Doctoral Seminar in Empirical Asset Pricing

Topic 9

Realized Returns: Fundamentals or Noise?

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1 Do Asset Prices Reflect Fundamentals?

- Can excess volatility be traced to factors other than information about fundamentals?
- Here we look at a few classic and not so classic papers in this literature, which is very large and encompasses a lot of the behavioral finance literature (which is covered in detail in other PhD classes)

1.1 Do Asset Prices Reflect Fundamentals?

- Goal: To explain the residual in

$$R_{it} = E_{t-1}\left[R_{it}\right] + \varepsilon_{it}$$

- Campbell's decomposition: revisions in expectations of future cash flows and revisions in expectations of future discount rates
- Can we identify independently the news that moves prices?

- Informal tests: newspaper articles (Cotler, Poterba, Summers,1986, JoPM)

  Example: biggest fifty one-day moves in the stock market. What news drove them?

  Biggest news stories tend to be "stock market moved"(!)

- Formal tests with specified news:

Roll's (1984) "Orange Juice and Weather"

- What explains daily changes in prices of futures contracts written on the price of frozen concentrated orange juice?
- Price depends on supply, demand for OJ
- Supply strongly affected by weather in central Florida

  Freezes ruin oranges; lower supply, raise price

- Two questions

  1. Do OJ futures prices contain information about future temperatures that is not in weather service forecasts?
  2. Does news about weather in central Florida explain most of the price variability in OJ futures?
  3. Data (prices and min daily temperatures) in figure below

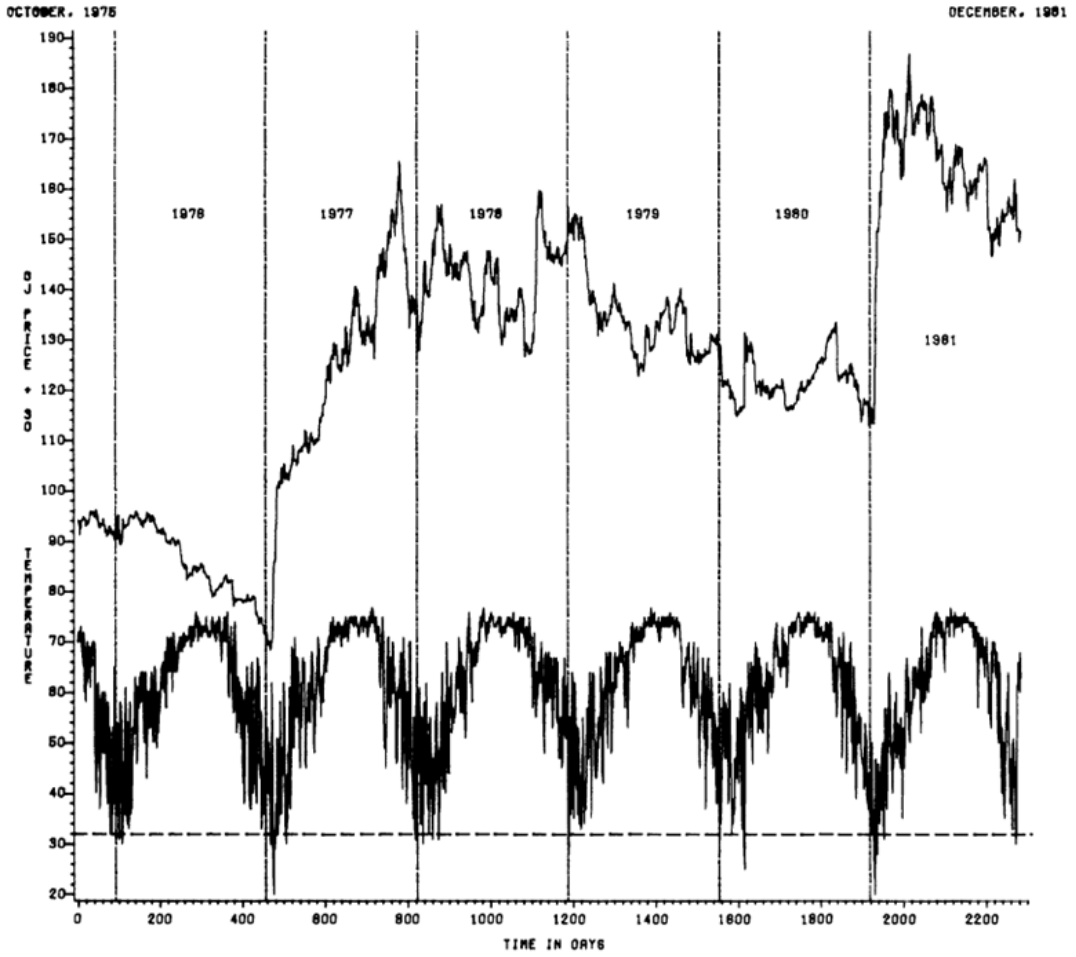

FIGURE 3. OJ FUTURES PRICES AND MINIMUM TEMPERATURES AT ORLANDO

- Minimum daily temperature is most important weather-related data for OJ

  Call this T_t

- A test of whether OJ prices contain info about T_t not in National Weather Service (NWS) forecasts

  - NWS forecast error measured by actual low temp minus predicted low temp
  - Regression of forecast error on percentage price changes in futures contracts (Note: Since R_t is change in futures' prices, it is not a return to a trading strategy)

$$\text{forecast error}_t = a + b_{-2}R_{t-2} + b_{-1}R_{t-1} + b_0R_t + b_1R_{t+1} + b_2R_{t+2} + e_t$$

  - Market efficiency implies coefficients on future price changes should be zero (else they are forecastable)

- If market contains info not in NWS forecast, coefs on lagged price changes should be negative
    - Roll supports both results (after correcting for futures price limits)
- The purpose of this regression is largely to show that our usual assumption of market efficiency is not rejected.

- How much of the variability in futures prices is explained by T_t?
    - Roll's regression

$$R_t = b_o + b_1 \max[0, 32 - T_t] + b_2 \max[0, 32 - T_{t-1}] + \varepsilon_t$$

      nonlinear form recognizes that temperatures above freezing should have little effect on prices
    - Big results: R^2 of only 6%

- Variance on "non-news" days (no newspaper articles) is not much lower than variance on "news" days

  e.g., why are prices moving around in the summer?

- Roll's interpretation: We cannot explain price movements in one of the simplest possible cases

A reinterpretation of Roll's result by Boudoukh, Richardson, Shen, and Whitelaw

- Roll's functional form not sufficiently nonlinear. Replacement is

$$R_t = b_0 + b_1 \max[0, 32 - T_t] + b_2 \max[0, 32 - T_t]^2 + \varepsilon_t$$

  R^2 more than 30%

- Substantial news other than temperature in central Florida
    - Brazil
    - Crop reports

1.2 Cross-sectional and short-run time-series variations in the volatility of idiosyncratic returns

- Roll (1988): R^2 – How much of a stock's return can be explained by market-wide information?
  - Estimates factor models of stock returns (5 factor APT) and finds a typical R^2 of 24%.
  - Large-cap stocks have a larger fraction of their return associated with aggregate and big portfolio returns than do small-cap stocks
  - Natural explanation is they are more diversified (smaller idiosyncratic component)
- However:
  1. Relation between ME, R^2 of regression disappears for the largest stocks (presumably full diversification)
  2. Yet when Roll constructs artificial large firms by summing over a set of smaller firms in same industry, finds larger ME produces higher R^2 even within the largest artificial size decile
  3. When Roll looks at R^2 of large-cap stocks on days when no newspaper stories about them, R^2 only slightly higher than on days when newspaper stories appear.
     - Roll's concludes that most of the returns to the large stocks is "background noise"
     - On the non-story days, what is driving stock prices???

1.3 French and Roll (1986) - A Natural Experiment in Stock Return Volatility

- In 2^{nd} half of 1968, NYSE closed on Wednesdays due to paperwork
- French and Roll (1986) use this fact to investigate the following hypotheses
  1. Does more public information arrive during trading hours than during non-trading hours?
  2. Does private information create additional volatility during trading hours?

3. Does the trading process introduce noise, perhaps through overreaction on the part of traders?

- Minor empirical point

  Ratio of variance of weekend returns (close Friday to close Monday) to variance of one-day returns is only 1.1

  - Interpretation – news moves prices, and less news on weekends

    Quick calculation with σ_N^2 as variance of non-open hours and σ_T^2 as variance of open hours

$$66\sigma_N^2 + 6\sigma_T^2 = 1.1\left(18\sigma_N^2 + 6\sigma_T^2\right) \Rightarrow \sigma_T^2/\sigma_N^2 = 71.8$$

- Main empirical point

  - During 2^{nd} half of 1968, variance of two-day stock returns from end-Tuesday to end-Thursday is 1.15 times the variance of one-day returns
  - During 39 other half-years, variance ratios range from 1.18 to 4.32, mean of 2.0

    Therefore highly unlikely first ratio differs from 2.0 by chance

- Interpretations

  - Public information flow should be unaffected by NYSE's paperwork
  - Possible that less private information is revealed
    - Traders with private info do not reveal unless they can trade on it
  - But why is private information that would have been revealed on Wednesday not revealed on Thursday?
    - Kyle's Econometrica 1985 answer: constant intensity of trading
  - Could test by looking at weekly variances in 2^{nd} half of 1968; but insufficient data
  - Possible that trading process introduces volatility

1.4 Investor Inattention – What is 'news'?

- If investors have rational expectations, all relevant public information is immediately impounded in prices.
- If, however, there are limits to agents' information processing capacity (either rational as in Sims research, or irrational as in "I didn't notice the macro announcement yesterday")
    1. there may be lags between the time a news story is released and the time by which this information is impounded in prices
    2. re-releases of information may have price impact if, somehow, the re-release is more salient to investors
    3. too much information may cause investors to react to the same piece of news twice, confounding stale news already impounded in prices for actual news
- There is a very large literature on investor inattention. You should look at papers by Stefano DellaVigna, Paul Tetlock, Harrison Hong, Sims, to mention a few. Here we will consider two papers I like (because the first motivated the second, which I wrote..!)

Huberman and Regev (2001) – Re-release of information and salience

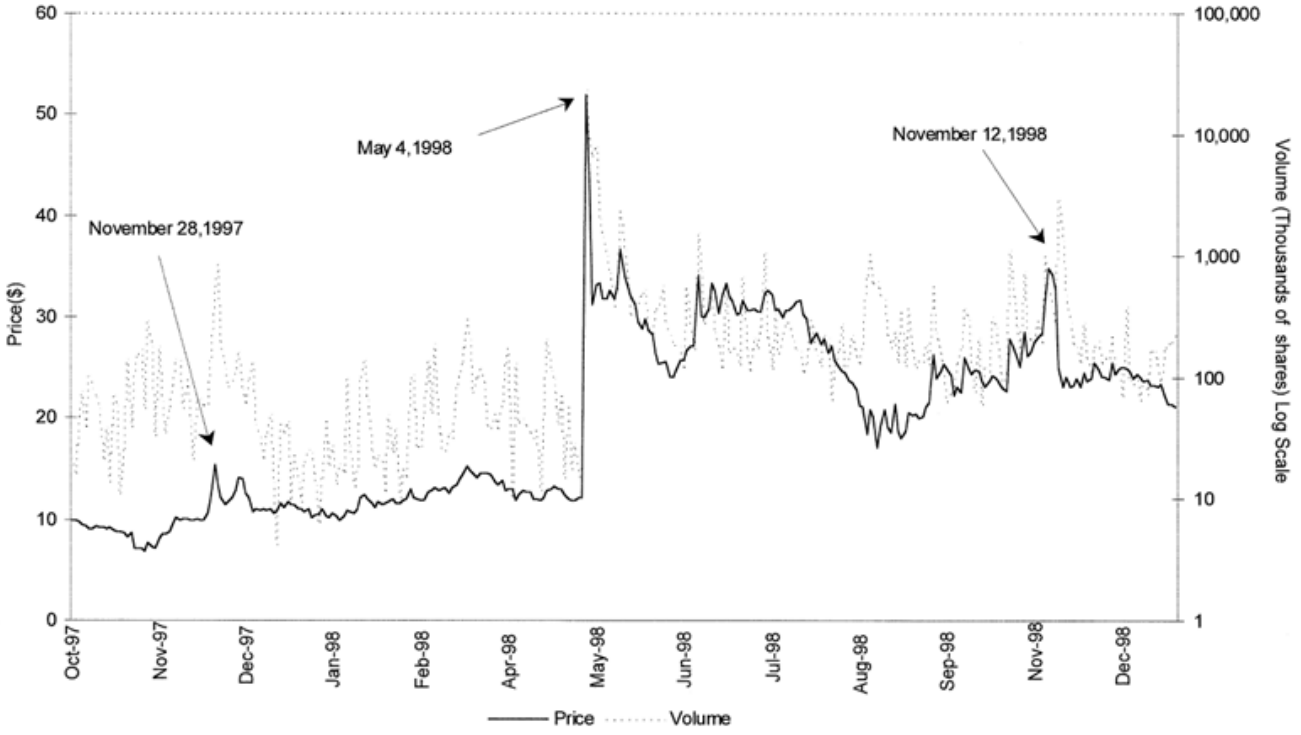

Figure 1. ENMD closing prices and trading volume, October 1, 1997, to December 30, 1998.

- November 1997: *Nature* publishes a scientific piece on a break-through in cancer research, mentioning ENMD as a company that has licensing rights related to this break-through cure.
  - Minor price increase
- May 3, 1998: The New York Times publishes an article that is basically a re-release of the article in *Nature*
  - Major price increase for ENMD
  - On average 7.5% price increase for other unrelated biotech firms
- November 12, 1998; The Wall Street Journal publishes an article stating that other labs have failed to replicate the experiment reported in the two articles mentioned above
  - price drops, but not all the way...

Gilbert, Kogan, Lochstoer, and Ozyildirim (2011) – Aggregate Market Response and Macro Summary Statistics

- Much research documents evidence of investor inattention with respect to idiosyncratic news events (the dusty corners of financial markets)
  - What about for aggregate prices and with respect to macro economic information?
  - A difficult hurdle for inattention as here we should expect prices to be very efficient
- Instrument: The Conference Board's Leading Economic Index (LEI)
  - A summary statistic based on a weighted average of 10 previously published macro releases.
  - Index methodology published on the Conference Board's web page.
  - Last component released 8:30am the day before the LEI release (at 10:00am)
  - In sum, a recurring, pre-scheduled event
- Efficient markets: no price response
  - Inattention 1: a subset of investors only pay attention to summary stat (more salient or cheaper in terms of processing costs)
  - Inattention 2: a subset of investors regard the release of the summary stat as information in addition to the releases of the individual components
  - (note that the inattention stories implicitly assumes limits to arbitrage on the part of the attentive investors, as these otherwise would eliminate any price impact by front-running the trades of the inattention. With limits to arbitrage, they still front-run but not in a sufficient quantity such as to eliminate price impact arising from the actions of the inattentive)

Figure 2
Timeline of the Model

This figure shows the basic timeline of the model. The risky asset pays off a dividend d_2 at $t = 2$ and d_3 at $t = 3$. At $t = 1$, a noisy public signal of d_3 is released ($s_1 = d_3 + \varepsilon_1$) and trading takes place at a market-clearing equilibrium price of p_1. At $t = 2$, the first-period signal is re-released as $s_2 = s_1$, i.e., it is a stale release of information. Trading occurs at the equilibrium price p_2.

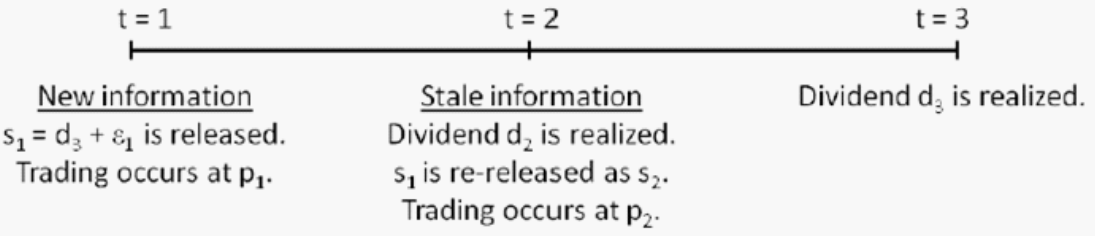

Figure 3
Return Responses under Different Models of Inattention

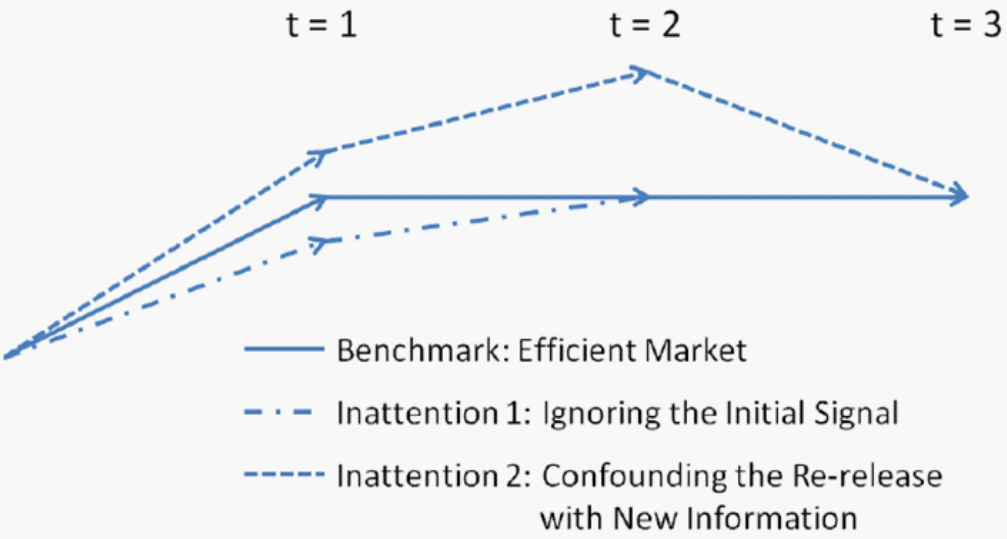

Table II
Return Response around the LEI Announcement

The table shows the regression results for different return intervals as given by the column headers. The generic regression is $R_{t,i} = \gamma_i + \delta_i (\Delta LEI_t - E_{t-}[\Delta LEI_t]) + \varepsilon_{i,t}$ where i correspond to the return interval and t refers to the 116 announcement dates in the sample (2/1997 – 2/2009). The expectation of the LEI release is the median of analyst forecasts as given by Bloomberg. For brevity, we only report the δ_i coefficients. Standard errors and R^2 are given below the corresponding δ_i-estimate in parentheses. The standard errors are corrected for heteroskedasticity and, for the cross-sectional results, clustered by announcement date. The top row shows the results for S&P500 futures returns, as defined in the main text. The next five rows use market beta quintile sorted portfolios. These betas are obtained from CRSP and the sort at each time t is done based on betas estimated using data available to investors at time t. The bottom four rows show results for Treasury bond futures returns. In the last column, the return is the return to a front-running strategy that, if the LEI surprise is positive, goes long one unit at 10:00am the day before the announcement, short two units at 10:05am the day of the announcement, and long one unit at close the day after the announcement. All returns are in percent and the LEI surprise is normalized to have unit variance. Thus a regression coefficient of 0.1 means that there is a 10 basis point surprise to a 1 standard deviation positive "shock" to the LEI announcement.

Log return (%) vs. Bloomberg LEI surprises	Pre-announcement 10:00 trad. day before – 09:59 day of LEI annc.	Announcement 10:00 – 10:04 day of LEI annc.	Post-announcement 10:05 day of LEI annc. – 16:00 day after LEI annc.	Net response 10:00 trad. day before – 16:00 day after LEI annc.	Return response for front-running strategy
S&P500 futures	0.261*	0.045**	−0.347***	−0.041	0.652***
	(0.152/3.5%)	(0.019/6.7%)	(0.119/5.6%)	(0.200/0.0%)	(0.205/10.5%)
Highest β_{mkt}-quintile	0.613**	0.101**	−0.681**	0.007	1.505***
	(0.306/2.1%)	(0.049/3.0%)	(0.318/1.3%)	(0.454/0.0%)	(0.538/3.2%)
Quintile 4	0.444**	0.072*	−0.462***	0.069	1.060***
	(0.213/1.1%)	(0.037/3.1%)	(0.176/0.6%)	(0.278/0.0%)	(0.357/3.2%)
Quintile 3	0.392**	0.063**	−0.290**	0.186	0.840***
	(0.186/2.6%)	(0.032/3.3%)	(0.136/0.6%)	(0.254/0.2%)	(0.287/3.9%)
Quintile 2	0.296**	0.049**	−0.211**	0.139	0.630***
	(0.128/1.8%)	(0.022/2.8%)	(0.103/0.3%)	(0.186/0.1%)	(0.198/2.3%)
Lowest β_{mkt}-quintile	0.166*	0.037**	−0.103	0.097	0.323**
	(0.090/0.7%)	(0.016/1.9%)	(0.072/0.1%)	(0.123/0.1%)	(0.143/0.6%)
2-yr T-bond	−0.007	−0.005***	0.025	0.013	0.037*
	(0.010/0.4%)	(0.002/8.0%)	(0.016/2.3%)	(0.017/0.4%)	(0.021/3.3%)
5-yr T-bond	−0.013	−0.013***	0.070*	0.044	0.096*
	(0.027/0.2%)	(0.004/10.6%)	(0.040/3.4%)	(0.043/0.9%)	(0.054/4.1%)
10-yr T-bond	−0.020	−0.021***	0.101*	0.060	0.143*
	(0.044/0.3%)	(0.006/13.5%)	(0.059/3.7%)	(0.068/0.9%)	(0.082/4.3%)
30-yr T-bond	−0.039	−0.032***	0.089	0.019	0.160
	(0.076/0.4%)	(0.009/12.9%)	(0.085/1.4%)	(0.111/0.0%)	(0.123/2.6%)

- Unconditional annual return on front-running strategy is 7-8%!

Time-Variation in the Response Coefficient due to Inattention

The table shows the results from running the following regression using S&P500 futures 5-minute announcement returns as well as the front-running strategy returns (defined in the main text): $R_{t,i} = \alpha_i + \beta_{0,i} \times StaleNewsReversal\_XS_{t-1} + (\beta_{1,i} + \beta_{2,i} \times StaleNewsReversal\_XS_{t-1}) \times LEI\_Surprise_t + \varepsilon_{i,t}$ where i correspond to the return interval and t refers to the 116 announcement dates in the sample (2/1997 – 2/2009). $LEI\_Surprise_t$ is equal to $\Delta LEI_t - E_{t-}[\Delta LEI_t]$, where the expectation of the LEI release is the median of analyst forecasts as given by Bloomberg. $StaleNewsReversal\_XS$ is a monthly, cross-sectional measure of the amount of individual firms' return reversal after stale firm news announcements. This measure is constructed from monthly cross-sectional Fama-MacBeth regressions using a measure of news staleness developed in Tetlock (2011), and its $t-1$ subscript indicates that the measure is based on return data for the month prior to the announcement month. The methodology is described in detail in the main text. A large degree of return reversal in the cross-section of stock returns leads to a high $StaleNewsReversal\_XS$. Thus, if over-reaction to stale news in the cross-section of stock returns is positively related to over-reaction to stale aggregate news at the aggregate stock market level, the expected sign on the interaction term's regression coefficient ($\beta_{i,2}$) is positive: high degree of over-reaction to stale news leads to a higher aggregate return response to the (100% stale) LEI announcement. The standard errors of the regression coefficients are given in parentheses, and they are corrected for heteroskedasticity. All returns are in percent and $LEI\_Surprise$ and $StaleNewsReversal\_XS$ are both normalized to have unit variance.

Log return (%) S&P500 futures	Announcement 10:00 – 10:04 day of LEI annc.	Return response for front-running strategy
$StaleNewsReversal\_XS_{t-1}$	-0.028^{*}	-0.113
	(0.015)	(0.148)
$LEI\_surprise_t$	0.033^{**}	0.574^{***}
	(0.015)	(0.211)
$StaleNewsReversal\_XS_{t-1} \times LEI\_surprise_t$	0.017	0.512^{**}
	(0.020)	(0.236)
R^2_{adj}	7.5%	9.1%

Background Risk and the LEI Return Response

The table shows the regression results for the 5-minute announcement returns, as well as the front-running strategy returns (defined in the main text) for five different portfolios. The portfolios correspond to a return standard deviation quintile sort *within* the highest market beta quintile. Both the market beta and standard deviation of each stock are taken from CRSP and are based on one-year lagged daily return data. Thus, it is available to investors at each time t. The regression for each return interval is $R_{t,i,j} = \gamma_i + \delta_i \left(\Delta LEI_t - E_{t-}\left[\Delta LEI_t\right]\right) + \varepsilon_{i,t}$ where i correspond to the portfolio, j refers to a stock in the portfolio, and t refers to the 116 announcement dates in the sample (2/1997 – 2/2009). The expectation of the LEI release is the median of analyst forecasts as given by Bloomberg. For brevity, we only report the δ_i coefficients. Standard errors and R^2 are given below the corresponding δ_i-estimate in parentheses. The standard errors are corrected for heteroskedasticity and clustered by announcement date. All returns are in percent and the LEI surprise is normalized to have unit variance.

	$R_t = \gamma + \delta \left(\Delta LEI_t - E_{t-}\left[\Delta LEI_t\right]\right) + \varepsilon_t$					
Return volatility quintiles (within highest β_{mkt} quintile):	**1**	**2**	**3**	**4**	**5**	**5 – 1**
δ from announcement return regressions (s.e.)	0.086*	0.101**	0.109*	0.105**	0.107**	0.021
	(0.044)	(0.051)	(0.057)	(0.050)	(0.048)	(0.021)
$\hat{\delta}$ from front-running return regressions (s.e.)	1.098**	1.183**	1.634***	1.656***	1.999**	0.891**
	(0.447)	(0.468)	(0.573)	(0.557)	(0.786)	(0.423)

- In sum, the interaction between limited risk-taking ability on the part of attentive investors (arbitrageurs) and the inattentive can generate interesting patterns in the cross-section of stock returns as well as at the aggregate market level.