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Belief Dispersion among Household Investors and Stock Trading Volume

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Abstract

We study the effects of belief dispersion on stock trading volume. Unlike most of the existing work on the subject, our paper focuses on how household investors' disagreements on macroeconomic variables influence market-wide trading volume. We show that greater belief dispersion among household investors is associated with significantly higher trading volume, even after controlling for the disagreements among professional forecasters. Further, we find that the belief dispersion among household investors who are more likely to own stocks has more pronounced effects on trading volume, suggesting a causal relationship. Finally, we show that greater "belief jumbling," or the dispersion of belief changes over a given period, is also related to more active trading during the same period.

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1 Introduction

In a standard representative agent model, an equilibrium asset price clears the market, but no trading occurs in the market because all investors are assumed to be identical. Trading arises in models where investors have different endowment levels, portfolio positions, preferences, or beliefs. This paper presents an empirical analysis on how heterogeneity of beliefs, or disagreement, affects stock trading volume. We will address the effects of two types of disagreement—dispersion of belief distributions at a given point in time and dispersion of belief changes over time—on the trading volume of the entire stock market. For convenience, in the remainder of the paper, we will frequently refer to the former type of disagreement as "belief dispersion" and to the latter type as "dispersion of belief changes."[1] We will largely focus on the effects of belief dispersion on trading volume and will also present suggestive results on how dispersion of belief changes influences trading volume.

Indeed, the theoretical significance of disagreement among investors on trading volume has been appreciated at least since Varian (1985) and Karpoff (1986), which show that trading arises if investors interpret signals differently or if they interpret signals in the same way but start with different prior beliefs. In the ensuing years, an extensive literature has examined whether the model predictions hold empirically. Most of the existing literature consists of event studies that focus on how the trading of securities of individual firms or industries is affected by disagreement among professional investors, typically within a short period around the time of earnings releases or other major corporate news announcements. To the best of our knowledge, little has been done in studying how disagreement among investors about the outlook for key macroeconomic indicators can influence market-wide trading volume. Furthermore, beliefs of household investors have been largely unexplored despite households' significant participation in the stock market. According to the Flow of Funds Accounts released by the Federal Reserve, household investors directly own about 40% of outstanding equities in the U.S. and hold about an additional 20% of outstanding equities through mutual funds. In an era of prosperous research on household finance (Campbell 2006), lack of understanding how household investors may influence stock trading volume presents a significant gap in the literature, which our paper attempts to close.

Relative to previous studies, our paper has five distinct features. First, using the Thom-

[1] Dispersion of belief changes is often dubbed "belief jumbling," a term used in Karpoff (1986) and Bamber, Barron, and Stober (1997).

son Reuters/University of Michigan Surveys of Consumers (SCA), we study the beliefs of household investors, instead of professional analysts. Second, instead of firm- or industry-specific beliefs, we focus on beliefs about key macroeconomic variables—such as business conditions, unemployment, and interest rates—that potentially influence the level and riskiness of future dividend flows and discount rates. Accordingly, the trading volume we are interested in is the market-wide volume, instead of that of a specific firm or industry. Third, because the SCA data have information on household economic and demographic characteristics, we are able to examine whether the trading volume effects of belief dispersion among certain consumers vary with their propensity of owning stocks. Fourth, instead of event studies that typically focus on short periods of time bracketing some corporate news announcements, our study explores a much more extensive sample period of nearly 30 years (covering from late 1970s to mid-2000s). Fifth, the SCA has a semi-longitudinal structure that allows us to directly measure investors' belief changes over time and the dispersion of the belief changes. Therefore, our analysis also speaks to the nature of the relationship between the dispersion of belief changes and trading activities, a question most of the existing work has not addressed (with Barron (1995) and Bamber, Barron, and Stober (1997) being two exceptions).

Our results suggest that greater disagreements among household investors, measured by either belief dispersion or dispersion of belief changes, are associated with higher stock market turnover rates. These positive effects are both statistically and economically significant. For example, an increase of one standard deviation in the dispersion of consumers' expectations about near future business conditions implies an increase in the detrended monthly turnover rate in the entire stock market by over one-tenth of its standard deviation.

Because beliefs of household investors (and the dispersion among them) are potentially correlated with those of professional analysts, we are interested in whether household belief dispersion introduces any information explaining stock trading in addition to that conveyed in belief dispersion among professional analysts. Notably, our results appear to hold well after controlling for the dispersion among professional forecasters within the same period of time, suggesting that belief dispersion among household investors does have a net extra effect on stock trading volume. In addition, as robustness analyses, we show that our results hold under various model specifications and alternative measurements of belief dispersion. For example, when we redo the analysis separately for the three major stock exchanges—

namely, the New York Stock Exchange, NASDAQ, and American Stock Exchange—the results are broadly consistent with the baseline analyses, with those of the NASDAQ being most pronounced.

To examine whether the statistical correlations speak to any causal relationship between trading volume and belief dispersion, we further compare the correlations across various subgroups of household investors. Indeed, belief dispersion among household investors who are more likely to participate in the stock market have stronger effects on trading volume.

Finally, our paper also makes a methodological innovation in measuring investor disagreements when beliefs are reported as categorical, instead of numerical, values. Specifically, we introduce the weighted Herfindahl index to measure dispersion of ranked categorical variables. We show that our constructed series of household investors' belief dispersion tends to be significantly countercyclical—disagreements tend to rise when the economy is in recessions.

The paper proceeds as follows. Section 2 briefly summarizes the previous theoretical contributions on the relationship between investor belief heterogeneities and trading volume, followed by motivating our analysis through a review of the existing empirical literature. Section 3 describes the data. Section 4 introduces our measures of belief dispersion and dispersion of belief changes and presents summary statistics. Section 5 presents the main empirical results and robustness analyses. Section 6 concludes and outlines a future research agenda.

2 Related Literature

One of the most surprising and elegant pieces of economic theory is the No-Trade theorem (Milgrom and Stokey 1982). The theorem states that in a speculative market composed of fully rational agents with identical prior beliefs, no trade will occur in equilibrium, even in the presence of asymmetric information. The prediction is obviously not meant to be realistic, but it provides a starting point to any attempt to answer the question—why do people trade in financial markets?

Tirole (1982) describes the conditions under which the No-Trade theorem does not hold: (1) there exist irrational traders, or noise traders who trade for liquidity reasons; (2) some investors trade for hedging or diversification purposes; and (3) agents have different prior beliefs. Regarding the first possibility, a rapidly growing literature in psychology and behavioral finance has documented the behavioral biases of human beings in making financial decisions. Hirshleifer (2001) and Barberis and Thaler (2003) provide thorough reviews of earlier contributions. More recently, Scheinkman and Xiong (2002) suggest investor overconfidence as a potential source of heterogeneous beliefs, a hypothesis that finds empirical support in Statman, Thorley, and Vorkink (2006).

Outside of the school of behavioral finance, a large body of the literature investigates trading volume under Tirole's second assumption, allowing agents to have different endowments or different preferences. In such an environment, trade happens because investors form their optimal portfolios based on their budget constraints and risk tolerances which are different across individuals. For example, Wang (1994) introduces both heterogeneous investment opportunities (endowments) and asymmetric information in a competitive market, and identifies a link between the nature of heterogeneity among investors and the dynamics of trading volume. The challenge that the heterogeneous endowment argument faces is that it can generate only one round of trade, after which no further trade will take place.

In this paper, we focus on the third condition outlined by Tirole (1982) under which trade arises, namely, agents having different beliefs. The argument is, first and foremost, empirically sound. Considering "the glass is half full or half empty" argument, it speaks to the deep psychological roots of the dispersion of human optimism or pessimism. As Hong and Stein (2007) argue, "disagreement models uniquely hold the promise of being able to deliver a comprehensive joint account of stock prices and trading volume, which we consider to be one of the highest priorities for theoretical work in asset pricing."

Various theoretical papers have demonstrated how differences in beliefs can be linked to trading volume. Karpoff (1986) is one of the seminal early contributions. Specifically, he shows that both different interpretations of the same information and different prior beliefs can stimulate trading activities.[2] Hence, two different aspects of belief heterogeneity—(1) dispersion of prior beliefs and (2) dispersion of belief changes—can stimulate trade; both aspects are addressed in this paper.

By no means is this paper the first attempt at providing empirical evidence for Karpoff's theory. Rather, we are motivated by the insufficiency of and gaps in the existing, albeit vast,

[2]For subsequently developed models with different prior beliefs, see Detemple and Murthy (1994); for models in which investors have different ways of updating their posterior beliefs, see Harris and Raviv (1993) and Kandel and Pearson (1995).

empirical literature. We highlight several major ways in which our paper improves upon and extends the previous work.

First, most existing empirical studies do not measure investor beliefs directly. Instead, they use financial analysts' forecasts as an approximation and estimate their dispersion. However, Dinh and Gajewski (2007) point out that such proxies can be inaccurate since they represent only a small proportion of economic agents, who are often more informed and more sophisticated than most market participants. In addition, analysts' forecasts may be influenced by their interests and incentives and thus can be biased. For example, analysts' desire to win investment banking clients may lead them to adjust their forecasts to avoid earnings disappointments (Chan, Karceski, and Lakonishok 2003). Moreover, Hong, Kubik, and Solomon (2000) find that analysts, especially inexperienced ones, herd in their forecasts because of career concerns.

Effort has been made to characterize belief heterogeneity in a more direct and comprehensive way. Bessembinder, Chan, and Seguin (1996) consider the open interest of S&P 500 index futures a proxy for dispersion of traders' opinions regarding underlying values and find it positively related to trading volume. Their approach, although probably covering a broader set of investors, is still not a direct measure of belief. Goetzmann and Massa (2005) construct an opinion dispersion index from information about 100,000 retail investors and find the index positively related to contemporaneous trading volume and stock return. Furthermore, they find that dispersion of opinion among retail investors Granger-causes dispersion of opinion among analysts. However, their paper does not measure investors' opinion per se; instead, it uses investor characteristics, such as age, income, and occupation, to construct the dispersion index.

In this paper, we address these concerns by constructing metrics of belief dispersion using data of self-reported expectations directly collected in a nationwide representative survey of consumers, who, unlike professional analysts, are largely immune to the aforementioned conflict of interests. Despite an increasing presence of household investors in the stock market, to the best of our knowledge, this paper is the first study on how belief dispersion among household investors may affect trading volume in the stock market.

Furthermore, this paper is among the first to examine the effects of dispersion of macroeconomic beliefs on trading volume. Previous studies have largely focused on dispersion of earnings forecasts of individual firms, without considering concurrent dispersion of beliefs regarding future macroeconomic conditions. However, expectations on future macroeconomic conditions (such as interest rates and unemployment) play a pivotal role in shaping investors' strategies and portfolio choices as these variables tend to influence the level and riskiness of future dividend flows of all firms and the interest rate at which future dividends are discounted.

Most prior studies examine specific events, such as the releases of corporate earnings, and beliefs and trading volumes are measured over a short period of time bracketing such events (Comiskey, Walkling, and Weeks 1987, Ziebart 1990, Lang and Litzenberger 1989). Nevertheless, agents do not trade only on their opinions about earnings releases. Investors' opinions about the economy and their perspectives on interest rates and employment should all be critical in forming their opinions about financial investment and trading strategies. One immediate piece of supporting evidence is the large systematic outflows and inflows of money in different sectors of the mutual funds industry in the wake of the current financial crisis. In reality, agents receive new information on a continuous basis, especially information concerning the economy. As new information comes, investors update both their short- and long-term outlooks for the economy and financial markets. Thus, it is an empirical question to what extent each piece of information matters in generating trades.

The household survey we use also presents a unique opportunity for studying the potential differences in how belief dispersion affects trading volume across subgroups of consumers that are different by their propensity of investing in stocks. If indeed, a higher degree of belief dispersion among investors causes more active trading, we expect such an effect to be most pronounced for dispersion among households that are most likely to invest in stocks, and most subdued for dispersion among households who invest little in stocks.

Finally, most prior empirical research looks at only the static aspect of belief dispersion and ignores the dynamics of beliefs, with Barron (1995) and Bamber, Barron, and Stober (1997) being two of the few exceptions. The two papers explicitly test Karpoff (1986) by illustrating the positive relationship between trading volume and differential belief revisions among investors. Our paper shares a similar spirit. Exploiting the longitudinal structure of the survey allows us to further explore how dispersion in belief changes within a given period of time affects the trading activities during the same time.

3 Data

3.1 Surveys of Consumers

We use the respondent-level data of the Thomson Reuters/University of Michigan Surveys of Consumers (SCA) to measure household investors' beliefs and their dispersion. The SCA is conducted by the Institute of Social Research at the University of Michigan. The most influential SCA products is the Index of Michigan Consumer Sentiment. Introduced in the late 1940s, the index has established itself as one of the most widely followed indicators that measure households' sentiments about current and future economic and business conditions. Validation studies have shown that the information collected in the SCA predicts the dynamics of the nationwide economy remarkably well.[3]

The SCA has been conducted monthly since 1978, and in recent years a minimum of 500 consumers have been surveyed each month from a phone facility in Ann Arbor, Michigan. The consumer-level data we use cover more than 30 years.[4] The SCA provides a short panel structure. About 40 percent of the respondents were surveyed again six months after their first interview, a feature we will exploit to study the effects of dispersion of belief changes on trading volume. However, these consumers were not called again after the follow-up interview.

Each month, about 50 core questions are asked to collect information broadly related to consumers' assessments of current economic conditions and their expectations about the future of their households and the national economy.[5] Moreover, the SCA collects information about key demographic characteristics and the economic status of sampled consumers. We will study the belief dispersion (and its changes) about future business conditions, personal financial conditions, unemployment, and interest rates. Table 1 summarizes the variables on which our study focuses. We keep all original variable names as they were assigned

[3]The Index of Michigan Consumer Sentiment is included in the Leading Indicator Composite Index published by the Bureau of Economic Analysis because of its "economic significance" and "statistical adequacy." For more information about the SCA, see the documentation at the SCA webpage at `www.sca.isr.umich.edu/main.php`.

[4]Although the survey started shortly after World War II, respondent-level data for the years before 1961 are not publicly available. For the period from 1961 to 1965, the respondent-level data are available only in February; for 1966, they are available in February and August; and for 1967 to 1977, the respondent-level data are available quarterly in February, May, August, and December.

[5]From time to time, additional questions, known as the "riders", were added in special modules. These questions, though interesting and potentially closely related to stock market trading activities, are typically asked only for a limited number of months and may not be asked at regular monthly frequency.

by the SCA staff. Four of the five questions—PEXP, BEXP, UNEMP, and RATEX—are about consumers' expectations in the near term, typically within the next 12 months. They survey households' short-term expectations on personal finance, business conditions, the unemployment rate and interest rates respectively. The only question regarding long-term expectations is BUS5, which is expectations about business conditions during the next five years.

Most SCA questions have categorical, instead of numerical, answers.[6] The predominance of categorical questions may be due to the fact that they are easier to answer for typical household respondents. For example, when asked about unemployment expectations, consumers are asked to choose from three answers—"more unemployment," "about the same," and "less unemployment"— rather than to specify an unemployment rate. Similarly, when asked about future business conditions, consumers choose from "better off," "same," and "worse off." One advantage of focusing on categorical responses is that it avoids the influence of "wild answers." However, when beliefs are so represented, constructing measures of belief dispersion (and dispersion of belief changes) is less straightforward. In Section 4, we will discuss the technique used to measure the dispersion of the categorical answers.

3.2 Survey of Professional Forecasters

Earlier research has documented that dispersion of beliefs regarding corporate earnings among professional analysts can influence trading activities to a large extent. Presumably, wider belief dispersion among professional analysts regarding future macroeconomic conditions can also induce higher trading volume, pressing us to study whether belief dispersion among household investors has any net extra effects on trading volume beyond the extent to which their belief dispersion is correlated with those among professional forecasters.

To measure belief dispersion on macroeconomic conditions among professionals, we use the Survey of Professional Forecasters (SPF) collected by the Federal Reserve Bank of Philadelphia.[7] The SPF is different from the SCA in a number of aspects. First, the SPF is

[6] The only exceptions are two questions about future inflation rates, for which consumers are asked to give numerical answers. We did not study the effects of dispersion in inflation expectations because, relative to dispersion of categorical responses, dispersion of numerical responses in consumer surveys are more prone to be influenced by "wild" answers. For example, the cross-sectional standard deviations of inflation expectations in the SCA are much higher than those in the Survey of Professional Forecasters.

[7] The survey was conducted by the National Bureau of Economic Research before being transferred to the Federal Reserve Bank of Philadelphia in early 1990s.

conducted quarterly whereas the SCA is a monthly survey. Second, the survey method and questions in the SPF are somewhat different from those in the SCA. In particular, unlike the categorical responses given to the qualitative questions asked in the SCA, SPF respondents are asked to report the numerical value of their forecasts, among others, of GDP, industrial production, corporate profit, and unemployment rate.

To control for belief dispersion among professional forecasters in a parsimonious way, we separately estimate the belief dispersion time series for each question in the SPF and synthesize them into the first principal components of these series.[8]

3.3 Trading Volume and Market Returns

We use the market-wide stock turnover rate (the total number of shares traded in a period divided by the average total number of shares outstanding during the period) as a measure of trading volume in our estimation. Normalizing trading volume with shares outstanding allows us to abstract from increases in volume that are due mainly to the growth of the economy or the stock market. The turnover measure has been used in various studies, such as Campbell, Grossman and Wang (1993) and LeBaron (1992). Data on both the number of shares traded and shares outstanding are from the Center for Research in Security Prices. In our baseline analysis, we aggregate the monthly trading volume and shares outstanding of all securities traded on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and NASDAQ.

Our sample covers the period from January 1978 to the end of 2006, which was the year before the financial crisis unfolded. We choose not to include the years of financial crisis and its aftermath in the sample because both stock returns and trading activities exhibited highly unusual patterns during this period that are unlikely to be explained by the mechanism of interest in this study. In addition, Chordia, Roll, and Subrahmanyam (2011) document that in most recent years, turnover increased the most for stocks with the greatest level of institutional holdings, highlighting the role played by institutional investors in increasing turnover rates. By excluding those years from our sample, we are able to focus on a period of time when household investors account for a more substantive share of trading.

As shown in the upper panel of figure 1, turnover rates in the U.S. stock market steadily increased during our sample period. Many explanations have been proposed to explain this

[8] See Section 5 for details.

trend. For example, Smidt (1990) suggests that the long-run trend in equity turnover can be attributed to transaction cost changes. A Dickey-Fuller test suggests that the series is trend stationary. The lower panel of figure 1 shows the cubic detrended series of turnover, which will be used in our baseline analysis.[9] The series has a mean equal to zero and a standard deviation equal to 0.013. We note that the detrended series exhibits a certain level of persistence (autocorrelation coefficient above 0.5), which we will control for in our estimations.

4 Measures of Belief Dispersion and Dispersion of Belief Changes

4.1 Dispersion Measures

To measure dispersion of beliefs in the SCA that are denoted by categorical values, we construct a weighted negative Herfindahl index. The Herfindahl index has been widely used as a measure of market concentration (see, for example, Neumark and Sharpe (1992)). It is thus natural for us to use it to measure the opposite of concentration—dispersion. Recall that the standard Herfindahl index is defined as

$$H = \sum_{i=1}^{N} p_i^2, \tag{1}$$

where p_i is the share of the i-th element among N elements. The Herfindahl index takes a value between $1/N$ and 1. A lower value of the index indicates greater dispersion.

The standard Herfindahl index treats each of the N elements symmetrically, without taking into account the ordering among the elements. Thus, the distances between elements are equal. However, one important aspect of the SCA data is that different answers are naturally ranked, and hence the distance between answers matters. For example, a sample consisting of 50 percent survey responses that are "better off" and 50 percent "worse off" will yield the same value of standard Herfindahl index as a sample consisting of 50 percent "better off" and 50 percent "about the same" answers, although opinions in the first sample are clearly more dispersed. To explicitly account for such relative distances, we construct

[9] In robustness analysis, we vary the detrending method to allow for trends of various polynomials.

(for each survey month) a weighted negative Herfindahl index as

$$WNHI = -\sum_{i=1}^{N} \omega_i p_i^2, \tag{2}$$

where ω_i is a weight assigned to element i. We give lower weights to elements closer to the polars and higher weights to elements in the middle. Specifically, in our baseline analysis, we let the weights on the answers of "better off" and "worse of" be equal to one and the weight on the answer of "about the same" be equal to two. The weights were chosen to generate lower Herfindahl index values (higher dispersion) for belief distributions with more polar answers. We also alter the weights as part of the robustness analysis, and the results were not qualitatively sensitive to the weight choices. Finally, for expositional convenience, we take the negative value of the index to make it an increasing function of the degree of belief dispersion—higher value of the index indicates greater dispersion.

4.2 Measures of Dispersion of Belief Changes (DBC)

Bamber, Barron, and Stober (1997) define belief jumbling as "information-triggered belief revisions that differ across investors and change an individual's expectation relative to the distribution of expectations held by others (i.e., the reordering of beliefs across investors)." Similar to their approach, we construct a measure of dispersion in belief changes that can capture the reordering of beliefs across investors.

In the SCA surveys, about 40 percent of the consumers are surveyed again six months after they were surveyed the first time. We can thus track consumer belief changes over a six-month interval. The limitation of the data is that, for each consumer, only one observation of belief change was available because the consumers are not contacted again after the second interview.

Recall that all of the SCA questions we study have categorical answers. The SCA typically asks the consumer whether the future of the economy will be better, worse, or about the same or whether an economic indicator, such as the interest rate and the unemployment rate, will go up, go down, or remain the same. To measure belief changes in qualitative expectation variables, we construct a "belief crossing" variable. This variable takes the value of -1 (1) if at month m the consumer expected the economy to be better (worse), but in six months, when surveyed again, the consumer instead expected the economy to be worse (better). Similarly, we define the belief crossing variable to be -1 (1) if at month m the consumer expected an economic indicator to be higher (lower) in the future, but in six months, when surveyed again, the consumer instead expected the same indicator to be lower (higher). If the consumer's answer was unchanged six months later, the belief crossing variable takes the value of 0. For all expectation variables, if either in month m or month $m + 6$, the consumer reported "to be the same," the belief crossing variable would be set to 0 as well. More specifically, we defined $Crossing$ as the following:

$$Crossing = \begin{cases} -1 & \text{if better}\rightarrow\text{worse (higher}\rightarrow\text{lower)} \\ 0 & \text{if better}\rightarrow\text{the same (higher}\rightarrow\text{the same)} \\ 0 & \text{if better}\rightarrow\text{better (higher}\rightarrow\text{higher)} \\ 0 & \text{if the same}\rightarrow\text{better} \\ 0 & \text{if the same}\rightarrow\text{the same} \\ 0 & \text{if the same}\rightarrow\text{worse} \\ 0 & \text{if worse}\rightarrow\text{worse (lower}\rightarrow\text{lower)} \\ 0 & \text{if worse}\rightarrow\text{the same (lower}\rightarrow\text{the same)} \\ 1 & \text{if worse}\rightarrow\text{better (lower}\rightarrow\text{higher)} \end{cases}$$

This is a conservative measure of belief changes in the sense that it considers only those about-face changes of beliefs from one end of the spectrum to the other as a belief change. When we count changes from "the same" to "better" or to "worse" (and the reverse) as belief changes but with a smaller weight, our results are qualitatively preserved. The dispersion of belief changes (DBC) over six months is defined as the standard deviation of the belief crossing measure for each given time period

$$DBC_m = \sigma(Crossing_{i,m}) = \sqrt{\frac{\Sigma_{i=1}^{N_m}(Crossing_{i,m} - \overline{Crossing_{i,m}})^2}{N_m}}, \tag{3}$$

where $Crossing_{i,m}$ is the crossing of agent i's belief between month $m - 6$ and m, which takes the value of (-1,0,1) and N_m is the number of survey respondents with valid belief change measures.

4.3 Summary Statistics

Table 2 presents the summary statistics for the SCA data. The upper panel presents the time series means and standard deviations of the constructed $WNHI$ for each SCA questions. Recall that higher $WNHI$ (closer to zero) suggests a more dispersed distribution of beliefs. It is interesting to observe that beliefs about longer-term business conditions in the next five years, $BUS5$, are more dispersed than beliefs about other shorter-term economic conditions, such as $BEXP$, which represents the expectations about business conditions after one year. The $WNHI$ values for $PEXP$, $RATEX$, and $UNEMP$ suggest that beliefs on those variables are dispersed to similar extents as is $BEXP$. Figure 2 illustrates how belief dispersion vary over time in the SCA data. We notice that three of the five series of belief dispersion, $PEXP$, $RATEX$ and $UNEMP$, exhibit strong counter-cyclicality. The peaks of dispersion of expectations about near-term economic conditions, interest rate, and unemployment largely coincide with the dates of recessions as defined by the National Bureau of Economic Research. However, we find less-strong cyclical dynamics in the belief dispersion for expectations about personal financial and longer-term business conditions.

Expectations on various macroeconomic indicators held by the same investor are likely correlated (people expecting lower unemployment also tend to expect better business conditions), potentially making dispersion of beliefs on these macroeconomic indicators also correlated. To summarize the information contents contained in the five series of belief dispersion, following Buraschi and Whelan (2010), we compute the principal components of these series. We will focus on the first principal component, as it accounts for over 50 percent of total variance, and each of the successive principal components explains no more than 20 percent of total variance. As shown in the lower right panel of Figure 2, the first principal component also exhibits pronounced counter-cyclicality.

The bottom panel of Table 2 shows time series means and standard deviations of the constructed measure of dispersion of belief changes, DBC. We keep only the months in which more than 100 consumers can be linked to their follow-up surveys. The two expectation variables that exhibit the largest cross-sectional dispersion, $BUS5$ and $RATEX$, also have the largest means and standard deviations of DBC, suggesting that consumer beliefs about future business conditions and interest rate movements are more prone to revisions. Figure 3 illustrates how dispersion of belief changes varies over time in the SCA data. We notice that, first, the series of dispersion of belief changes is more volatile than the series of belief dispersion; second, the three belief variables whose dispersion series exhibit strong cyclicality also show similar cyclicality in the series of dispersion of belief changes. Following our treatment of the belief dispersion series, we compute the principal components for the DBC series. We note that the first principal component, shown in the lower right panel of figure 3, explains only 40 percent of the total variance and exhibits some counter-cyclicality.

5 Empirical Results

5.1 Belief Dispersion and Trading Volume

5.1.1 Baseline Analysis

We estimate the following model for belief dispersion in the SCA sample:

$$Turnover_m = \alpha + \rho Turnover_{m-1} + \beta WNHI_m^J + \gamma Mean_m^{ICE} + \delta R_m + \sum_{i=1}^{11} \psi_i I_{i=m} + \varepsilon_m, \quad (4)$$

where $Turnover_m$ is the cubic-detrended turnover for month m. We include one lag, $Turnover_{m-1}$, of the dependent variable to absorb some of the autocorrelations exhibited in the detrended turnover series. Superscript J indexes the five expectation variables ($PEXP$, $BEXP$, $BUS5$, $RATEX$, and $UNEMP$), and $WNHI_m^J$ is the weighted negative Herfindahl index for variable J in month m. We also control for the mean levels of the expectation index, ICE. The index is constructed by the SCA staff as a summary of investors' expectations about economic fundamentals and thus is likely to affect stock market trading activities. R_m is the contemporaneous gross return in the S&P 500 index. Various papers look at the relationship between stock returns and trading volume. For example, the use of momentum or contrarian trading strategies would clearly lead stock returns and trading volume to be correlated. In addition, we include a vector of monthly dummies to control for seasonal factors. Hong and Yu (2009) find that trading volume in summer vacation months is significantly lower than that in other months. In contrast, trading around year-end could be higher, driven by tax-related reasons. These seasonal fluctuations can be captured by the monthly dummies, denoted as $\sum_{i=1}^{11} \psi_i I_{i=m}$ in Equation 4.

In the above specification, the parameter of interest is β. Recall that we construct the $WNHI$ so that higher $WNHI$ implies wider belief dispersion. Should wider belief dispersion indeed induce larger trading volume, we will observe $\beta > 0$ in Equation (4). Table 3 reports the estimation results. All standard errors are adjusted for autocorrelations and heteroskadasticity using the Newey-West method with first-order autocorrelation.[10] We find that all β-coefficients are positive and that all β's except the one for $BEXP$ are statistically significant, indicating that more-dispersed beliefs about future personal financial conditions, future business conditions (over the next five years), interest rates and unemployment are

[10] Allowing for higher orders of autocorrelation does not change the results qualitatively.

associated with higher stock market turnover. The effects are not only statistically significant but also economically significant. For example, if the $WNHI$ of $BUS5$ increases one standard deviation (0.042, table 2), the monthly turnover rate will increase 0.13 percentage point, or about 10 percent of the standard deviation of the detrended turnover rate. An increase of one standard deviation in the $WNHI$ of $PEXP$, and $RATEX$ corresponds to a similar increase in turnover. Finally, the estimation using the first principal component yields similar results.[11]

For all regressions reported in Table 3, we find that stock market returns are not contemporaneously correlated with turnover rates. This finding is likely due to the lower sample frequencies (monthly) that our study focused on, compared with those in the literature, which are typically daily. In addition, we find that the mean level of the ICE variable, $Mean(ICE)$, has a positive effect on turnover rates.

5.1.2 Analysis by Demographic Characteristics

Investors of different demographic and socioeconomic characteristics have different propensities of investing in stocks. For example, the Survey of Consumer Finances data show that prime-age, more educated, white, and higher-income investors are more likely to hold stocks (also, see Hong, Kubik, and Stein (2004)). To examine whether the observed correlation between household investors' belief dispersion and trading volume speak to any causal relationship, we further study the relationship between trading volume and belief dispersion among subgroups of investors who are different in their likelihood of holding stocks. If it is indeed that wider dispersion of beliefs causes higher trading volume, such an effect should be stronger for dispersion among households that are more likely to participate in the stock market. In particular, we expect that belief dispersion among prime-age, college educated, white, and high income investors to affect market-wide trading volume more significantly.

We compute the belief dispersion series and re-estimate Equation (4) for each subgroup of investors. The estimates of β coefficients for these demographic and socioeconomic subgroups are summarized in table 4. As the results indicate, the estimated effects of belief dispersion on trading volume tend to be more pronounced in magnitude and more statistically significant for the groups of household investors that are more likely to own stocks. For example, as

[11] The smaller point estimate of that coefficient is due to the normalization of the series of first principal component.

shown in column (6), the estimated coefficients for the first principal component estimated for the prime-age, at least high school educated, white and higher-income investors are uniformly larger and of higher statistical significance than those estimated for investors who are young, have no high school degree, black, and have the lowest income. Such a stark contrast in the estimates is suggestive of a causal relationship between belief dispersion and trading volume.

5.1.3 Compare with Professional Forecasters

It is well documented that disagreements among professional analysts can affect trading volume. It is possible that the degree to which household investors disagree with each other is correlated with the belief dispersion among professional analysts. Thus, it is important to understand whether belief dispersion among household investors carries any additional information that is helpful for understanding the market-wide trading volume beyond dispersion among professional analysts. Using the SPF data, we can construct series of belief dispersion among professional forecasters regarding the future economic conditions related to those surveyed in the SCA. Specifically, we focus on professional forecasters' projection dispersion on GDP growth, corporate profit growth, industrial production growth and unemployment.

There are several differences between the SPF and SCA that we need to address. First, unlike the monthly SCA survey, the SPF is a quarterly survey. We interpolate the SPF series to monthly frequency. Second, although both surveys collect information on expectations of macroeconomic conditions, answers given to the SPF are all numerical rather than categorical. Accordingly, dispersion in the SPF is measured using sample standard deviations within the same quarter, rather than using the weighted Herfindahl index. Third, the questions asked in the SCA and SPF, though related, are not directly comparable. To facilitate constructing a parsimonious model for comparison, we focus on the first principal components of the series constructed for both surveys. The first principal component of the SCA series explains greater than 50 percent of total variance, while the first principal component of the SPF series explain nearly 70 percent of total variance.

The first column of Table 5 repeats column (6) in Table 3. The second column of the table shows the estimates when the first principal component of the SCA series is replaced with that of the SPF series. As we expected, dispersion among professional forecasters also has strong predictive power over market-wide trading volume, with an economic significance comparable to that of the household investors. When we include the first principal components of both the SCA and the SPF data, we find that the estimated coefficient for the SCA series is only moderately smaller than that in column (1) and remains statistically significant. Therefore, on balance, our results show that belief dispersion among household investors does appear to carry additional information regarding stock trading volume fluctuations. That said, we want to point out that due to the substantial differences between the SCA and SPF surveys (such as survey frequency and the nature of variables), we caution that the results in Table 5 should be interpreted as tentative and indicative.

5.1.4 Robustness

While presenting our baseline results, we have made several choices in organizing the data for parsimonious analysis. Are these results sensitive to the way we calculate turnover rates, belief dispersion and model specifications? We implement a sequence of robustness analyses to show that the relationship presented between belief dispersion and market-wide stock turnover rate is highly robust. The estimated β coefficients of varying specifications are summarized in Table 6.

We first experiment with giving different weights, ω_i in Equation (2), to survey answers that are "about the same" when we compute the weight Herfindahl index. In our baseline analysis, we give a weight of 2 to such answers. We now try a smaller value of the weight, 1.5. We also present the result where the ordering of the answers is not taken into account ($\omega = 1$). As rows (b.1) and (b.2) in the table show, most coefficients remain positive and are both statistically and economically significant, with the exception of $BUS5$ and $UNEMP$. In particular, the coefficient estimated for the first principal component is largely unchanged for $\omega = 1.5$ and remains significant even for $\omega = 1$.

We next experiment with alternative detrending methods. Our baseline specification uses a cubic polynomial to detrend the series of turnover rate. Rows (c.1) and (c.2) present results of linear and quadratic-detrending, respectively. As the estimated coefficients show that trend specification does not qualitatively alter our conclusions. In addition, recall that the detrended turnover series exhibits an appreciable degree of persistency. We control for the autocorrelation in the detrended turnover series by including its own lag in Equation (4). In robustness analyses, we experiment with including two lags. The results, reported in row (c.3), are largely unchanged, apart from the estimates of $BUS5$ and $UNEMP$, which become statistically insignificant. We also study a specification of replacing the dependent variable of Equation (4) with the first order difference of the detrended turnover rate and omitting the lagged detrended turnover rate from the control variables. The results, shown in row (c.4), remain little changed from the baseline analysis, with the exception that the coefficient estimated for $BUS5$ becomes a small insignificant negative number.

We then examine whether our baseline results, derived from the aggregated turnover rates in the three major stock exchanges, hold in each of the stock exchanges. We calculate the turnover rate for NYSE, AMEX, and NASDAQ separately. The regression results using exhange-specifc turnover rates as dependant variables, shown in rows (d.1) through (d.3), are broadly consistent with the baseline analysis. However, we note the estimated coefficients for AMEX are largely insignificant except for $PEXP$. In contrast, the estimated coefficients for NASDAQ tend to be larger in magnitude and statistically significant at a higher level than the baseline analysis.

Finally, in row (e) we explore whether our results are sensitive to additional control variables such as short-term interest rates, yield curve slope and credit spreads. This specification is conservative in the sense that it removes time variations in turnover that are correlated with business cycles, proxied by the three macro variables. Despite this, our results show that belief dispersion remains largely significant in explaining stock turnover rates.

5.2 Trading Volume and Dispersion of Belief Changes

We now turn our attention to effects of dispersion of belief changes on trading volume. We replace the dispersion measure $WNHI$ in Equation (4) with the measure of dispersion of belief changes, DBC, which we defined in Section 4.2. The results are presented in Table 7. Recall that in the SCA sample, some respondents were interviewed for the second time six months after the initial interview; the dependent variable is therefore the six-month cumulative turnover rate, and the S&P returns are also quoted for the six-month time period between the two interviews. Because the six-month turnover rates are overlapping, we allow for the residuals to be autocorrelated up to five lags when correcting standard errors using the Newey-West method. In Table 7, not all β-coefficients are statistically significant. However, they are mostly positive and the β-coefficient of DBC^{BUS5}, DBC^{RATEX} and DBC^{UNEMP} are statistically significant. Regarding the economic significance, an increase of one standard deviation in DBC^{BUS5} implies that the six-month turnover rate will be higher by 0.13 percentage point (or about one-tenth standard deviation of the detrended six-month turnover rate). The exception, the coefficient of $PEXP$, is negative but small in magnitude and statistically insignificant. We also note that the estimated coefficient for the first principal component is very small and insignificant, likely attributable to the fact that the first principal component can only explain about 40 percent of total variance of the DBC series. On balance, the results are broadly consistent with the predictions of Karpoff (1986) and the subsequent empirical findings by Barron (1995) and Bamber, Barron, and Stober (1997) which state that the extent to which people's belief revisions differ from each other also contributes to the fluctuations of trading volume.

6 Conclusion

This paper implements a direct test of the hypothesis that greater belief dispersion and dispersion of belief changes induce higher trading volume (Varian 1985, Karpoff 1986, Ng 2003, Detemple and Murthy 1994, Harris and Raviv 1993, Kandel and Pearson 1995). Empirical evidence of trading volume's relationship with belief dispersion has been limited due to the difficulty in measuring beliefs; this limitation is even greater for dispersion of belief changes. Most of the prior efforts have focused on studying the beliefs of financial analysts around events such as earnings releases. We contribute to the literature by looking directly at the beliefs of households using semi-longitudinal survey data. We argue that this contribution brings us one step closer to measuring the beliefs of market participants and that this measure is likely immune to the biases that stock analysts may inherently have. Moreover, instead of focusing on informational events such as earnings releases, we focus on consumers' beliefs regarding the economy as a whole, such as future business conditions, future personal financial conditions, interest rate changes and unemployment outlooks.

We have shown broad evidence that stock market turnovers are positively related to both the dispersion of contemporaneous beliefs about the future economic outlook and the dispersion of changes in beliefs. Turnovers are more sensitive to dispersion among consumers who fall into the demographic and income groups that are associated with higher stock market participation, which adds credibility to the supposition that these results are not spurious. Moreover, consistent with Karpoff (1986), we find that the dispersion of belief changes ("belief jumbling") over a six-month period is also positively correlated with the cumulative turnover rates during the same time period.

Future research could study capital markets beyond stock exchanges and link forecasters' disagreement on economic indicators to markets that are most relevant to the expectations. For example, one could investigate the relationship between the trading volume in the market for Treasury inflation-protected securities and forecasters' disagreement about future inflation or the relationship between the trading volume in the corporate bond market and disagreement about future corporate bond spreads in the Survey of Professional Forecasters. In addition, it would be helpful to contrast the trading volume sensitivity of individual securities to household and professional investors' belief dispersion and study whether the differences are correlated with the share of institutional holding. Such efforts would provide further evidence that belief dispersion and belief jumbling generate trade.

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Table 1: Description of SCA Expectation Variables (all categorical)

Variable name	Description
$PEXP$	Expectations about whether the consumer himself will be better off financially in a year.
$BEXP$	Expectations about the business conditions in the country after one year.
$BUS5$	Expectations about the business conditions in the country during the next 5 years.
$RATEX$	Interest rates expectations— borrowing rates go up or down during the next year?
$UNEMP$	Unemployment expectations—more or less unemployment during the next year?

Table 2: Summary Statistics of the SCA Data

The table reports the summary statistics of the SCA sample. The upper panel presents time series means and standard deviations of the belief dispersion, measured (for each month) with the weighted negative Herfindahl Index ($WNHI$), for categorical variables $PEXP$, $BUS5$, $BEXP$, $RATEX$, and $UNEMP$. The lower panel reports time series means and standard deviations of our measure of dispersion of belief changes, DBC, for the same expectation variables. The definition of $WNHI$ and DBC are given in Equation (2) and (3).

$WNHI$ of	$PEXP$ (Personal Finance)	$BUS5$ (LT Business Condition)	$BEXP$ (ST Business Condition)	$RATEX$ (Interest Rates)	$UNEMP$ (Unemployment)
Time series mean	-0.626	-0.398	-0.656	-0.508	-0.638
Time series std. dev.	0.048	0.042	0.107	0.076	0.090
DBC of	$PEXP$	$BUS5$	$BEXP$	$RATEX$	$UNEMP$
Time series mean	0.179	0.313	0.223	0.316	0.243
Time series std. dev.	0.041	0.054	0.049	0.066	0.044

Table 3: Turnovers and Belief Dispersion

The table reports turnovers' responses to the dispersion among SCA respondents' beliefs. Dispersion of PEXP, BUS5, BEXP, RATEX and UNEMP are measured using the weighted negative Herfindahl index ($WNHI$). PCA is the first principle component of the dispersion of the other five variables. Independent variables also include monthly dummies. Numbers in parentheses are Newey-West adjusted standard errors. ***, ** and * correspond to significance levels at 99%, 95% and 90% correspondingly. Dependent variable $Turnover$ is measured monthly and is quoted in percentage points. It is also trend adjusted using cubic detrending.

Belief variable	$PEXP$ (Personal Finance)	$BUS5$ (LT Business Condition)	$BEXP$ (ST Business Condition)	$RATEX$ (Interest Rates)	$UNEMP$ (Unemployment)	PCA (First Principle Comp.)
	(1)	(2)	(3)	(4)	(5)	(6)
$WNHI$	3.555***	3.042**	1.109	2.323***	1.417*	0.142***
	(1.181)	(1.490)	(0.689)	(0.799)	(0.824)	(0.048)
Lagged turnover	0.593***	0.584***	0.596***	0.570***	0.597***	0.584***
	(0.054)	(0.058)	(0.057)	(0.059)	(0.057)	(0.057)
Mean(ICE)	0.014***	0.004	0.014***	0.013***	0.015***	0.021***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
S&P return	2.685	2.625	2.816	2.453	2.763	2.758
	(1.759)	(1.751)	(1.766)	(1.785)	(1.742)	(1.771)
constant	1.091*	0.854	-0.408	0.097	-0.296	-1.686***
	(0.588)	(0.881)	(0.342)	(0.428)	(0.395)	(0.475)
Monthly dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.478	0.473	0.471	0.481	0.472	0.480
N	347	347	347	347	347	347

Table 4: Turnover Sensitivities To Belief Dispersion Among Demographic Groups

The table reports turnovers' responses to belief dispersion among SCA demographic sub-samples in $PEXP$, $BUS5$, $BEXP$, $RATEX$, $UNEMP$. Dispersion measures are constructed and regressions are run separately for each demographic group. Each cell reports the β coefficient in Equation (4). Independent variables also include monthly dummies. Numbers in parentheses are Newey-West adjusted standard errors. ***, ** and * correspond to significance levels at 99%, 95% and 90% correspondingly. Turnovers are quoted in percentage points and trend-adjusted.

Subgroups	$PEXP$ (Personal Finance)	$BUS5$ (LT Business Condition)	$BEXP$ (ST Business Condition)	$RATEX$ (Interest Rates)	$UNEMP$ (Unemploy-ment)	PCA (First Principle Comp.)
	(1)	(2)	(3)	(4)	(5)	(6)
by age						
Age $<$ 35	1.534	2.041	0.758	2.214**	-0.099	0.072
	(1.220)	(1.082)	(0.544)	(0.776)	(0.610)	(0.050)
Age $\geq$ 35	2.603**	2.751*	1.030	2.219**	1.861*	0.157**
	(0.838)	(1.360)	(0.652)	(0.760)	(0.790)	(0.048)
by education						
Below high school	0.390	1.888	0.208	1.058	0.198	0.051
	(0.382)	(0.966)	(0.352)	(0.795)	(0.527)	(0.038)
High school graduates	3.695**	2.300	1.154	2.231**	1.432	0.151**
	(1.228)	(1.279)	(0.679)	(0.788)	(0.758)	(0.050)
by race						
Black	0.836	1.733*	-0.180	1.638***	0.179	0.087
	(0.565)	(0.767)	(0.405)	(0.480)	(0.522)	(0.046)
White	2.821**	1.939	0.954	2.178**	1.205	0.143**
	(1.084)	(1.341)	(0.613)	(0.788)	(0.704)	(0.049)
by income						
Lowest income quintile	0.244	2.175**	0.600	1.808**	-0.136	0.060
	(0.603)	(0.766)	(0.412)	(0.693)	(0.607)	(0.039)
highest income quintile	1.696	1.091	0.649	1.736**	0.465	0.116*
	(0.885)	(0.981)	(0.589)	(0.634)	(0.506)	(0.053)

Table 5: Turnover Sensitivites to Belief Dispersion among Household and Professional Investors

The table reports turnovers' responses to belief dispersion in the SCA (household) and SPF(professional) sample. PCA_{SCA} is the first principle component of belief dispersion in $PEXP$, $BUS5$, $BEXP$, $RATEX$, $UNEMP$, measured using the weighted negative Herfindahl index ($WNHI$). PCA_{SPF} is the first principle component of belief dispersion in GDP growth, unemployment rate, corporate profit growth, and industrial production. The SPF is conducted at a quarterly frequency, instead of monthly like the SCA sample. We interpolate the SPF quarterly series to monthly frequency. Independent variables also include monthly dummies. Numbers in parentheses are Newey-West adjusted standard errors. ***, ** and * correspond to significance levels at 99%, 95% and 90% correspondingly. Turnover is quoted in percentage points and adjusted with a cubic-trend.

	Household Only (1)	Professional Only (2)	Both (3)
PCA_{SCA}	0.142***		0.119**
	(0.048)		(0.052)
PCA_{SPF}		0.096***	0.063*
		(0.035)	(0.036)
Lagged turnover	0.584***	0.579***	0.571***
	(0.057)	(0.057)	(0.058)
S&P return	2.758	2.535	2.639
	(1.771)	(1.753)	(1.775)
Mean(ICE)	0.021***	0.016***	0.024***
	(0.005)	(0.005)	(0.006)
constant	-0.892*	-0.485	-1.137**
	(0.466)	(0.413)	(0.491)
Monthly dummies	Yes	Yes	Yes
R-squared			
N	347	347	347

Table 6: Turnover and Belief Dispersion–Robustness

The table reports robustness results on turnover's responses to the dispersion among SCA respondents' beliefs. Dispersions of PEXP, BUS5, BEXP, RATEX and UNEMP are measured using the weighted negative Herfindahl index ($WNHI$). PCA is the first principle component of the dispersion of the other five variables. Each cell reports the β coefficient for belief dispersion ($Disp$) in Equation (4). Each row corresponds to one alternative specification. In (b.1) and (b.2), we vary the weighting scheme in calculating $WNHI$. In (c.1) and (c.2) turnovers are linearly or quadraticly detrended. In (c.3) we add a second lag of turnover in Equation (4). In (c.4) both dependent and independent variables are first-order differenced. In (d.1), (d.2) and (d.3) we use turnovers in three different major exchanges seperately. In (e) we add additional control variables such as short-term interest rates, yield curve slope and credit spreads. Independent variables also include monthly dummies. Numbers in parentheses are Newey-West adjusted standard errors. ***, ** and * correspond to significance levels at 99%, 95% and 90% correspondingly. Dependent variable $Turnover$ is measured monthly and is quoted in percentage points.

	Belief variable	$PEXP$ (Personal Finance) (1)	$BUS5$ (LT Business Condition) (2)	$BEXP$ (ST Business Condition) (3)	$RATEX$ (Interest Rates) (4)	$UNEMP$ (Unemployment) (5)	PCA (First Principle Comp.) (6)
(a)	Baseline	3.555***	3.042**	1.109	2.323***	1.417*	0.142***
	w = 2, Cubic-detrending, AR(1), All Exchanges	(1.181)	(1.490)	(0.689)	(0.799)	(0.824)	(0.048)
(b.1)	$w = 1.5$	4.828***	2.743	1.731	1.962***	1.515	0.141***
		(1.662)	(2.314)	(1.074)	(0.727)	(1.136)	(0.049)
(b.2)	$w = 1$	5.886**	-0.324	3.268	1.572**	0.347	0.089*
		(2.701)	(2.070)	(2.149)	(0.637)	(1.499)	(0.046)
(c.1)	Linear detrending	2.975**	4.602***	1.397**	0.580	1.619*	0.106**
		(1.280)	(1.701)	(0.676)	(0.715)	(0.847)	(0.050)
(c.2)	Quadratic detrending	3.514***	3.045**	1.113	2.315***	1.426*	0.142***
		(1.181)	(1.490)	(0.688)	(0.798)	(0.824)	(0.048)
(c.3)	two lag turnover: AR(2)	2.939**	2.223	0.913	2.000**	1.172	0.121**
		(1.211)	(1.504)	(0.710)	(0.833)	(0.870)	(0.050)
(c.4)	First-order diff.	2.387**	-0.152	1.410	3.391**	2.387***	0.250***
		(1.113)	(1.830)	(1.116)	(1.645)	(0.911)	(0.070)
(d.1)	NYSE	1.837**	3.460***	0.215	1.199**	0.556	0.048
		(0.872)	(1.031)	(0.507)	(0.525)	(0.558)	(0.034)
(d.2)	AMEX	3.133*	0.078	0.887	0.340	1.013	0.099
		(1.703)	(1.421)	(0.902)	(0.922)	(1.021)	(0.064)
(d.3)	NASDAQ	6.052***	2.623	2.506*	4.220***	3.061*	0.299***
		(2.169)	(2.736)	(1.277)	(1.515)	(1.624)	(0.094)
(e)	Control for short-term rate, yield curve slope, credit spreads	3.580***	3.665**	1.150	2.501***	1.497*	0.164***
		(1.287)	(1.611)	(0.774)	(0.926)	(0.868)	(0.061)

Table 7: Turnovers and Dispersion of Belief Changes in the SCA sample

The table reports turnovers' responses to dispersion of belief changes in $PEXP$, $BUS5$, $BEXP$, $RATEX$ and $UNEMP$ among SCA respondents. Independent variables also include monthly dummies. Numbers in parentheses are Newey-West adjusted standard errors. ***, ** and * correspond to significance levels at 99%, 95% and 90% correspondingly. Turnover is measured for six-month periods and is quoted in percentage points. It is also trend-adjusted.

DBC of	$PEXP$ (Personal Finance)	$BUS5$ (LT Business Condition)	$BEXP$ (ST Business Condition)	$RATEX$ (Interest Rates)	$UNEMP$ (Unemploy-ment)	PCA (First Principle Comp.)
	(1)	(2)	(3)	(4)	(5)	(6)
DBC	-0.007	0.024**	0.007	0.024**	0.028**	0.001
	(0.015)	(0.011)	(0.015)	(0.010)	(0.014)	(0.001)
Lag turnover	0.602***	0.585***	0.599***	0.575***	0.591***	0.590***
	(0.056)	(0.056)	(0.057)	(0.060)	(0.057)	(0.058)
Mean(ICE)	0.000*	0.000	0.000*	0.000***	0.000***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
S&P Return	0.026	0.026	0.026	0.026	0.025	0.026
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
cons	-0.004	-0.011***	-0.009	-0.016***	-0.016***	-0.010**
	(0.006)	(0.004)	(0.007)	(0.006)	(0.006)	(0.005)
month dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.489	0.496	0.489	0.500	0.495	0.493
N	325	325	325	325	325	325

Figure 1: Monthly Turnovers and Detrended Turnovers of U.S. Stock Market

This figure plots time series of US stock market turnover rates in percentage points. Turnover is defined as the combined number of shares traded in NYSE, AMEX and NASDAQ in a given month divided by the average total number of shares outstanding during the same month. The top panel shows the turnover rates. The bottom panel shows the turnover after Cubic-detrending. The sample period is from 1978 to 2006.

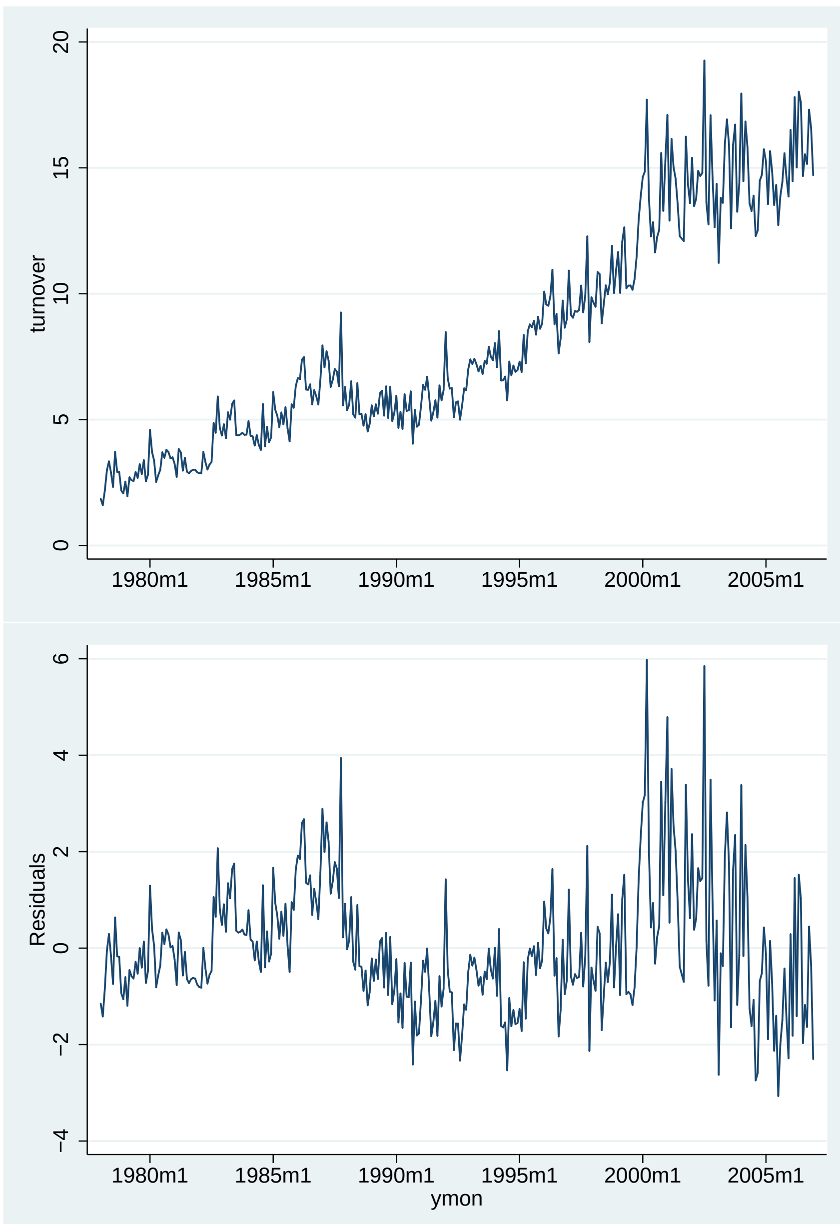

Figure 2: Monthly Belief Dispersion

This figure plots time series of dispersion of beliefs on five expectation variables in SCA. The five expectation variables are unemployment, interest rates, short-term business conditions (BEXP), personal financial conditions (PEXP) and long-term business conditions (BUS5). The last panel plots the first principle component of the five dispersion series. Belief dispersion are measured using weighted negative Herfindahl index (WNHI) described in Equation (2). Larger values indicate higher dispersion. Shaded areas are NBER recession periods.

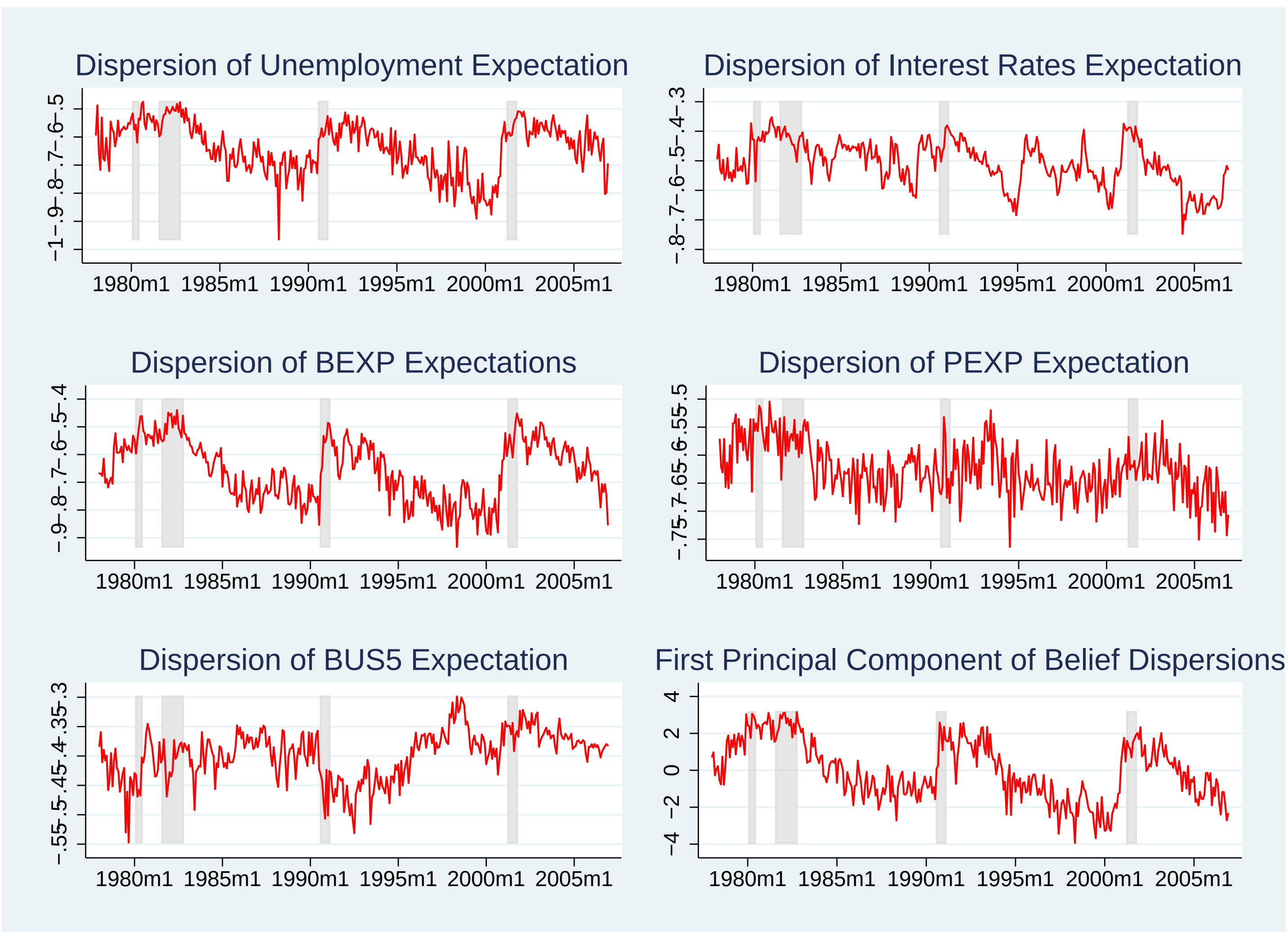

Figure 3: Monthly Dispersion of Belief Changes (DBC)

This figure plots time series of dispersion of beliefs changes (DBC) on five expectation variables in SCA. The five expectation variables are unemployment, interest rates, short-term business conditions (BEXP), personal financical conditions (PEXP) and long-term business conditions (BUS5). The last panel plots the first principle component of the five DBC series. DBC measure is defined in Equation (3). Larger values indicate higher dispersion. Shaded areas are NBER recession periods.