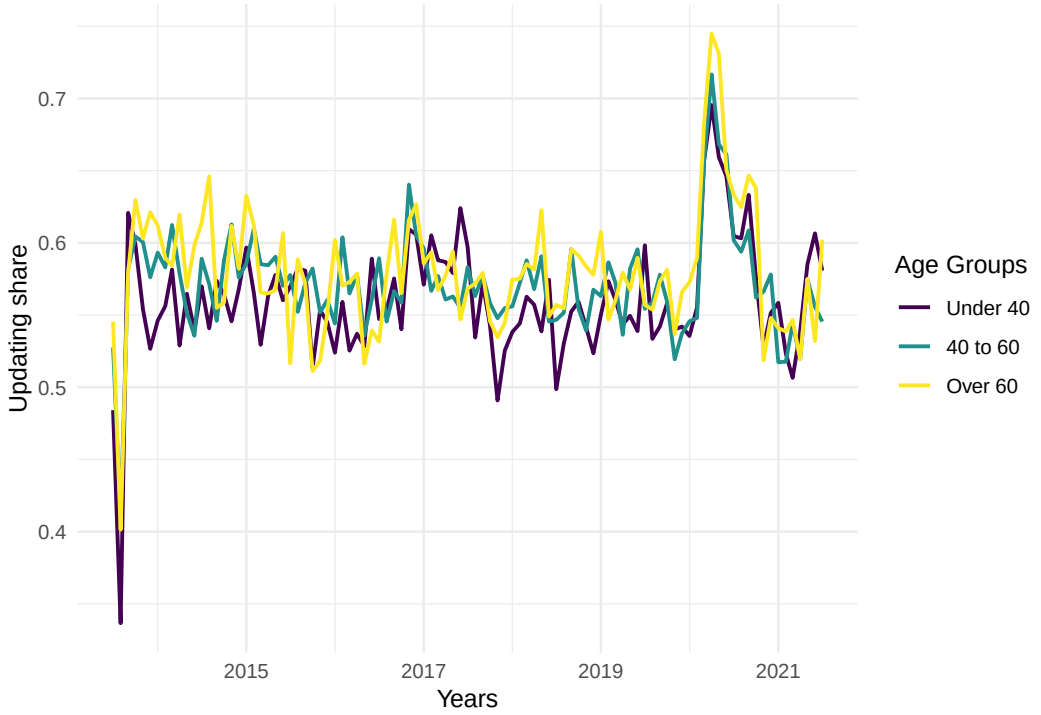

Figure 6: Updating Shares from the Micro-data

4.2 Regressions

-due to the shorter time series for the micro data we build two different regression tables with then we perform the different regressions

We have now regressions to test our first hypothesis:

-there is a positive correlation between aggregated inflation expectations and uncertainty, Google searches and the actual inflation

To avoid heteroscedasticity we only use the search term inflation weil hier mehr leute suchen.

-first regression model with aggregated data: uncertainty~ GS_infl -second regression model with aggregated data: Median~ GS_infl - third regression model with aggregated data: median of exp~ GS_infl+Uncertainty+CPI

- we also differ between the two sub time-series to analyze if the correlations differ in the two phases

-we build two models for the first interval to analyze the effect of CPI

- we do the same regressions with our second sub time-series

Table 4: Regressions for aggregated Data, full sample

	Dependent variable:		
	Uncertainty	Median	'Point Prediction'
GS_infl	0.027***	0.049***	0.002
	(0.003)	(0.004)	(0.005)
Uncertainty			1.253***
			(0.106)
CPI			0.248***
			(0.045)
Constant	1.623***	1.120***	−0.265
	(0.123)	(0.153)	(0.247)
Observations	107	107	107
Adjusted R^2	0.468	0.648	0.860
Residual Std. Error	0.438 (df = 105)	0.547 (df = 105)	0.458 (df = 103)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 5: Regressions for aggregated Data, sample from 06/13-02/20

	Dependent variable:		
	Uncertainty	Median	'Point Prediction'
GS_infl	−0.018***	−0.007*	−0.011
	(0.004)	(0.004)	(0.007)
Uncertainty			1.447***
			(0.182)
CPI			0.127**
			(0.058)
Constant	3.093***	3.081***	−0.027
	(0.155)	(0.157)	(0.627)
Observations	81	81	81
Adjusted R^2	0.167	0.024	0.518
Residual Std. Error	0.250 (df = 79)	0.254 (df = 79)	0.390 (df = 77)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 6: Regressions for aggregated Data, sample 03/20-04/22

	Dependent variable:		
	Uncertainty	Median	'Point Prediction'
GS_infl	0.020***	0.057***	0.023**
	(0.003)	(0.007)	(0.009)
Uncertainty			0.931**
			(0.367)
CPI			0.254***
			(0.086)
Constant	2.423***	0.868*	−0.503
	(0.174)	(0.431)	(1.105)
Observations	26	26	26
Adjusted R^2	0.672	0.720	0.940
Residual Std. Error	0.302 (df = 24)	0.749 (df = 24)	0.411 (df = 22)
Note:			*p<0.1; **p<0.05; ***p<0.01

We can now look at the second hypothesis:

-there is a positive correlation between Google searches and updating behavior of individual consumers -use of different models with different directions of the relationship

5 Robustness and Limitations

5.1 Robustness

- we can see bias in the updating behavior due to monthly updating (QUELLE!!!)

-longer tenure, more updating? regression about this with micro data

5.2 Limitations

- the micro data is only available until July 2021, therefore missing the crucial changes in search behavior, expectations and real inflation of the last ten months

Table 7: Regressions for Micro-Data

	Dependent variable:			
	'Updating share'		GS_infl	Uncertainty
GS_infl	0.0003			
	(0.0004)			
Uncertainty		0.016*		
		(0.009)		
'Updating share'			16.857	2.111*
			(24.178)	(1.170)
Constant	0.560***	0.530***	28.113**	1.404**
	(0.017)	(0.023)	(13.838)	(0.669)
Observations	97	97	97	97
Adjusted R^2	−0.005	0.023	−0.005	0.023
Residual Std. Error (df = 95)	0.037	0.036	8.644	0.418
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 8: Regressions for Micro-Data 2

	Dependent variable:
	'Updating Frequency'
Tenure	0.014***
	(0.001)
Constant	0.415***
	(0.005)
Observations	14,937
Adjusted R^2	0.045
Residual Std. Error	0.229 (df = 14935)
Note:	*p<0.1; **p<0.05; ***p<0.01

6 Conclusion

Space for our Conclusion

Conclusions: - in google trends for US: cyclical updating behavior until mid 2021, after that huge increase, co movement with the expectations of inflation short-term - cyclical updating: increases in spring and around October (black Friday), low interest in the summer and around Christmas/new year

A Tables

B Figures

Literature

Dräger, L., & Lamla, M. J. (2017). Imperfect information and consumer inflation expectations: Evidence from microdata. *Oxford Bulletin of Economics and Statistics*, *79*(6), 933–968. http://doi.org/10.1111/obes.12189

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