

## Time to Buy or Sell

Gizem Turna Cebeci, Orhan Erdem, Yusuf Varlı

Annual Conference of the Center for Economics and Econometrics (CEE)

DECEMBER 21, 2015

# Outline

- 1 Introduction
  - Motivation
- 2 Literature Review
  - Biases
  - Buy-Sell Imbalance (BSI)
- 3 Data and Methodology
  - Data
  - Methodology
- 4 Results
  - Statistical Results
  - Regression Results
- 5 Conclusion
  - Contributions
  - Main Findings

# Motivation

To demonstrate an evidence of the existence of systematic biases by investigating the behaviors of individual investors who are acting in one of the emerging financial markets.

## Overconfidence vs. Disposition Effect

### Overconfidence

- Overestimate knowledge, underestimate risks and exaggerate ability to control events (Buy more stock after the positive and significant portfolio return).

### Disposition Effect

- Tendency of selling stocks whose prices are above the purchasing price and holding stocks whose prices are below the purchasing price (Sell the stocks after the price increases, but hold after the price decreases).

## Buy-Sell Imbalance

A ratio of net buying volume to the total trading volume.  
A measurement tool to analyze buying behavior of investors in financial markets.

- Chordia et al. (2002): **Order Imbalance Number (OIBNUM)**.
- Kamesaka et al. (2003): **Net Investment Flow (NIF)**.
- Griffin et al. (2003): stock-based **BSI**.
- Kumar and Lee (2006): monthly portfolio **BSI**.
- Colwell et al. (2008): stock-based **BSI** (number).
- Barber and Odean (2008): stock-based **BSI**.

## Data

- Source: Central Registry Agency (MKK).
- 25.000 individual investors' transactions.

Selection criteria:

- Investors having portfolio amount more than TRY 1.000 (or USD 500)
- Investors making at least one transaction in between the sampling period.

Sampling period: 01.01.2008 - 31.12.2012 (1259 observations of non-holiday regular weekdays).

# Methodology

Two other variables are derived:

## 1. Buy-Sell Imbalance (BSI):

The difference between purchasing volume of all stocks, and selling volume of all stocks in a given day divided by the sum of purchasing volume of all stocks and selling volume of all stocks in a given day.

# Methodology

$$BSI_{j,t} = \frac{\sum_{i=1}^{s_{i,t}} PV_{i,t} - \sum_{i=1}^{s_{i,t}} SV_{i,t}}{\sum_{i=1}^{s_{i,t}} PV_{i,t} + \sum_{i=1}^{s_{i,t}} SV_{i,t}} \quad \text{where}$$

$$PV_{i,t} = Q_{i,t}^P P_{i,t}$$

and

$$SV_{i,t} = Q_{i,t}^S P_{i,t}$$

$BSI_{j,t}$  is the buy-sell imbalance of investor  $j$  on day  $t$  and  $PV_{i,t}$  is the purchasing volume of stock  $i$  on day  $t$  and  $SV_{i,t}$  is the selling volume of stock  $i$  on day  $t$ .  $Q_{i,t}^P$  is quantity purchased on stock  $i$  on day  $t$ ,  $Q_{i,t}^S$  is quantity sold on stock  $i$  on day  $t$  and  $p_{i,t}$  is the price of that stock on day  $t$ .  $s_{i,t}$  is the number of stocks purchased or sold on day  $t$ .



# Methodology

## 2. Market-adjusted portfolio return:

$$r_{j,t} = \sum_{i=1}^{s_{j,t}} p_{i,j,t} r_{i,t} - r_t^m$$

$r_{j,t}$  is the market-adjusted portfolio return for investor  $j$  on day  $t$ ,  $p_{i,j,t}$  is the weight that is calculated by dividing the end-of-day market value for stock  $i$  to the end-of-day market value of portfolio held by investor  $j$  on day  $t$ ,  $r_{i,t}$  is daily return for stock  $i$  on day  $t$ ,  $s_{j,t}$  is the number of stocks held by investor  $j$  on day  $t$  and  $r_t^m$  is corresponding daily rate of return on BIST100 index.

## Statistical Analysis

General relation:

- 1 Sort investors,
- 2 Divide 5 groups,
- 3 Calculate average BSI,
- 4 Repeat for each day.

There are five time series data. 1: Loser group, 5: Winner group.

Detailed analysis:

- Divide investors into subsamples based on portfolio size, ages and gender.
- Implement the same procedure of grouping and averaging.

## Descriptive Statistics

		Buy-sell imbalance (BSI)	Market-adjusted portfolio return
Male	Mean	0.0052	0.01%
	Median	0	-0.09%
	Variance	0.0473	0.05%
Female	Mean	0.0014	0.02%
	Median	0	-0.07%
	Variance	0.0267	0.04%
Young	Mean	0.0086	0.01%
	Median	0	-0.12%
	Variance	0.0590	0.06%
Old	Mean	0.0021	0.01%
	Median	0	-0.06%
	Variance	0.0348	0.04%

There are 6049 female and 18947 male investors. 5243 of them are young and 5167 of them are old investors. Market-adjusted portfolio return exists for the days in which the investor makes any trading (buy-or sell) for each investor. BSI exists independent of whether or not there is any trading.

## Regression Analysis

The panel regression with the transactions of the individual investors between 2008 and 2012.

Panel variable: investors (25,000)

Time variable: days (1,259)

- 1 The simple linear regression model:

$$BSI_{j,t} = \beta_0 + \beta_1 r_{j,t-1} + \beta_2 \Delta x r_{j,t} + \beta_3 \text{female} + \beta_4 \text{middle} + \beta_5 \text{old} + u_{j,t}$$

- 2 VAR model for each investor types.
- 3 VAR model for each regions.

## Figure 4.1. The relationship between the average BSI and previous day market-adjusted portfolio return.



Investors are sorted based on previous day portfolio returns and divided into 5 groups. Group 1: investors whose previous day portfolio returns are minimum. Group 5: investors whose previous day portfolio returns are maximum.

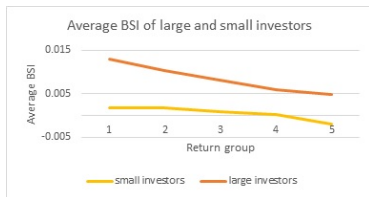
## Table 4.1. The comparison of the average BSI values of each group for all investors

Return Groups	Minimum Return	Maximum Return	Average Return	Average BSI	t value	t value for the group:
1 (min)	-0.66428	-0.01224	-0.02480	0.00563	1.65921*	1 and 2
2	-0.01224	-0.00408	-0.00780	0.00503	3.10460***	2 and 3
3	-0.00408	0.00232	-0.00088	0.00375	2.84393***	3 and 4
4	0.00232	0.01102	0.00620	0.00254	5.56300***	4 and 5
5 (max)	0.01102	4.93202	0.02787	0.00033	15.03214***	1 and 5

The t statistics belong to BSI series. \*\*\* refers to significance at 1%, \*\* refers to significance at 5%, \* refers to significance at 10%.

## Figure 4.2 Large-Small

The comparison of large and small investors based on portfolio size.



Divide data into subsamples based on portfolio size.

*Large* > 50,000TRY

*Small* < 10,000TRY

## Table 4.2. The comparison of the Average BSI values of large and small investors

Return Group	Portfolio Size	Average BSI	t value
1	Small	0.0018	-18.4574***
	Large	0.0129	
2	Small	0.0017	-13.6422***
	Large	0.0103	
3	Small	0.0009	-10.831***
	Large	0.0081	
4	Small	0.0003	-8.9049***
	Large	0.0059	
5	Small	-0.0019	-11.7360***
	Large	0.0049	

Divide data into subsamples based on portfolio size. t values represents the difference between average BSI values of small and large investor groups at each return group. \*\*\* refers to significance at 1%, \*\* refers to significance at 5%. \* refers to significance at 10%.



## Figures 4.3 & Figure 4.4

The comparison of young and old investors and the comparison of male and female investors.



Divide data into two subsamples based on both age and gender.  
18-35 for young adults, 36-55 for middle-aged adults and 56+ for old investors.

Table 4.3. Within group analysis of age.

Return Group	Investor Type	Average BSI	Variance	t value
1	Young	0.00790	0.00017	10.46400***
	Old	0.00302	0.00010	
2	Young	0.00819	0.00020	11.11483***
	Old	0.00235	0.00014	
3	Young	0.00635	0.00023	8.30754***
	Old	0.00165	0.00017	
4	Young	0.00445	0.00024	7.39894***
	Old	0.00032	0.00015	
5	Young	0.00116	0.00024	4.68662***
	Old	-0.00134	0.00012	

Divide data into subsamples based on age. ( $H_0$ : Average BSI values of young and old investors are the same). \*\*\* refers to significance at 1%, \*\* refers to significance at 5%, \* refers to significance at 10%.

Table 4.4. Within group analysis of gender.

Return Group	Investor Type	Average BSI	Variance	t value
1	Male	0.00655	0.00009	13.34186***
	Female	0.00199	0.00006	
2	Male	0.00609	0.00012	11.07864***
	Female	0.00175	0.00007	
3	Male	0.00472	0.00015	9.14591***
	Female	0.00085	0.00007	
4	Male	0.00343	0.00014	8.90356***
	Female	-0.00024	0.00008	
5	Male	0.00099	0.00012	8.22095***
	Female	-0.00220	0.00007	

Divide data into subsamples based on gender. ( $H_0$ : Average BSI values of male and female investors are the same.). \*\*\* refers to significance at 1%, \*\* refers to significance at 5%, \* refers to significance at 10%.

Table 4.5. Panel specific models with AR(1)

Dependent Variable: $BSI_{j,t}$	FE	RE
$r_{j,t-1}$	-0.0680 (-35.25)***	-0.0681 (-35.35)***
$\Delta x r_{j,t}$	0.1079 (37.17)***	0.1078 (37.16)***
Gender	0 -	-0.0038 (-12.52)***
Middle	0 -	-0.0021 (-6.39)***
Old	0 -	-0.0043 (-10.64)***
Constant	0.0037 -84.4	0.0059 -20.05

## Table 4.5 Cont'd

Dependent Variable: BSI	FE	RE
R-squared (within)	0.0001	0.0001
R-squared (between)	0.0005	0.0054
R-squared (overall)	0.0001	0.0003
Fraction of variance due to residuals	0.0152	0.0065
Number of observations	24,509,141	24,509,141
$\rho$	-0.0458	-0.0458

The t statistics are in parentheses.  $\rho$  is the estimated autocorrelation coefficient. \*\*\* refers to significance at 1%, \*\* refers to significance at 5%, \* refers to significance at 10%.

## VAR Model-Based on Investor Types

	large (portfolio size>50.000 TL)				small (portfolio size<10.000 TL)			
	male	female	young	old	male	female	young	old
<b>BSI</b>								
<b>BSI</b>								
L1	-0.01884	-0.02003	0.00236	-0.01374	-0.06563	-0.05787	-0.05962	-0.08333
L2	0.00016	-0.00490	0.01485	-0.00181	-0.02210	-0.02065	-0.01807	-0.03799
L3	0.00897	0.00350	0.01471	0.00697	0.00085	0.00043	0.00259	-0.01666
L4	0.01270	0.00948	0.01928	0.00882	0.00736	0.00198	0.00692	-0.00193
L5	0.01370	0.00685	0.02204	0.01175	0.00985	0.00519	0.01110	0.00285
<b>RET</b>								
L1	-0.07596	-0.08068	-0.10238	-0.10928	-0.06572	-0.04690	-0.07586	-0.03459
L2	-0.04395	-0.00135	-0.03477	-0.03593	-0.03068	-0.00652	-0.02461	-0.01051
L3	-0.01167	-0.01726	-0.00538	-0.02368	-0.00408	-0.00681	-0.00849	-0.00545
L4	-0.01101	0.00244	0.00279	-0.01006	-0.00438	-0.00084	-0.00563	-0.00862
L5	0.00845	-0.00901	-0.01025	0.00818	-0.00712	0.00212	0.00195	-0.01104
<b>XR</b>								
L1	0.23852	0.15189	0.25272	0.19889	0.12234	0.03869	0.12832	0.04818
L2	0.12271	0.08604	0.18426	0.10037	0.07015	0.02514	0.06398	0.01364
L3	0.08225	0.06168	0.06158	0.07041	0.05139	0.02247	0.06494	0.01912
L4	0.08026	0.05394	0.07507	0.06091	0.04267	0.01643	0.04174	0.01868
L5	0.03926	0.02325	0.05400	0.02303	0.03278	0.01761	0.03257	0.01084
L5	0.01782	0.02981	0.00047	0.00842	0.01240	0.01173	0.00904	0.00422

## VAR Model-Based on Investor Types

	large (portfolio size>50.000 TL)				small (portfolio size<10.000 TL)			
	male	female	young	old	male	female	young	old
<b>RET</b>								
<b>BSI</b>								
L1	-0.00002	0.00005	-0.00003	-0.00007	-0.00016	-0.00006	-0.00016	-0.00010
L2	-0.00002	-0.00004	-0.00003	0.00001	0.00006	-0.00018	-0.00005	-0.00015
L3	-0.00005	-0.00049	-0.00007	-0.00006	0.00015	-0.00028	0.00006	-0.00006
L4	0.00010	-0.00005	0.00007	-0.00004	0.00009	0.00007	0.00013	0.00012
L5	0.00002	-0.00007	0.00013	0.00000	-0.00005	0.00007	-0.00004	-0.00017
<b>RET</b>								
L1	0.04464	0.04259	0.04768	0.04372	0.03859	0.03601	0.03887	0.03918
L2	-0.00458	-0.00465	-0.00884	-0.00796	-0.00143	-0.00999	-0.00406	-0.00769
L3	0.00510	0.00637	0.00300	0.00284	0.00260	-0.01200	-0.00033	-0.00962
L4	0.00525	0.00979	0.00493	0.00346	0.00319	-0.00848	0.00097	-0.00988
L5	0.00041	-0.00246	0.00741	-0.00376	0.00125	-0.00840	0.00224	-0.01079
<b>XR</b>								
L1	0.00322	0.00244	0.00724	0.00278	0.00605	-0.00458	0.00635	-0.00580
L2	-0.03011	-0.02525	-0.02958	-0.02281	-0.03529	-0.02526	-0.03760	-0.02123
L3	-0.00558	-0.00038	-0.00675	0.00155	-0.00416	0.00600	-0.00395	0.00839
L4	-0.01313	-0.01095	-0.01721	-0.00611	-0.01412	-0.00026	-0.01432	0.00428
L5	0.00818	0.00986	0.01014	0.01256	0.00201	0.01085	0.00414	0.00944
L5	-0.02100	-0.02078	-0.02306	-0.01637	-0.03088	-0.02540	-0.03067	-0.02470
<b>GC Test</b>								
B-R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-B	0.07	0.20	0.76	0.81	0.09	0.10	0.36	0.38

## VAR Model-Based on Geographical Regions

	Marmara	Aegean	Mediterranean	Blacksea	Central Anatolia	Eastern Anatolia	Southeastern Anatolia
<b>BSI</b>							
BSI							
L1	-0.03963	-0.05552	-0.05734	-0.04954	-0.04274	-0.06228	-0.07298
L2	-0.00976	-0.02250	-0.01891	-0.01876	-0.01396	-0.02399	-0.01396
L3	0.00576	-0.00147	-0.00393	-0.00468	0.00401	-0.00398	-0.00015
L4	0.01158	0.00110	0.00249	0.00375	0.00874	0.00708	0.01082
L5	0.01252	0.00671	0.00698	0.00418	0.01018	0.00539	0.01258
<b>RET</b>							
L1	-0.06490	-0.07877	-0.08042	-0.07007	-0.06467	-0.05513	-0.08163
L2	-0.03018	-0.03359	-0.02669	-0.02311	-0.02894	-0.04298	-0.01961
L3	-0.01521	-0.00683	-0.01094	-0.01107	-0.01424	0.00383	0.00022
L4	-0.00207	-0.00832	-0.00949	0.00398	-0.00881	0.00367	-0.01472
L5	-0.00677	-0.00678	-0.00158	-0.00553	-0.00265	-0.02379	0.00979
<b>XR</b>							
L1	0.14991	0.12693	0.14175	0.12000	0.13397	0.15746	0.17071
L2	0.09059	0.06487	0.05441	0.05598	0.07261	0.06445	0.03667
L3	0.06459	0.07524	0.06354	0.04773	0.05585	0.05137	0.04104
L4	0.04127	0.03428	0.04631	0.04890	0.04778	0.07814	0.06372
L5	0.03594	0.02443	0.02879	0.02648	0.02651	0.03281	0.05464
L5	0.03489	0.01942	0.00344	0.02648	0.03007	0.04060	0.03450



## VAR Model-Based on Geographical Regions

	Marmara	Aegean	Mediterranean	Blacksea	Central Anatolia	Eastern Anatolia	Southeastern Anatolia
RET							
BSI							
L1	-0.00006	-0.00001	-0.00026	0.00000	0.00002	-0.00024	-0.00019
L2	0.00006	-0.00007	-0.00014	-0.00009	-0.00002	-0.00004	0.00009
L3	0.00009	-0.00012	0.00001	0.00001	-0.00004	-0.00007	0.00013
L4	0.00008	0.00001	0.00010	0.00000	0.00017	-0.00007	-0.00003
L5	-0.00004	-0.00001	0.00003	0.00003	0.00002	0.00022	0.00000
RET							
L1	0.04084	0.03696	0.03500	0.03085	0.04015	0.04305	0.03915
L2	-0.00522	-0.00670	-0.00470	-0.00333	-0.00393	-0.00223	-0.00060
L3	-0.00007	-0.00214	-0.00487	0.00087	0.00225	0.00120	-0.00012
L4	0.00224	0.00031	-0.00234	-0.00227	0.00256	-0.00008	-0.00018
L5	0.00132	-0.00337	0.00171	0.00004	-0.00323	0.00676	0.01007
XR	0.00505	0.00217	0.00223	-0.00475	0.00291	-0.00216	0.00533
L1	-0.03327	-0.02848	-0.02951	-0.03036	-0.02745	-0.03723	-0.03891
L2	-0.00568	0.00189	-0.00331	-0.01001	-0.00016	-0.00321	-0.00299
L3	-0.01532	-0.00473	-0.01338	-0.01292	-0.00689	-0.01300	-0.01209
L4	0.00543	0.00900	0.00540	0.00646	0.00832	0.00582	0.00590
L5	-0.03002	-0.02560	-0.02420	-0.02741	-0.02602	-0.03013	-0.02791
GC Test							
BSI-RET	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RET-BSI	0.35	0.44	0.00	0.95	0.08	0.44	0.75

## Contributions

- Investor-based BSI.
- Daily data.
- Portfolio size, age and gender effects.
- Geographical effects.

## Main Findings

- Tendency to realize gains in a short time but avoid to realize losses.
- Evidence of Disposition Effect (DE) bias.
- Small investors are less affected by DE bias.
- Female investors are less affected by DE bias.
- Old investors are less affected by DE bias.

THANK YOU

Gizem Turna Cebeci