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Heterogeneous Beliefs, a Short-Sale Restriction, and the Cross Section of Stock Returns: An Evidence from China

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Abstract

We find a negative cross-sectional relation between heterogeneous beliefs and future stock returns in China, where short sale is prohibited in our sample period. Compared to other empirical works, which often be done in a market without short sale prohibition, we obtain this strong negative results after controlling several characteristics of stocks, such as size, leverage, book to market ratio and momentum. This negative relationship supports theoretical conjecture on heterogeneous beliefs (Miller (1977)). Our heterogeneous beliefs proxy is unexplained turnover, which is turnover of individual stocks adjusted by market turnover and its momentum. We also control the liquidity and idiosyncratic uncertainty in the robust test. These two factors are often attributed to the reason of the negative relation between turnover and future returns.

Key Words

Heterogeneous Beliefs, Cross-Section Returns, Short-Sale Prohibition.

JEL Classification

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1 Introduction

A class of Fama-French models is often accompanied by the assumption that different investors form their beliefs in a homogeneous fashion. This counter-intuitive assumption implies that all investors reach the same conclusion about the fundamental value of a stock. Even if the same information set is equally accessible by all investors, their estimates of a company's future profitability may be diverse by reflecting different preferences, discount factors, liquidity constraints, the investment horizons, and several behavioral characteristics uncovered recently[1]. It seems that heterogeneity in beliefs may be an important missing factor from a class of Fama-French models. Heterogeneous beliefs also play an essential role for assessing how a short-sale restriction on holding of stocks affect their returns in a few security-market equilibrium models. Miller (1977), Harrsion and Kreps (1978) and Scheinkman and Xiong (2003) establish a negative link between opinion divergence and returns under the short-sale constraints. They argue that such an institutional restriction prevents investors of pessimism for a company from taking a short position in that stock and therefore encourage their exit from the market. On the other hand, Varian (1985) treats heterogeneity of beliefs as one source of risk and obtains a positive dispersion-return relation, although his model lacks a short-sale constraint. In sum, a theoretical impact of heterogeneity in beliefs is mixed, depending on the strength of a short-sale restriction. Given a recent interests in the ban of naked short-selling of credit default swaps in the European market[2], theoretical inconclusiveness of the effect of short-sale constraints should be complemented by a robust empirical analysis.

Unfortunately, empirical results are also mixed. Diether, Malloy and Scherbina (DMS, 2002) claim a negative relation between dispersion in analysts' earnings forecasts and stock returns. They rely on a theoretical argument by Miller (1977) such that disagreement among investors combined with a short-sale constraint generates a premium for asset valuation. In contrast, Anderson, Ghysels and Juergens (2005) claim a positive link between analysts' dispersion and stock return. Garfinkel and Sokobin (GS, 2006) use unexplained volume as a proxy of belief dispersion to confirm a similar positive association. They interpret their results in favor of Varian (1985). Buraschi, Trojani and Vedolin (2011) suggest a more complex relation between disagreement and returns interacted with the level of leverage. Disagreement increases expected stock returns for normal levels of leverage while the opposite may hold for low level. To summarize, the aforementioned empirical works show mutually incompatible results in terms of the relation between heterogeneous beliefs and stock returns. Moreover, they typically rely on data from stock exchanges allowing investors for shot-selling. Relation between heterogeneous beliefs and stock returns has not been obvious under a strict short-sale restriction.

This paper tries to confirm such relation by combining two empirical strategies. The first one is to use a serially demeaned, market-adjusted volume per share outstanding as a proxy for the divergence of opinions. We call this proxy an unexplained volume by following Garfinkel and Sokobin (2006). There are three advantages of this proxy over the

[1] See, e.g. Hong and Stein (2007).

[2] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ecofin/128081.pdf

traditional dispersion of analysts' forecasts. First, our proxy reflects a fresh disagreement rather than a time-invariant level of disagreement prior to the period under consideration. Hong and Stein (2007) emphasize that transition of investors' minds between pessimism and optimism induces returns by triggering strong motifs of trades in the market over the associated period of time. In a market with a strict short-sale restriction, greater divergence of opinions among investors may expel pessimistic investors from the market, lowering the return over the corresponding period. Second, as noted by Boehme, Danielsen and Sorrescu (2006), the variability measures of earning forecasts may be subject to a selection bias because they can be computed only for those companies followed by many analysts with multiple forecasts. Since many followers are usually associated with relatively large, industry-representative companies, any reported effects of divergence in opinions may just reflect those for large companies. In contrast, the transaction volume data are widely available. Third, Garfinkel (2009) suggests that the unexplained volume is positively correlated with his new measure of dispersion in private opinions based on proprietary limit orders and market orders. On the other hand, the variability of analysts forecasts is not correlated with such a measure of private information for small companies or around days of earning announcement.

The second strategy is to use data from the Shanghai Security Exchange. In this market, the short-sale was totally prohibited before March, 2010. Therefore, we can test Miller (1977) in an environment very consistent with his conjecture. Note that GS (2005) use the unexplained volume as we do but they use data from NYSE/AMEX without institutional short-sale constraints. D'Aavola (2002) documents that they find a positive association between such proxy and future returns, as predicted by Varian (1985). On the other hand, we use such proxy for the market with the short-sale prohibition. Note that China Securities Regulatory Commission has gradually promoted marginal trading and securities lending since March 2010. Therefore, our study will also be a basis for a future analysis of policy effect concerning the relaxing/tightening a short-sale restriction in a representative emerging market.

Our empirical findings are summarized as follows:

1. We find a negative cross-sectional relation between heterogeneous beliefs and future stock returns in the Shanghai Security Exchange over the period of short-sale ban.

2. Our result survives even after controlling for several characteristics of stocks, such as size, leverage, book to market ratio and momentum. This negative relationship supports a dynamic version of conjecture by Miller (1977).

3. Our finding is robust to the projection of our unexplained volume proxy onto measures of liquidity and idiosyncratic uncertainty. Although the negative relation between turnover and future returns are often attributed to these factors, we find that the residual of this projection still induces very similar results as the original proxy.

The remainder of this paper is organized as follows. Section 2 discusses the related literatures on the heterogeneous believes. Section 3 presents the hypotheses, data and describes the research methods. Section 4 contains the results and section 5 provides the robust test and section 6 concludes.

2 Literature Review

There are two strands of literature on the relation between the heterogeneous beliefs and the sign of future return. The earlier contributors are Miller (1977) for the negative direction and Varian (1985) for the positive direction. There are also many empirical works on this topic, using various proxies to capture heterogeneity in beliefs.

2.1 Negative Relation between Heterogeneous Beliefs and Returns

Miller (1977) conjectures that in a market with short sale constraints with investors of dispersed opinions, equity prices tend to reflect views of optimists rather than those of pessimists. The reason is that investors with low evaluation for the company may not have other choices but to leave the market. Only the investors with high evaluation will stay in the market. The price of stock tends to be higher but reverts in the future, hence a negative return over time. However, Miller's model is static by nature so that investors keep their initial positions without any rebalancing until stock liquidation. Dynamic models such as Harrison and Kreps (1978), Scheinkman and Xiong (2003) and Hong, Scheinkman, and Xiong (2006) share the spirit with Miller and derive a negative relation between heterogeneous beliefs and returns.

DeTemple and Murthy (1997) develop an equilibrium model for log investors. Each of them maximizes utility from a stream of future consumption in the presence of a portfolio constraint. In this model, equilibrium stock price is at a premium of the expected present value of a stream of future dividends. Since the latter prevails as an equilibrium stock price if the investors have common beliefs, their result formally expresses the inflation of stock price induced by a short-sale constraint. Note that they could derive this implication given a milder constraint in terms of the investment-wealth ratio, like a margin requirement, than the exogenous short-sale ban as in our data.

Duffie, Gârleanu and Pedersen (2002) emphasize the necessity and difficulty of locating lendable securities, led to the initial price elevation and the decline afterwards so that such a short-sale restriction induces a negative return in the future, especially after the initial public offering (IPO). Since it is impossible to take a short position before IPOs, and still difficult to do so immediately after that, IPO data provide a rare environment for testing the relation between heterogeneous beliefs, short-sale constraint and the stock return response. A recent investigation by Chemmanur and Krishnan (2011) is consistent with the negative relation between heterogeneity in beliefs and stock returns.

Lee and Swaminathan (2000) discover that a lower return follows a higher turnover. Combined with several volume-generating mechanism as surveyed by Hong and Stein (2007), this suggests the negative relation between heterogeneous beliefs and future returns. Diether, Malloy and Scherbina (2002) find the negative effect of the dispersion in analyst forecasts, using a dataset from 1983 to 2000 in the US. Using the dispersion of analysts' forecasts as a proxy for the divergence in opinions, they document that the negative relation is more pronounced for small firms, high book-to-market firms, and low momentum firms. Goetzmann and Massa (2005) use a panel data of investors' accounts in the US and construct an investor-based measure of dispersion of opinion. They also find the negative relation.

Boehme, Danielsen and Sorescu (2006) use three measures of opinion dispersion: dispersion of analysts' forecasts, idiosyncratic volatility (SIGMA) and trade volume (turnover). They find that these proxies are highly correlated with each other but the latter two are more useful than the first. In particular, for the stocks that are not followed by analysts, they report a negative relation between disagreement and returns. They emphasize the simulateneous presence of heterogeneity in beliefs and the short-sale restrictoin to generate such relation, as is consistent with DeTemple and Murthy (1997). The efficacy of the volume proxy is consistent with Garfinkel (2009), suggesting that his new measure of dispersion in private information is strongly and positively correlated with the unexplained volume.

2.2 Positive Relation between Heterogeneous Beliefs and Returns

In contrast to Miller (1997), Varian (1985) document that investors' disagreement is one source of risk. Greater dispersion in beliefs is viewed as a risk factor and therefore attracts higher return for compensation. However, his model lacks the important short-sale restriction. It is not clear if we can apply his conjecture to the analysis of stock returns under strict short-sale restriction in our sample period.

Doukas, Kim and Pantzalis (DKP, 2006) argue that after controlling the common uncertainty in the analysts' earnings forecasts, dispersion in analysts' forecasts is positively related to stock returns. They attribute the negative dispersion-return relation found in DMS (2002) to the uncertainty effect instead of opinion divergence. They report that returns associated with earning announcement are increasing as ex-ante opinion becomes more divergent. Anderson, Ghysels and Juergens (2005) also use the dispersion of analysts' forecasts as the proxy. They separate dispersion as short-term (one year ahead forecast variance) and long-term (five-year ahead forecast variance) and show their positive association with returns.

Garfinkel and Sokibin (2006) also establish a positive link between the unexplained volume and the post earning-announcement returns, the same sign as DKP (2006) obtain. Recall that both works rely on return data from CRSP files in the US. D'Avolio (2002) documents empirically that the most stocks in CRSP files are shortable, and the 16% of those hard-to-borrow stocks are mostly tiny and illiquid, accounting for only .6% of the total market value. As we observe, it is not obvious if their results defy the negative relation between heterogeneous beliefs and stock returns because a strict short-sale restriction is necessary to generate such relation.

Garfinkel (2009) criticizes a premise behind the dispersion of analysts' forecasts as a proxy for the divergence in investors' opinions. Indeed, (i) analysts may have incentive to express optimistic reports to encourage more investment on those stocks as McNichols and O'Brein (1997) suggest, (ii) professional managers worry about withdrawls from his fund to avoid short-run liquidity constraint even if those positions are likely to be winners in the long run (Shleifer and Vishny 1997), and (iii) investors may have their own private information and valuation methods, as is consistent with the story of heterogeneous priors (see, among others, Hong and Stein 2007).

In sum, a theoretical impact of heterogeneity in beliefs has not been determined in a convincing way. Not all theoretical models employ short-sale restrictions.

3 Methodology

3.1 Hypothesis

From the re-opening of the Chinese mainland stock markets in early 1990s to March of 2010, the short selling had been prohibited in the Shanghai Security Exchange (SSE). Given the prediction by Miller (1977), those stocks traded in the Shanghai market might have been overpriced if investors disagreed about their values because the opinions by pessimistic investors might not have been reflected. Let us pose a research hypothesis as follows:

Greater heterogeneity in beliefs might induce lower stock returns in Shanghai.

3.2 Data

Our data cover the period from January, 1, 2001 to December, 31, 2009, including all A-share stocks in the SSE[3]. After removing all stocks retired from or judged as not qualified in the market, the final sample contains 740 stocks. We match their daily and monthly data of transactions in the stock exchange with corresponding accounting data from the audited financial reports. All data are collected through the China Resset dataset[4].

3.3 Unexpected turnover as a proxy for heterogeneous beliefs

We construct a measure of the heterogeneous beliefs by serially-demeaned, market-adjusted turnover per share outstanding as follows. For the stock-i at day-t, let $V_{i,t}$ be the raw transaction volume and $S_{i,t}$ be the total share outstanding. Variables with $i = m$ stand for those of the market. Our measures of the turnover for individual stock-i at day-t ($TO_{i,t}$) and in month-T with days $t = 1 \dots n$ ($TURN_{i,T}$) are defined by

$$TO_{i,t} = \left(\frac{V_{i,t}}{S_{i,t}} - \frac{V_{m,t}}{S_{m,t}}\right) - \frac{1}{50}\sum_{s=t-54}^{t-5}\left(\frac{V_{i,s}}{S_{i,s}} - \frac{V_{m,s}}{S_{m,s}}\right), \quad TURN_{i,T} = \frac{1}{n}\sum_{t=1}^{n} TO_{i,t} \tag{1}$$

Let us put four remarks. First, we use the volume per share outstanding as a daily unadjusted turnover *in percentage*. Second, the market turnover is calculated similarly and is subtracted from individual turnovers to control the effect of market-wide news.

[3]A-share stocks are denominated in the Chinese Yuan while the B-share stocks are in the US Dollar.
[4]http://www.resset.cn/en/

Third, an asset-specific liquidity effect is captured by a time-series average of such market-adjusted individual turnovers from 54 days ago to 5 days ago and is further subtracted from the market-adjusted turnover of stock-i at day t for the serial demeaning. This serial demeaning accounts for the name "unexplained volume" for $TO_{i,t}$, namely the variation unexplained by the past time series average of daily market-adjusted volume per share outstanding. Finally, our daily measure is calculated for all days rather than for special days, e.g. of earning announcements as Garfinkel and Sokobin (2006) focus on. In particular, the serial demeaning is implemented over a rolling-window of 50-day size. This approach partially accounts for the possible time-varying momentum effect in the trading volume.

3.4 Research Methods

We use (i) the cross-sectional regression analysis and (ii) the porftolio analysis to investigate the relation between opinion dispersion and stock return. The first approach relies on a two-step procedure by Fama and MacBeth (1973) to discover if unexplained turnover in month-$(T-1)$ can predict cross-section monthly return in month-T. The first step is doing regression of monthly return on different factors calculated in previous month and getting the coefficients. The second is calculating the time-series coefficients' mean, standard error and t-statistics.

The second approach amounts to the formation of portfolios in month T-1 based on different characteristics of stocks and comparison of their monthly buy-and-hold returns. We use the unexplained turnover, size, leverage, BM ratio and momentum factor to test if the heterogeneous beliefs effect would be affected by these factors. The portfolio analysis is more relevant and closer to the portfolio management in practice.

4 Results

4.1 Regression Tests

We run a Fama-MacBeth regression with our nine years data to examine the cross-sectional relation between heterogeneous beliefs and return. The first step is for every month T, regressing return on unexplained turnover and other control variables in month T-1. The second step is using all the coefficients to calculate the aggregate coefficients. The regression equation we use is as follow:

$$\begin{aligned}RET_{i,T} =& \alpha_T + \beta_1 \cdot TURN_{i,T-1} + \beta_2 \cdot IV_{i,T-1} + \beta_3 \cdot ILQ_{i,T-1} \\ &+ \beta_4 \cdot UMD_{i,T-1} + \beta_5 \cdot ln(M)_{i,T-1} + \beta_6 \cdot ln(B/M)_{i,T-1} \\ &+ \beta_7 \cdot \beta_{i,T} + \epsilon_{i,T}\end{aligned}$$

The dependent variable is a month-T buy-and-hold return, and the main dependent variable is the monthly unexplained turnover as defined in (1). There are six additional control variables in the right hand side.

4.1.1 $IV_{i,T}$

Barinov (2011) suggests that turnover may be a proxy for firm-specific uncertainty and aggregate volatility. Therefore, we calculate the idiosyncratic volatility (IV) to control firm-specific uncertainty. Following Ang, Hodrick, Xing and Zhang (2006), we run the regression:

$$\begin{aligned} r_{i,t} &= RET_{i,t} - RET_{m,t} = \alpha_i + \beta_{i,1} \cdot MKT_t + \beta_{i,2} \cdot SMB_t + \beta_{i,3} \cdot HML_t + \epsilon_{i,t} \\ IV_{i,T} &= (\frac{1}{n}\sum_{t=1}^{n} \hat{\epsilon}_{i,t}^2)^{1/2} \end{aligned}$$

where $r_{i,t}$ is the daily excess return of stock-i, MKT, SMB, and HML are three factors of the market portfolio a lá Fama-French, and $IV_{i,T}$ is the idiosyncratic volatility of stock-i in the month-T.

4.1.2 $ILQ_{i,T}$

Turnover has also been interpreted as a proxy for liquidity demand by Benston and Hagerman (1974) and Amihud (2002). The latter suggests that illiquidity predicts return since the inability to trade sufficiently large amount of stocks in the market swiftly should be a risk factor to be compensated. A negative relationship between the unexplained turnover and the future returns, if any, may be generated by higher liquidity demand, leading to a lower risk premium and therefore lower return rather than the consequence of heterogeneous beliefs. Although the serial demeaning over the rolling window may partially accounts for the past momentum that may be partially driven by liquidity motif as explained by Garfinkel and Sokobin (2006) and Garfinkel (2009), we consider liquidity as time-varying and decide to control the contemporaneous liquidity effect further by adding the illiquidity measure a lá Amihud (2002). It is denoted by $ILQ_{i,T}$ and is defined as follows:

$$ILQ_{i,T} = \frac{1}{n}\sum_{t=1}^{n} \frac{|RET_{it}|}{V_{it}} \cdot 10^6$$

where $|RET_{it}|$ is the absolute return of stock-i from day-$(t-1)$ to t in the month-T with n days, $t = 1 \dots n$, and $V_{i,t}$ is as previously. Because the scale of their ratio tends to be very small, following Amihud (2002), we multiply it by 10^6 with no changes in the statistical inference later.

4.1.3 CAPM/Fama-French Factors

We also add several other variables that have been effective to explain returns in multi-factor models. UMD is the average monthly return from month T-12 to T-2 to control the momentum. $ln(M)$ is the natural logarithm of market capitalization to control the size effect. $ln(B/M)$ is the natural logarithm of book to market ratio. β is the CAPM-β obtained by regressing individual returns onto the market return from month T-25 to month T-2.

4.1.4 Results

Table 1 reports summary statistics of dependent and independent variables in this regression analysis from the second to fifth columns. The last two columns report the estimated coefficients of regressing $r_{i,t}$ onto these variables. Two models are different if we include the market risk measured by the CAPM beta. For these columns, robust t-values are reported in parentheses.

Table 1: Summary of Regression Analysis

Variables	Mean	Std	Min	Max	Model 1	Model 2
r	0.02	0.16	-0.76	1.89		
$TURN$	0.05	1.16	-8.80	17.68	-0.003***	-0.003***
					(-3.09)	(-3.03)
IV	0.19	0.02	0.00	3.25	-0.538***	-0.616***
					(-4.02)	(-4.82)
$Illiq$	0.00	0.04	0.00	6.13	1.131***	1.017**
					(2.68)	(2.47)
UMD	0.02	0.06	-0.16	0.97	0.071	0.041
					(1.27)	(0.75)
$ln(M)$	20.88	1.05	17.46	26.10	-0.001	0.000
					(-0.52)	(0.11)
$ln(B/M)$	-0.29	0.81	-9.04	2.92	0.005***	0.003**
					(3.40)	(2.54)
β	1.08	0.38	-2.16	10.77		0.020**
						(2.12)
$Const.$					0.050	0.005
					(0.98)	(0.10)
$Adj.R^2$					9.64	15.95

***, **, *: statistically significant at 1%, 5%, 10% levels.
R^2 and summary statistics of $Return$ and $Turn$ are in percentages.

The coefficient of $TURN$ is significantly negative. Consistent with Amihud (2002), there seems a illiquidity risk premium on return. The coefficients of book-to-market ratio become smaller and less significant in Model 2 relative to Model 1, perhaps because β captures some risk factors correlated with the other included factors.

4.2 A Portfolio Analysis

Let us consider four different cases of portfolio formation and their performance. After sorting all stocks according to their several characteristics in the previous month, we assess the average monthly buy-and-hold return of equal-weighted portfolio within each category.

Case 1: Sorting by Size and Belief Dispersion

We sort all stocks into nine categories composed of three classes of the size of market capitalization on the last trading day of the previous month, and three degrees of the unexplained turnover in the last month. The average monthly returns are summarized in Table 2.

Table 2: Mean Returns of Portfolios sorted by Size and Belief Dispersion

	Size			
Dispersion	Small	Medium	Large	All
Low	2.64	2.33	1.86	2.27
Medium	2.57	2.03	1.65	2.08
High	1.12	0.84	1.09	1.02
Low - High	1.52***	1.49***	0.77***	1.25***
t-statistic	(5.49)	(5.63)	(2.98)	(8.16)

*** : statistically significant at 1% level.
t-statistics in the parentheses are to test if two samples come from normal distributions with unknown and possibly unequal variances.

Table 2 shows that the negative association between the unexplained turnover and the monthly returns is widely observed over all sizes of market capitalizations. Low and high dispersion measures exhibit significant difference for size-sorted as well as aggregate portfolios even at the 1% level. This is a sharp contrast to DMS (2002). Based on a similar sorting of stocks by size and another measure of opinion dispersion, they cannot confirm a significant difference between high and low dispersion portfolios for the portfolio of a relatively big size. They claim that the dispersion effect is only pronounced in small stocks. DMS (2002) do not explain why for big size group the difference is not pronounced. As they mentioned, they use I/B/E/S data in order to use analysts' forecasts as opinion dispersion, but the universe of I/B/E/S is composed of firms followed by multiple analysts. Such firms are typically industry-representative in terms of their market capitalizations. Moreover, their finding is not consistent with several theoretical contributions such that the relation of heterogeneous beliefs and return should not be affected by size when all the stocks are subjected to the short sale constrains (see, e.g. Harrison and Kreps (1978), Scheinkman and Xiong (2003) and Hong, Scheinkman, and Xiong (2006)). In contrast, our empirical results seem in line with these works, perhaps because of the superiority of the unexplained volume over the variation of analysts' forecasts as Garfinkel (2009) claim. Our paper uses whole market data in China and our result supports the prediction that under short sale constraints, heterogeneous beliefs and returns are negatively related regardless of size.

Table 2 also shows an interesting non-monotonic relation between size and return for the portfolio with high opinion divergence. It is worthwhile to investigate in the size effect in high opinion divergence groups in future works.

Case 2: Sorting by Size, Leverage and Belief Dispersion

This case involves 27 categories of stocks sorted by size, leverage and belief dispersion with three classes for each. The leverage is defined as the percentage ratio of total debt to total asset. Sorting stocks by the leverage is motivated by Buraschi, Trojani and Vedolin (2011). We also sort stocks by the size as previously, because larger firms tend to have higher leverage ratios than smaller firms (Titman and Wessels (1988), Rajan and Zingales

(1995)). We obtain data of debts and assets of firms in our sample from their accounting reports. Since the accounting reports are not issued every month, we will keep using those in the nearest months until the latest updates come out so that the leverage ratios are in the information sets of all investors. Table 3 reports the returns from these three cut sorted portfolios.

Table 3: Mean Portfolio Returns by Size, leverage, and Dispersion

	Low Leverage			Medium leverage			High leverage		
Dispersion	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap
Low	2.65	2.63	1.86	3.10	2.21	1.92	2.88	2.66	2.01
Medium	2.49	2.32	1.65	2.62	1.80	1.88	2.73	1.97	1.87
High	1.21	1.16	1.06	1.26	0.80	1.43	1.17	1.05	1.12
Low-High	1.44***	1.47***	0.80**	1.84***	1.41***	0.49	1.71***	1.61***	0.89**
t-statistic	(2.97)	(3.09)	(1.76)	(3.75)	(3.05)	(1.05)	(3.34)	(3.34)	(1.98)

***, **: statistically significant at 1%, 5% levels.
t-statistics in the parentheses are to test if two samples come from normal distributions with unknown and possibly unequal variances.

Table 3 shows that the average return monotonically decreases as the belief dispersion becomes higher for any combination of the size and leverage. The return differentials relative to the high and low belief dispersions are also significantly positive for eight out of nine combinations, with the only exception for the large size, moderately levered firms. Our results for firms of the big size are at odd with some of those in Buraschi, Trojani and Vedolin (2011). They obtain a *positive* association between the belief dispersion measured by the variability of analysts' earning forecasts and return for highly levered firms. We suspect that their proxy of the belief dispersion and a selection bias behind that may be blamed for by the same reason as Garfinkel (2009) criticizes DMS (2002). In sum, the negative relation between the belief dispersion and the future returns does not seem upset by the leverage factor.

Table 3 also suggests that the non-monotonicity of the size effect on the portfolio associated with the high disagreement may be due to those for firms with a medium leverage.

Case 3: Sorting by Size, BM Ratio and Belief Dispersion

This is the case with a book-to-market ratio for sorting stocks. The book-to-market ratio is defined as the book value of a stock holders' equity plus balance sheet deferred taxes divided by the market capitalization at the end of each month. Following DMS(2002), we still use the size for sorting stocks because firms of larger sizes tend to have lower book-to-market ratios. Table 4 reports the average monthly returns of 27 portfolios.

The monotonically inverse relation between belief dispersion and returns are observed for most of the cases. Interestingly, portfolios of lower BM ratios enjoy larger return differentials for the high and low belief dispersion (1.42, 1.65, and 0.94) compared to those of higher BM ratios (1.33, 1.46, and 0.77). Moreover, average returns of portfolio

Table 4: Mean Portfolio Returns by Size, Book-to-Market, and Dispersion

	Low BM			Medium BM			High BM		
Dispersion	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap
Low	2.10	2.01	1.50	2.73	2.40	1.82	3.17	2.62	2.10
Medium	2.07	1.68	1.24	2.79	1.90	1.73	2.62	2.44	2.27
High	0.68	0.36	0.56	1.07	1.13	1.31	1.84	1.16	1.33
Low-High	1.42***	1.65***	0.94**	1.66***	1.27***	0.51	1.33***	1.46***	0.77**
t-statistic	(2.78)	(3.43)	(2.05)	(3.46)	(2.74)	(1.11)	(2.84)	(3.26)	(1.82)

***, **: statistically significant at 1%, 5% levels.
t-statistics in the parentheses are to test if two samples come from normal distributions with unknown and possibly unequal variances.

for each size with the high dispersion increase monotonically as the BM ratio becomes larger. Notice that stocks with high (low) BM ratios are recognized as value (growth) stocks. If there is high disagreement on the growth stocks, it is more likely to have lower returns than same disagreement on the value stocks. Growth stocks are more likely to have bad performance in future than value stocks. A strong disagreement among investors' opinions combined with the short sale prohibition might induce exits of investors with low evaluations so that the price can only reflect views of optimistic investors. Growth stocks are more likely to suffer from the price decline. So their returns are relatively lower than value stocks.

Case 4: Sorting by Size, Momentum and Belief Dispersion

This case deals with the momentum factor proposed by Jegadeesh and Titman (1993). It is defined as the average of monthly returns from 12 months ago to two months ago. Those with large momentum factors are frequently called the "winners" in the past, while the opposite happens for the losers. In conjunction with the size and belief dispersion, average monthly returns of 27 portfolios are reported in Table 5.

Table 5: Mean Portfolio Returns by Size, Momentum, and Dispersion

	Losers			Medium			Winners		
Dispersion	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap
Low	2.84	2.72	1.95	3.23	2.41	1.89	2.63	2.45	1.85
Medium	2.77	2.06	2.04	2.86	2.43	1.93	2.37	2.30	1.70
High	1.39	0.89	1.42	1.41	1.05	0.85	1.44	1.09	1.33
Low-High	1.45***	1.83***	0.53	1.82***	1.36***	1.04***	1.19***	1.36***	0.52
t-statistic	(2.88)	(3.89)	(1.15)	(3.75)	(2.87)	(2.34)	(2.30)	(2.80)	(1.08)

***, **: statistically significant at 1%, 5% levels.
t-statistics in the parentheses are to test if two samples come from normal distributions with unknown and possibly unequal variances.

Table 5 shows that the negative relation between return and dispersion are still strong after controlling the momentum in seven out of nine portfolios. In particular, we have the significantly positive return differential between high and low dispersion for the past winners. This is in a stark contrast to DMS (2002) because they could only find such phenomena for losers. It seems that the effect of heterogeneous beliefs in conjunction with the short-sale prohibition in Shanghai is a distinctive factor not simply captured by the momentum.

5 Robustness Checks

5.1 Robustness to Illiquidity and Idiosyncratic Volatility

The previous regression analysis suggests that the iliquidity and idiosyncratic uncertainty may account for the generation of returns. It might be the case that seemingly clear negative association between belief dispersion and returns is due to a negative correlation between turnover and those risk factors. To isolate the effect of belief dispersion, we regress the unexplained turnover further onto the illiquidity measure and idiosyncratic volatility as follows:

$$TURN_{i,T} = \alpha_{i,T} + \beta_{i,1} \cdot ILQ_{i,T} + \beta_{i,2} \cdot IV_{i,T} + \epsilon_{i,T}$$

Using residuals $\hat{\epsilon}_{i,T}$ from this regression instead of $TURN_{i,T}$ in all of the previous portfolio analysis, we obtain very similar results as shown in table 6.

Table 6: Mean Portfolio Returns After Controlling Illiquidity and Idiosyncratic Volatility

	Size				Leverage								
					Low			Medium			High		
Dispersion	Small	Medium	Large	All	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap
Low	2.66	2.24	1.77	2.22	2.58	2.69	1.67	3.14	2.07	1.93	2.66	2.48	2.00
Medium	2.52	2.04	1.71	2.09	2.46	2.38	1.67	2.34	1.81	1.85	2.73	2.10	1.75
High	1.19	0.92	1.11	1.08	1.23	1.05	1.16	1.50	0.92	1.47	1.36	1.10	1.26
Low-High	1.47***	1.32***	0.66***	1.14***	1.35***	1.64***	0.51	1.64***	1.15***	0.46	1.3***	1.38***	0.74*
t-statistic	(5.26)	(4.98)	(2.59)	(7.43)	(2.80)	(3.40)	(1.13)	(3.31)	(2.47)	(0.99)	(2.53)	(2.85)	(1.61)

	Book-to-Market									Mean Returns								
	Low			Medium			High			Losers			Mediums			Winners		
Dispersion	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap	Small Cap	Mid Cap	Large Cap
Low	2.06	1.98	1.45	2.71	2.43	1.82	3.22	2.67	2.09	2.84	2.68	1.95	3.29	2.39	1.86	2.53	2.46	1.79
Medium	2.13	1.73	1.21	2.76	1.83	1.75	2.63	2.37	2.13	2.81	2.05	1.91	2.69	2.36	1.91	2.38	2.14	1.73
High	0.74	0.33	0.64	1.12	1.20	1.28	1.80	1.22	1.49	1.36	0.99	1.53	1.59	1.16	0.91	1.55	1.24	1.38
Low-High	1.32***	1.65***	0.81**	1.59***	1.23***	0.54	1.42***	1.45***	0.60*	1.48***	1.69***	0.42	1.70***	1.23***	0.95**	0.98**	1.22***	0.41
t-statistic	(2.59)	(3.41)	(1.76)	(3.31)	(2.67)	(1.18)	(3.02)	(3.20)	(1.42)	(2.93)	(3.56)	(0.91)	(3.46)	(2.59)	(2.16)	(1.91)	(2.49)	(0.86)

***, **, *: statistically significant at 1% level, 5% level, 10% level respectively.
t-statistics in the parentheses are to test if two samples come from normal distributions with unknown and possibly unequal variances.

6 Conclusions

The relation between heterogeneity in beliefs and its consequence on stock returns are theoretically ambiguous. It is further excerbated by the presence and tightness of short-sale restriction. Yet another type of complication emerges from multiple measures of divergence in opinions proposed in the literature. We try to avoid such confounding effects in currently available approaches as much as possible by combining two empirical strategies. First, we define a measure of divergence in opinions by market-adjusted turnover per share outstanding demeaned over a rolling window. Second, we use data from Shanghai Security Exchange in which the short-sale was totally prohibited upto March 2010 to isolate the effect of heterogeneity in beliefs on the stock returns. Based on a regression analysis and a portfolio analysis, we re-establish the negative relation between dispersion in beliefs and the future returns. Our results are consistent with the prediction by Miller (1977) because our data from China highlights the impact of a strict shor-sale prohibition, while those for DMS are from the U.S. in which a short-sale restriction has not been so tight. There still remains a significant return differential in stocks of the biggest size. Further analysis of this unexplained phenomenon should be an interesting research question in the near future.

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