Individual Investors and Volatility

Thierry Foucault David Sraer David Thesmar

HEC, Princeton, HEC

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Plan

Motivations 1/2

- **Understanding the source of volatility is key for many areas in Finance.**
- **Two views**
  1. Volatility is due to the arrival of information (public or private reflected into trades) on fundamentals.
  2. But news alone do not seem to explain price movements ((Shiller (1981), Leroy and Porter (1981), Shleifer (1986), French and Roll (1988), Cutler et al.(1988) etc...
  3. $\Rightarrow$ Volatility is also due to "noise trading" (trades unrelated to change in fundamental information)
- **Then, identifying noise traders is important:**
  1. Can shed light on asset pricing puzzles since noise trading risk is a limit to arbitrage (Shleifer and Summers (1990)).
  2. Regulatory intervention: "Should something be done to prevent noise traders from suffering from their errors?" (Shleifer and Summers (1990)).

Motivations 2/2

- **Individuals are often viewed as noise traders.**
  1. Their trades are positively correlated and therefore retail investors' order imbalances affect prices (Kumar and Lee (2006), Dorn et al.(2008), Barber et al.(2009), Andrade et al.(2008)).
  2. Retail investors "undeperform" and make trading "mistakes:" Barber et al.(2006); Hvidkjaer (2006), Barber and Odean (2001, 2002, 2004), Frazzini and Lamont (2007), Grinblatt and Keloharju (2000)
  3. Causes of noise trading are unclear (irrationality, hedging/liquidity demand, shifts risk aversion)
- **Is trading by individuals a source of volatility?**

Problem: Causality

- **Difficult to test this hypothesis because retail traders' participation in a stock is endogeneous.**
  1. Kumar (2009): individual investors prefer stocks with high idiosyncratic volatility and skewness
  2. High volatility stocks are more likely to grab investors' attention
- $\Longrightarrow$ **Is the volatility of a stock high because it attracts retail traders or do stocks with high volatility attract retail traders?**
- **How to identify the causal effect of retail trading on volatility?**

Our approach 1/2

- **Black (1986-JoF):** "*Anything that changes the amount or character of noise trading will change the volatility of price*" (p. 533)
- **We exploit a reform of the French stock market that changes the amount of individual trading.**
  1. **Until September 2000:** the French stock market was a two-tier market featuring
     - ★ The "**Règlement Mensuel**" (**RM**): a market with end of the month settlement for actively traded stocks.
     - ★ The "Marché Au Comptant:" **a spot market for other stocks, with T+5 days settlement.**
  2. **After September 25, 2000**: all stocks trade spot
- **Unintended consequence of the reform:**
  - Made it **more costly to buy on margin or to short sell stocks listed on the RM for retail investors relative to more sophisticated investors.**
  - No change for other stocks.
  - $\Longrightarrow$**Good opportunity** to test whether restraining retail trading reduces volatility.

Our approach 2/2

- **But did the reform actually constrain French retail investors?**
- To address this question, **we use trades by all clients of a major French on-line broker:**
  1. Market share of our on-line broker over our sample period (1999-2002): 40%.
  2. On-line brokers accounted for 18% of all trades over our sample period.

Literature

- **Recent literature on price impact of retail investors' order imbalances:**
  1. Kumar and Lee (2006), Dorn et al.(2008), Hvidkjaer (2008), Kaniel et al.(2008), Barber et al.(2009),
- **Andrade et al (2009, JFE):** there is a positive cross-sectional correlation between return volatility and the volatility of retail order imbalances (after controlling for cash-flows volatilities).
- **Brandt, Brav, Graham and Kumar (RFS, 2009):**
  1. Episodes of high and low idiosyncratic volatility.
  2. Low price stocks/Stocks with high proportion of small trades have higher idiosyncratic volatility and are largely responsible for trends in idiosyncratic volatility.

Plan

1. Motivations
2. **The French monthly settlement market**

The French monthly settlement market

- **Since the 19th century, most actively traded stocks on the Paris Bourse were traded on a market with end of the month settlement**
- **And since the 80s, this was the only way to trade these stocks (no spot market).**
- **Main advantage** for retail investors: could buy stocks on margin or short-sell stocks very easily.

The French monthly settlement market

- **Example**: Investor A buys a stock on June 5, 2000 at $P_{June,5}$ =€20. For this month, the settlement date is June 30 and the last trading day for this settlement is June 23. On this day, the closing price is $P_{June,23}$ =€18

		Cash-Flows		
		June 23	June 30	July 28
	Close position on 6/10 at €22	0	€2	0
Actions	Roll over position/Close at €24 on 7/5	0	-€2	€6
	Take delivery on 6/30	0	-€20	0

The Reform

- **This system was suppressed on September 25, 2000.**
- **Since this date, all stocks on the French stock market trades in a "spot" market (i.e., T+3 delivery).**
- **Main effect:** it became more expensive for retail investors to buy stocks on margin and to short sale stocks:

> *"The monthly settlement system enables traders who do not own the stock to [...] avoid short-sales constraints. In contrast, for stocks traded spot, [...] this is costly and cumbersome in practice [to short sell]. Only large and sophisticated professional investors can undertake such strategies." (Biais, Bisière and Descamps (2000)).*

Plan

1. Motivations
2. The French monthly settlement market
3. **Testable hypotheses**

Model

- **Goal:** understand the effect of making speculation by noise traders more costly relative to sophisticated investors.
- **Simple extension of DeLong et al.(1990) with:**
  1. Uncertain dividends
  2. Differential trading costs for noise traders and sophisticated investors
  3. In this model, shifts in noise traders' demands come from correlated swings in their misperceptions of future prices/ dividends.
- **Not key:** Same predictions could be derived in other models of liquidity trading (Campbell and Kyle (1993), Campbell, et al. (1993), Llorente, et al. (2002)) with a different "engine" for swings in noise traders' demands (e.g., risk aversion as in Campbell et al.(1993)).
- As in much of the literature, we do not try to identify the sources (irrationality, hedging, risk aversion) of variations in individual investors' demands empirically, only its effects.

Assumptions 1/2

- **Trades take place at** $t = 0, 1, 2....., t, ...$
- **Two assets:**
  1. **Riskless asset** with rate of return r/unlimited supply
  2. **Risky asset**/supply= 1 share/with a dividend process:

$$d_t = \overline{d} + \beta(d_{t-1} - \overline{d}) + \xi_t,\ \xi_t \text{ i.i.d, } \xi_t \hookrightarrow N(0, \sigma^2_\xi),\ \beta < 1$$

- **Interpretation:** dividend = public information about the asset payoff.
- **Overlapping generations** of investors with CARA utility functions (or myopic investors as in Campbell, Grossman and Wang (1993)).

Assumptions 2/2

- **Investors arriving at date t** are endowed with shares of the riskless asset:
  1. Observe the current dividend (d_t)
  2. In aggregate, buy the risky security from the previous generation at price p_t.
  3. Resell it to the next generation, consume and leave the market at date $t+1$
- **Two types of investors**:
  1. **Sophisticated (proportion:** $1-\mu$**):** rational expectations on the distribution of p_{t+1}
  2. **Noise traders:** at date t, they believe that the mean resale price at date $t+1$ is $E_t(p_{t+1}) + \rho_t$ with $(\alpha < 1)$:

$$\textbf{Investors' Sentiment}: \ \rho_t = \alpha\rho_{t-1} + \varepsilon_t, \ \varepsilon_t \text{ i.i.d}, \ \varepsilon_t \hookrightarrow N(0, \sigma_\varepsilon^2)$$

Making speculation more costly for noise traders

- **Cost of buying/selling** X_{kt} shares for an investor with type $k \in \{S, NT\}$ (as in Dow and Rahi (2000)):

$$F(X_{kt}) = c_k (X_{kt})^2. \; c_k = \textbf{ trading cost coefficient for group } k.$$

- **We compare the equilibrium distribution of returns in two different market structures: (1)** The "RM" and **(2)** The "Main Market"
  1. Trading is more expensive for noise traders in both structures ($c_S \leq c_N$).
  2. Ttrading is more expensive for all traders in the Main Market
  3. **But relatively more so for noise traders**:

$$\frac{c_N^{Main}}{c_N^{RM}} > \frac{c_S^{Main}}{c_S^{RM}} \geq 1$$

Testable Implications 1/2

- **R_{t+1} : the excess return on the risky security from date t to date t+1:**

$$R_{t+1} = d_{t+1} + p_{t+1} - (1 + r)p_t$$

- **Implication #1:** *The volatility of stock returns ($Var(R_{t+1})$) is smaller in the Main Market than on the RM.*
- **Implication #2**: *The auto-covariance of stock returns in absolute value, $\mid Cov(R_t, R_{t+1}) \mid$ is smaller in the main Market than on the RM*

Intuitions

- **Implication #1:** Noise traders take smaller (long or short) positions when trading is more costly for them$\Longrightarrow$ Swings in noise traders' sentiment have less impact on prices.
- **Implication #2**:
  1. Suppose high noise traders' sentiment at date t $\Longrightarrow$ High price at date t $\Longrightarrow$ High return from date $t-1$ to date t on average but low return from date t to date $t+1$ on average as investors' sentiment is not persistent.
  2. $\Longrightarrow$ Noise trading induces reversals in stock returns.
  3. A smaller sensitivity of prices to investor's sentiment (higher trading restraint) $\Longrightarrow$ magnitude of reversals is smaller.

Testable Implications 2/2

- **Shocks to investors' sentiment induces noise traders to rebalance their position in the risky security $\Longrightarrow$ price adjustment:**

$$p^*_{t+1} - p^*_t = \Upsilon(\underbrace{\Delta X_{Nt}}_{\text{NT net order imbalance}}) + \underbrace{\eta_{t+1}}_{\text{Innovation in dividends'}}$$

- Υ = Price impact coefficient/ Measure of market liquidity from the point of view of noise traders.
- **Implication #3**: *The price impact of noise traders' order imabalances* (Υ) *is smaller in the Main Market than on the RM.*
- **Intuition**: Greater costs on noise traders $\Longrightarrow$ less volatility$\Longrightarrow$ sophisticated investors face less "inventory" risk$\Longrightarrow$ They demand a smaller compensation to absorb a given order imbalance from noise traders.

Important

- These implications would not hold if:
  1. All investors are sophisticated OR
  2. Sophisticated investors are those for which trading becomes relatively more expensive in the Main market.

Plan

Data

- **All stocks listed on the French stock market** from September 1998 to September 2002.
- **Before September 25, 2000, we have two groups of stocks:**
  1. **Treated stocks:** stocks listed on the **Règlement Mensuel (RM)**. On September 25, 2000, they switch from the RM to the spot market.[155 stocks on average]
  2. **Control stocks:** stocks listed on the **spot market**. They trade in the same environment during our sample period.[678 stocks on average]

Variables

- **We build a panel with one observation per month and per firm.**
- **Our dependent variables for each stock are:**
  1. **Volatility:** The monthly standard deviation of daily excess stock returns (three different measures)
  2. **Reversal:** The monthly autocovariance of daily stock returns
  3. **Price impact:** The monthly average of the daily Amihud ratio $(=(\frac{\text{Absolute Returns}}{\text{Volume}}))$=proxy for price impact of retail trades.
- Daily frequency as in Campbell et al.(1993) or Llorente et al.(2002).
- **Each variable is computed monthly over two years** $\longrightarrow$48 observations per stock.

Summary Statistics

	Control			Treated		
	Mean	St. Dev.	Obs.	Mean	St. Dev.	Obs.
Panel A : Full sample statistics						
Market capitalization (bn €)	0,2	1,9	32,301	6,5	1,5	7,596
Turnover (%)	1,6	2,8	33,228	4,7	4,4	7,612
Volatility1 (%)	3,0	1,2	22,783	2,4	0,9	7,398
Volatility2 (%)	3,0	1,2	22,783	2,4	0,9	7,398
Volatility3 (%)	2,6	1,3	22,783	2,1	0,9	7,398
Pimpact ($x10^6$)	10,2	26,5	24,232	0,1	1,5	7,484
Autocov ($x10^4$)	-0,5	2,8	21,947	-0,2	1,9	7,377
Bid Ask Spread / Midquote (%)	7,0	7,8	7,793	1,8	1,0	2,731

Retail investors' data

- We use data on all trades by retail investors at a major French on-line broker: 111,264 households in our dataset from 1999-2002.
- We use three variables to measure the level of trading activity by these investors in each month and in each stock:

$$\#\text{Buys}_{it} = \frac{\#\text{shares of stock } i \text{ purchased by the investors in our sample}}{\#\text{ of shares outstanding for stock } i}$$

$$\#\text{Sells}_{it} = \frac{\#\text{shares of stock } i \text{ sold by the investors in our sample}}{\#\text{ of shares outstanding for stock } i}$$

$$\#\text{Spectrades}_{it} = \frac{\#\text{ speculative trades for stock } i \text{ in month } t}{\#\text{ of shares outstanding for stock } i \text{ in month } t}$$

Summary statistics

	Control Stocks			Treated Stocks		
	1999	2000	2001	1999	2000	2001
Panel A – Aggregate Trading Statistics						
# Purchases	70,664	141,998	66,942	451,079	780,180	362,65
# Sales	54,651	113,453	55,245	424,927	651,636	324,51
Average trade size (€)	2,122	2,164	1,626	3,634	4,037	3,151
# Active investors	21,191	30,636	22,449	43,033	65,022	55,02
Panel B – Monthly Stock-level Trading Statistics: Trades						
# Buys	0.04	0.05	0.04	0.05	0.04	0.02
# Sells	0.03	0.04	0.03	0.04	0.04	0.02
#Trades	0.07	0.09	0.07	0.09	0.09	0.04
#Spectrades	0.01	0.01	0.01	0.02	0.02	0.01

Plan

Methodology 1/4

- We use two approaches to measure the effects of the reform on the variables of interest (volatility, retail trading activity etc...).
- **Approach 1: Differences-in-differences**. We run the following regression:

$$Y_{it} = \alpha + \beta_0 T_i + \beta_1 POST_t + \beta_2 T_i \times POST_t + \varepsilon_{it}$$

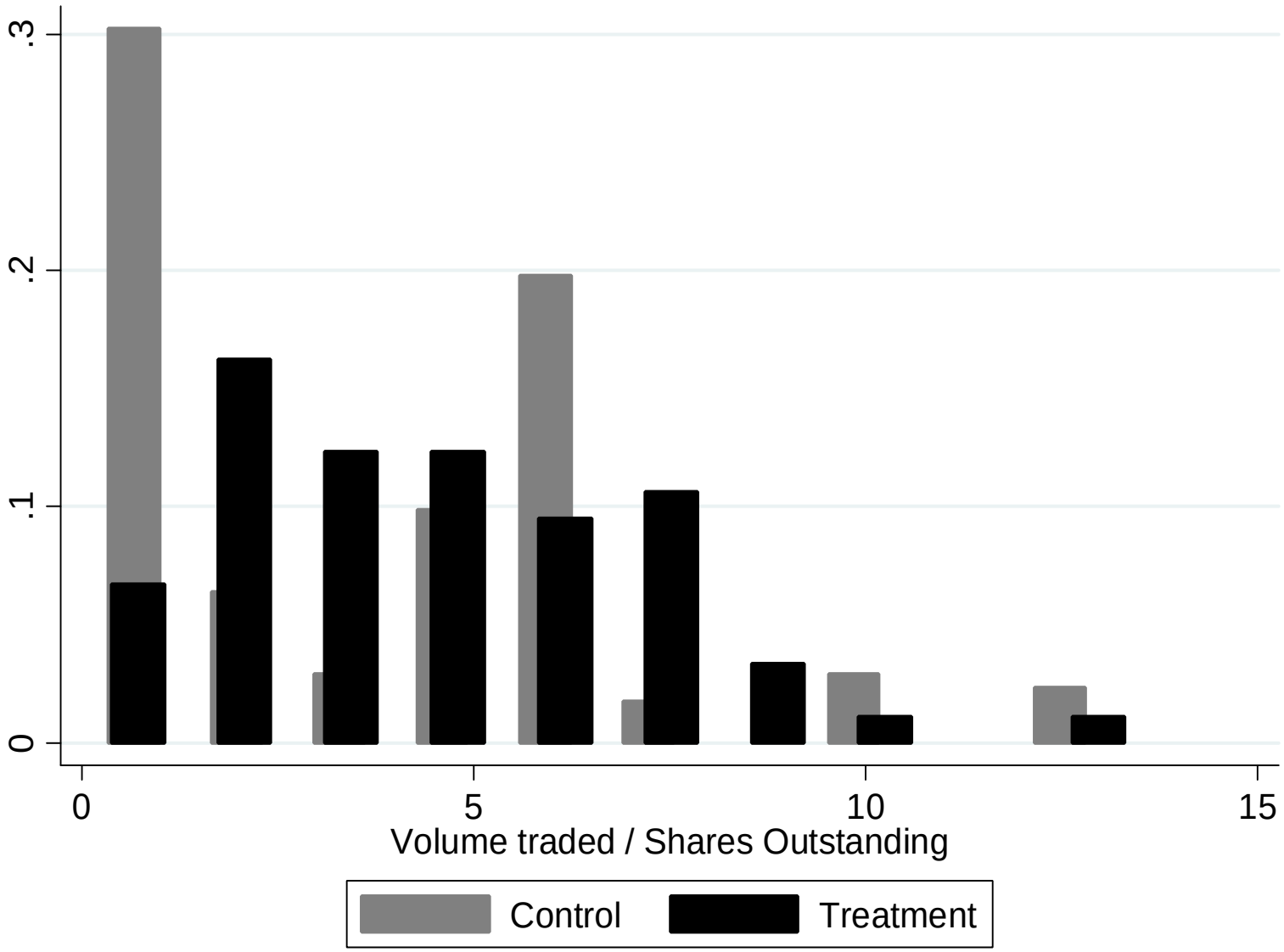
where: (i) Y_{it} is the outcome of interest for stock i in month t (e.g., volatility), (ii) $POST_t = 1$ after September 2000, (iii) $T_i = 1$ for stocks in the control group.

- **Interpretation:** β_2 measures the impact of the reform after controlling for fixed inter-groups differences and factors that affect the evolution of Y_{it}, common to both groups.

Methodology 2/4

- **Identification assumption:** differences in the outcomes between the two groups due to differences in group characteristics (market cap etc...) are fixed over time.
- **Problematic since treated and control stocks differ in terms of market capitalization and turnover** $\Longrightarrow$ We also use a matched sample estimation approach with three different matching procedures:
  1. Quartile Matching
  2. Percentage difference matching
  3. Propensity score matching

Methodology 3/4



Methodology 4/4

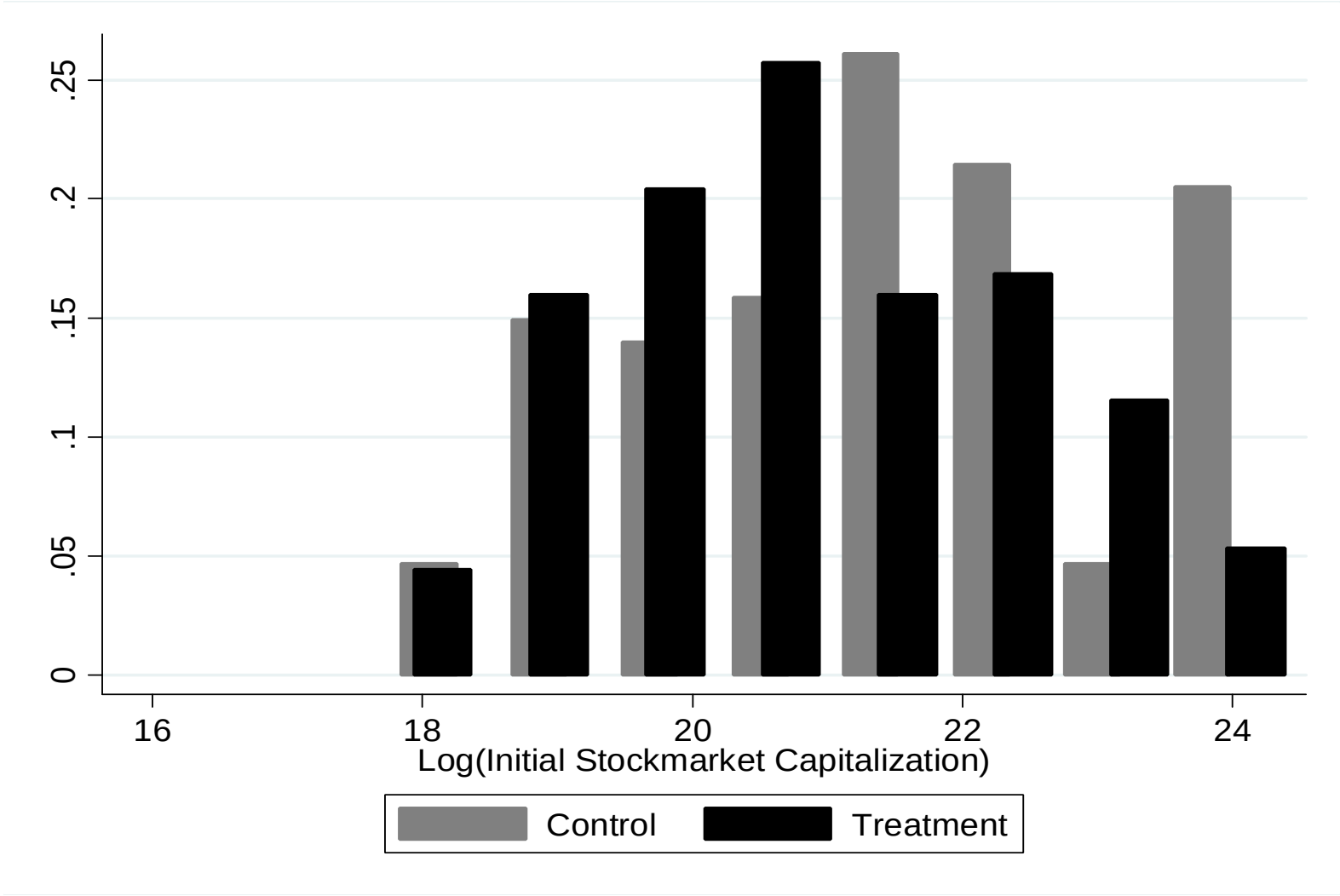


Figure 2: Matched Sample (Propensity Score Matching)

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6. **Empirical Findings**

Correlation between volatility and retail trading

- **We first estimate the following regression:**
  $\text{Volatility}_{it} = \alpha_i + \lambda_t + \beta_1 TA_{it} + \varepsilon_{it}$, to check whether volatility and retail trading activity are positively associated in our sample.

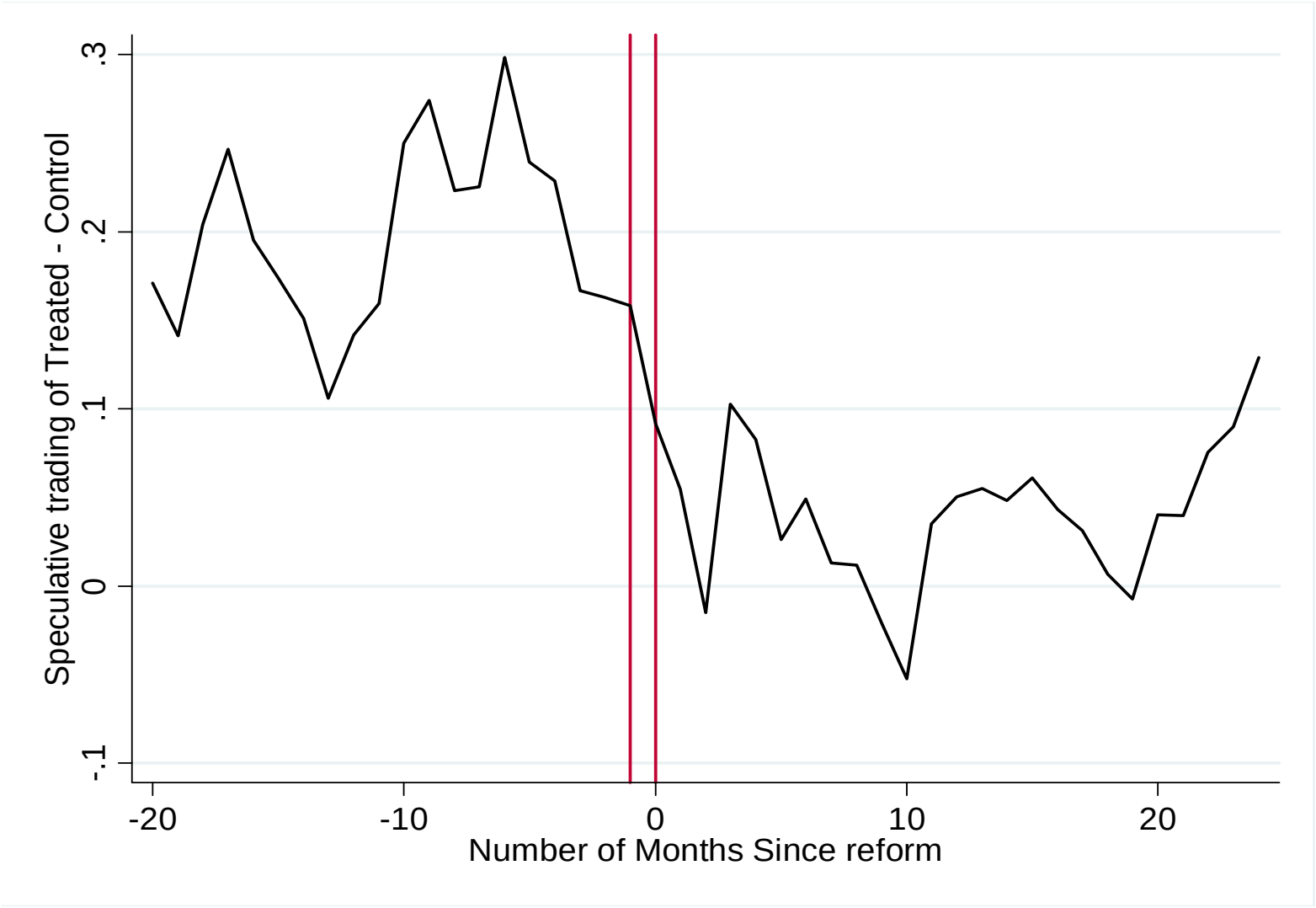
(×100)	Monthly Volatility					
#Trades=#Buys+#Sells	3.0^{***}	2.0^{***}	1.8^{***}			
	[16.1]	[22.4]	[11.6]			
#Spectrades				10.5^{***}	7.2^{***}	6.0^{***}
				[17.2]	[11.4]	[16.2]
Stock FE	No	Yes	Yes	No	Yes	Yes
Time FE	No	No	Yes	No	No	Yes
Observations	24,625	24,625	24,625	24,625	24,625	24,625

Does the reform affect retail trading?

- **YES:** Retail trading activity measures fall by about 2% after the reform.

	# Buys	**#Sells**	**#Spectrades**
	(1)	(2)	(3)
Treated × Post (β_2)	-0.020	-0.022	-0.014
	[-4.15]	[-4.77]	[-6.20]
Treated	0.002	0.009	0.011
	[0.37]	[1.61]	[4.56]
Post	-0.009	-0.005	-0.000
	[-1.81]	[-1.14]	[-0.06]
Constant	0.046	0.038	0.011
	[9.35]	[8.19]	[5.86]
Observations	29214	29214	29214
R^2	0.01	0.01	0.01

Does the reform affect retail trading? 2/2



Are retail investors a source of volatility?

- **Implication #1:** the volatility of treated stocks relative to control stocks declines after the reform, i.e., $\beta_2 < 0$.

	DD	Quartile matching	Percentage difference matching	Propensity score matching
Dependent variable: Volatility2 (Implication #1)				
Treated×Post	-0.297	-	-	-
	[-5.47]			
Treated	-0.472	-	-	-
	[-8.52]			
Post	0.200	-0.194	-0.172	-0.274
	[1.60]	[-2.97]	[-2.71]	[-3.25]
Constant	2.877	-0.227	-0.192	-0.238
	[30.80]	[-4.41]	[-3.31]	[-3.52]
Observations	30181	7398	4552	5652
R^2	0.06	0.01	0.01	0.01

- **The drop in volatility varies between 34% to 11% of the**

Auxiliary predictions 1/2

- **Implication #2:** In absolute value, the autocovariance of treated stocks relative to control stocks declines after the reform, i.e., $\beta_2 > 0$.

	DD	Quartile matching	Percentage difference matching	Propensity score matching
Panel B: Dependent variable: Autocovariance of Returns (Implication #2)				
Treated×Post	0.293	-	-	-
	[3.24]			
Treated	0.109	-	-	-
	[1.74]			
Post	-0.484	0.611	0.329	0.437
	[-5.19]	[4.06]	[2.18]	[2.26]
Constant	-0.231	-0.137	-0.172	-0.118
	[-2.81]	[-1.27]	[-1.85]	[-1.06]
Observations	29325	7378	4512	5578
R^2	0.01	0.02	0.00	0.01

Auxiliary prediction 2/2

- **Implication #3:** The Amihud ratio for treated stocks relative to control stocks declines after the reform, i.e., $\beta_2 < 0$.

	DD	Quartile matching	Percentage difference matching	Propensity score matching
Panel C: Dependent variable: Amihud Ratio (Implication #3)				
Treatment×Post	-4.029	-	-	-
	[-4.36]			
Treated	-8.120	-	-	-
	[-11.73]			
Post	4.119	-1.455	-2.087	-0.776
	[4.47]	[-4.78]	[-3.05]	[-1.62]
Constant	8.173	-0.630	-0.776	-0.308
	[11.81]	[-4.83]	[-4.01]	[-3.62]
Observations	31716	7484	4680	5818
R^2	0.04	0.04	0.01	0.00

Another approach

- **We also check the robustness of our findings regarding with volatility with an IV approach, using the reform as an instrument for retail trading activity.**

Dep. Variable	#Trades	Volatility2	Volatility2
Treated × Post	-0.041	-	-
	[-5.02]		
Post	-0.015	0.220	0.305
	[-3.76]	[9.39]	[5.93]
Treated	0.010	-0.686	-0.633
	[0.98]	[-17.41]	[-10.71]
#Trades	-	2.966	6.315
		[23.59]	[3.76]
Constant	0.084	2.701	2.385
	[19.96]	[88.83]	[14.96]
R^2	0.01	0.20	0.04

Size of the effects

- #Trades fall by about 4% due to the reform $\Longrightarrow$ Total effect of the reform on volatility: $-6.31*4\% = -0.25$ (twenty five basis points), as in Diff-in-Diff approach.
- How much volatility is due to retail traders?
  1. #Trades=9% in 2000.
  2. Thus, if we shut down retail trading volatility would drop by: $-6.31*9\% = -0.56$, i.e., 56 basis points or 23% of pre-reform volatility.
  3. Not large but in line with other empirical studies that attempt to measure the contribution of noise trading to volatility (e.g., Roll (1988), French and Roll (1986)).

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7. **Robustness**

Robustness issues

- **Possible Alternative explanations for the findings**
  1. **Improvement in liquidity of treated stocks unrelated to change in the amount of noise trading?**
  2. Positive contemporaneous relationship between volatility and returns at individual stock levels (e.g., Duffee (1995)). Does the effect of the reform disappear when we control for stock returns?
- **The choice of the sample period around the reform.**

Changing the window size

Window	36-months			24-months		
	Volatility2	Autocov.	PImpact	Volatility2	Autocov.	PImpact
Post	-0.275	0.483	-0.861	-0.248	0.290	-0.810
	[-3.51]	[2.21]	[-1.44]	[-3.33]	[1.14]	[-1.28]
Constant	-0.288	-0.175	-0.354	-0.346	-0.162	-0.414
	[-3.93]	[-1.65]	[-3.45]	[-4.11]	[-1.07]	[-3.08]
N	4309	4255	4436	2916	2867	3022

Conclusion

- Our findings support the hypothesis that retail trading is a cause of volatility.
- **But we do not identify the drivers of retail trading and its impact on volatility:**
  1. Irrationality?
  2. Correlated hedging needs?

Thanks!!