Return Extrapolation and Day/Night Effects

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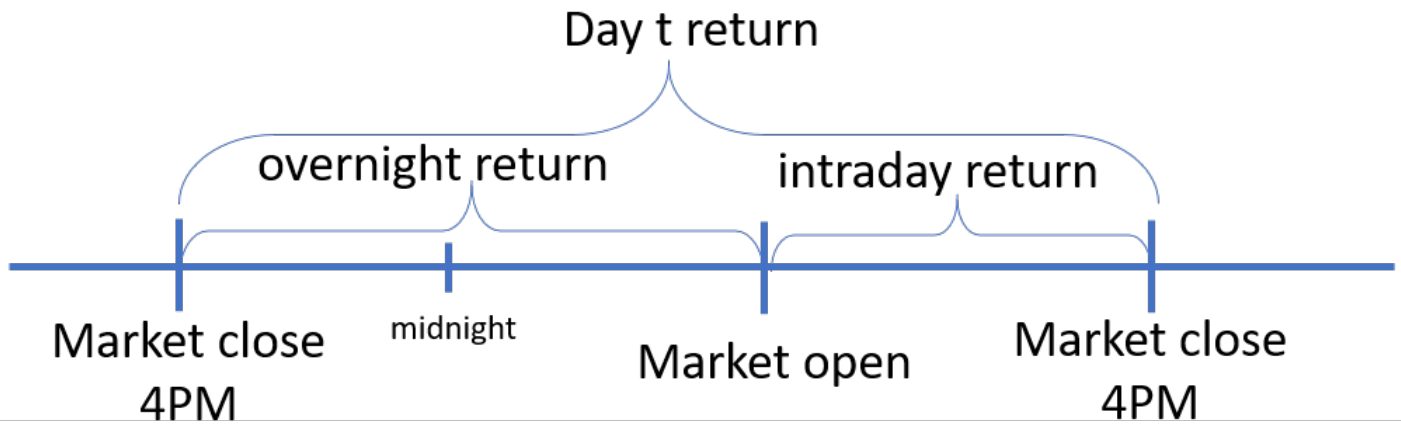
Tug of war – Lou, Polk, and Skouras (2019)



Panel A: Portfolios sorted by overnight returns

Decile	Overnight Excess	Intraday Excess
1	**−1.51%**	**1.62%**
	(−7.76)	(4.76)
10	**1.96%**	**−1.63%**
	(8.17)	(−4.74)
10–1	**3.47%**	**−3.24%**
	(16.57)	(−9.34)

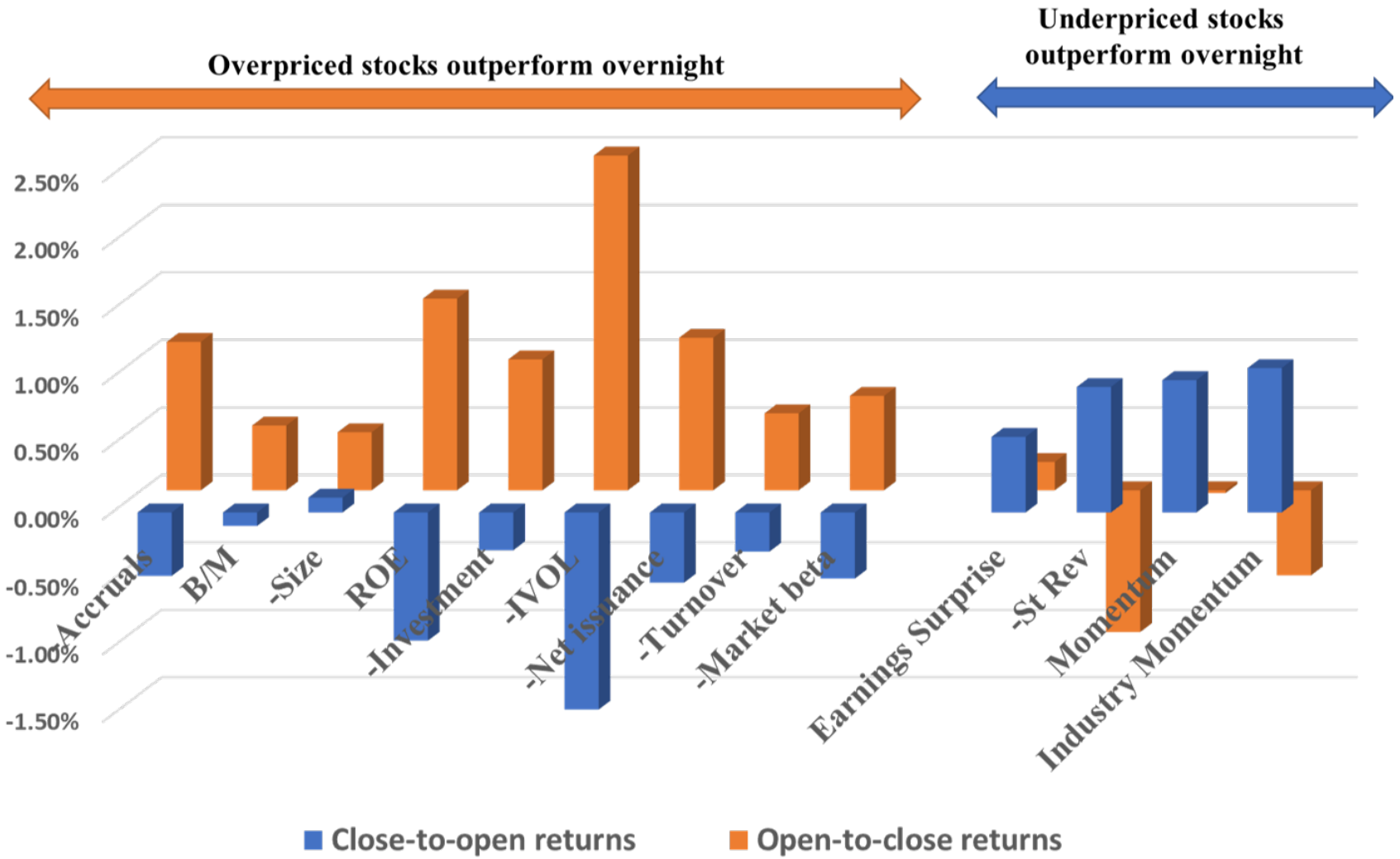
Panel B: Portfolios sorted by intraday returns

Decile	Overnight Excess	Intraday Excess
1	**1.59%**	**−1.51%**
	(5.51)	(−3.45)
10	**−0.22%**	**0.69%**
	(−1.20)	(2.51)
10–1	**−1.81%**	**2.19%**
	(−8.44)	(6.72)

- Stocks with relatively *high* past overnight (daytime) returns outperform *overnight* (during the day).

Tug of war – Lou, Polk, and Skouras (2019)

- Investors that have different clienteles trade on different times of the day.



Research questions

- What types of stocks do overnight traders prefer?
- What are the drivers of day/night return patterns?
- Relationship to other documented day/night return patterns
  - Stock prices appreciate only overnight (Kelly and Clark 2011)
  - CAPM only holds overnight (Hendershott, Livdan, Roesch 2020)

Three ingredients from behavioral finance and institutional trading

1) Return extrapolation
   - ▷ Expectations are positively correlated with past returns
   - ▷ Market returns (Greenwood and Shleifer 2014) and individual stock returns (Da, Huang, and Jin 2014)

2) Unsophisticated investors trade relatively more in the morning.
   - ▷ Different investor clientele (Lou, Polk, and Skouras 2019)
   - ▷ Higher attention at open (Berkman et. al. 2012)
   - ▷ Larger price dislocation and illquid at open (e.g., Brock and Kleidon 1992)

3) Short-selling constraint is binding $\rightarrow$ overpricing (Miller 1977)

Our main findings - Return extrapolation

- At the stock level, we find:
  - Morning (Afternoon) order imbalance is positively (negatively) related to past daytime returns
  - Overnight (daytime) returns positively (negatively) related to past daytime returns
- At the portfolio level, we find extrapolative trading leads to the observed day/night return patterns of characteristic-sorted portfolios
- At the aggregate level, we find evidence of extrapolative trading

Relationship to existing work

- The direction (daytime returns *positively* predict next night returns) is in contrast to
  - daily return reversals (e.g., Avramov Chordia, and Goyal 2006)
  - periodicity in order flows (Heston, Korajczyk, and Sadka 2010)
  - existence of investor clienteles (Lou, Polk, and Skouras 2019)
- We focus on the morning trades
  - Overnight risk premium (e.g., Barrot, Kaniel, and Sraer 2016, Hendershott et. al. 2020)
  - Margin requirement and lending fee overnight (e.g., Bogousslavsky 2021)

Data

- Trade and Quote (1993-2014) combined with Polygon (2015-2020)
  - Polygon is the data provider for Robinhood
  - NYSE, NASDAQ, and AMEX. Remove stock price less than \$5 and stocks with market capitalization that falls in the first NYSE quintile
- Returns are based on mid-quotes
- Intraday Order imbalance (OIB) measured using signed volume (Lee and Ready 1991)

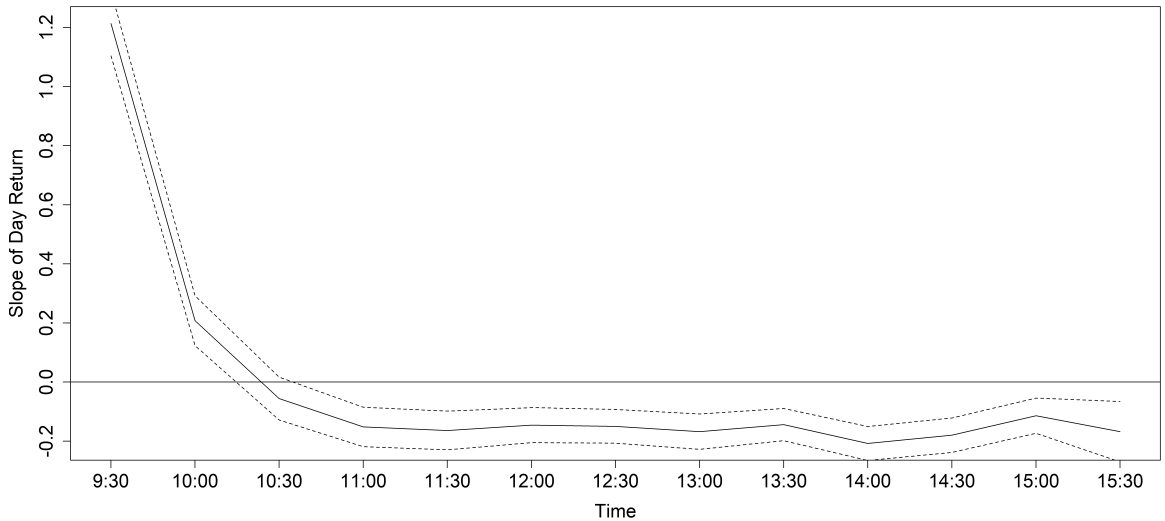
$$\text{OIB} = \frac{\text{Buy} - \text{Sell}}{\text{Shares Outstanding}}.$$

- 13 anomaly characteristics from Lou, Polk, and Skouras (2019)
- Boehmer, Jones and Zhang (2021) - retail order imbalance, intermarket sweep order to proxy institutional trade

OIB predictability - Fama-Macbeth (FM) approach

$$\text{OIB}_{int,t,i} = \alpha + \beta R_{9:45-3:59,t-1,i} + \delta' \text{OIB}_{\text{t}-1,\text{i}} + \epsilon_{\text{int,t,i}}$$

	9:30-9:45	9:45-10:30	10:30-4:00
$R_{9:45-3:59,t-1,i}$	1.8620 (26.88)	0.3332 (9.51)	-0.1537 (-9.68)
R^2 (%)	0.68	1.41	3.27



OIB predictability with short sale constraint

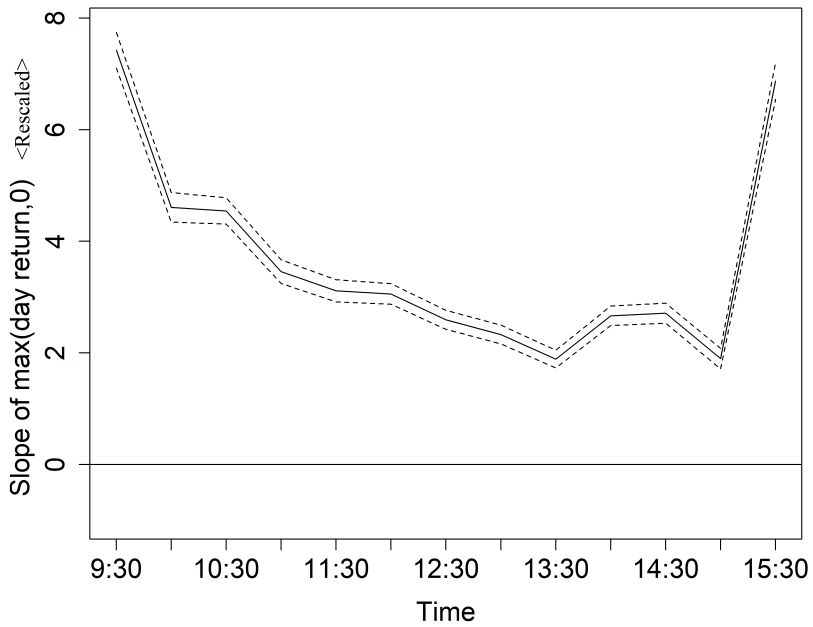
- Unconditional effect
  - Since returns are on average close to zero, return extrapolation does not imply any unconditional effect on morning OIB.

- However, with short-sale constraints, it will be binding only when past returns are negative.
  - We test this hypothesis using the term **Max(day return , 0)**
  - If there is extrapolation on past returns, β_a should be positive.

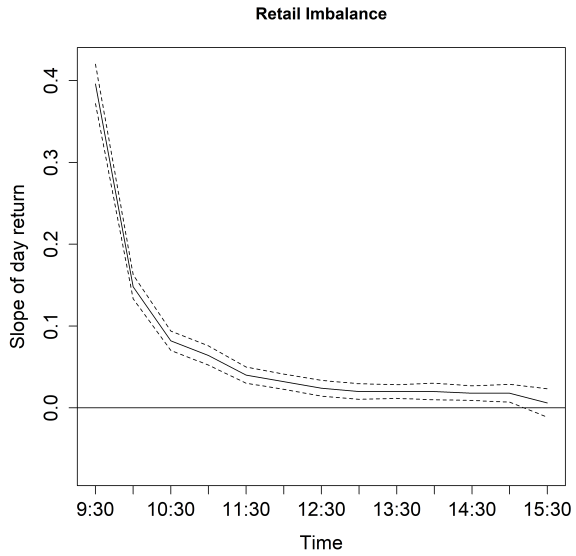
$$\begin{aligned}\text{OIB}_{int,t,i} = \alpha + \beta R_{9:45-3:59,t-1,i} \\ + \beta_a \max(R_{9:45-3:59,t-1,i}, 0) + \text{Control}_{t-1,i} + \epsilon_{int,t,i}\end{aligned}$$

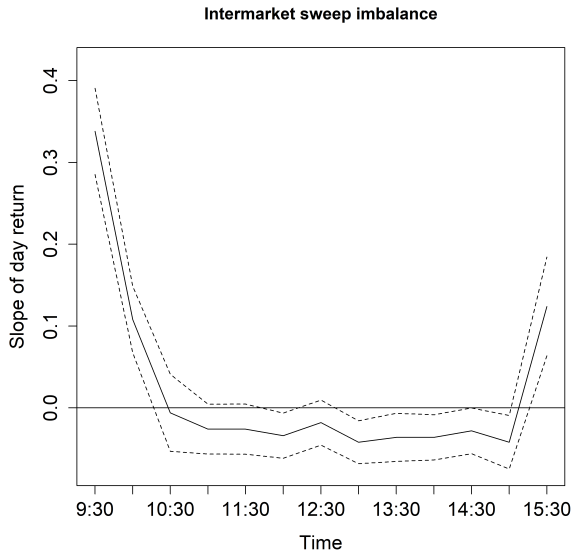
OIB predictability with short sale constraint

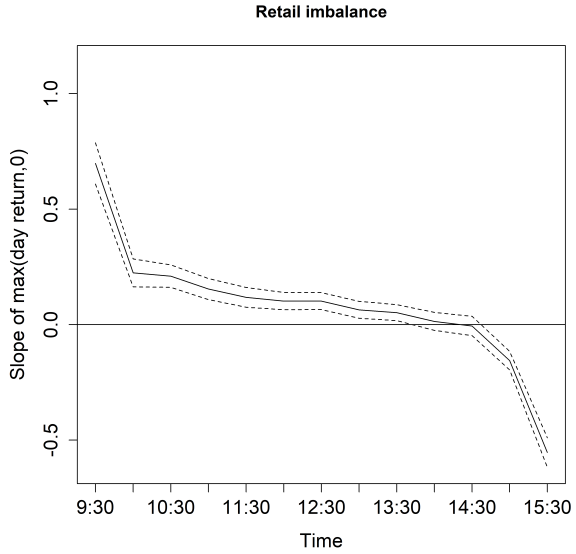
	9:30-9:45	9:45-10:30	10:30-4:00
$R_{9:45-3:59,t-1}$	0.8032	-0.3041	-0.4571
	(5.39)	(-3.98)	(-14.43)
$\max(R_{9:45-3:59,t-1}, 0)$	2.0664	1.3060	0.7893
	(9.56)	(11.66)	(18.14)
Control	Lagged night and week returns		
R^2 (%)	0.70	1.43	3.33

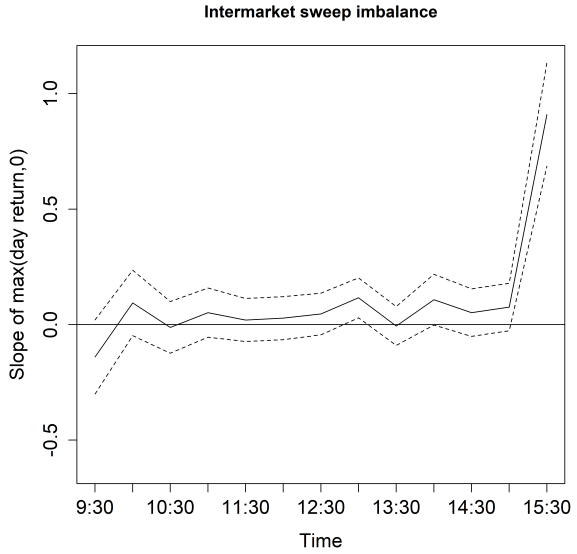


Retail (left) vs Institutional (right) Trade









Return predictability - FM approach

- To avoid mechanical reversal due to illiquidity and program trading, we use lagged day returns ending 3PM.

Dependent variable	$R_{3:59-9:45,t}$				$R_{9:45-3:59,t}$
$R_{9:45-3:59,t-1}$	-0.1000				
	(-0.87)				
$R_{9:45-3:00,t-1}$		0.9533	0.8807	-0.3839	1.1716
		(8.12)	(7.92)	(-2.76)	(6.89)
$\max(R_{9:45-3:00,t-1}, 0)$				1.0215	-0.2479
				(4.72)	(-1.05)
$R_{3:59-9:45,t-1}$			3.1559	3.7447	-3.2472
			(10.29)	(30.05)	(-23.00)
Characteristic controls	N	N	N	Y	Y
R^2 (%)	0.00	0.03	0.05	0.14	0.06

Proxies for retail trading

Regression of Order Imbalance

	Z=Mispricing		Z=Google Search Vol		Z=% Retail volume	
	9:30-9:45	10:30-4:00	9:30-9:45	10:30-4:00	9:30-9:45	10:30-4:00
$R_{9:45-3:59,t-1}$	0.9892	0.0969	2.4352	2.4352	0.4656	0.4903
	(4.07)	(1.96)	(28.55)	(-2.19)	(2.96)	(18.44)
$Z \times R_{9:45-3:59,t-1}$	0.0132	-0.0056	11.0916	11.0916	46.2576	-8.7669
	(2.69)	(-5.75)	(5.39)	(-9.03)	(13.21)	(-17.63)
Z	0.0004	0.0003	0.1028	0.1028	-0.1656	0.0068
	(5.05)	(15.71)	(4.3)	(5.47)	(-2.46)	(0.57)

Regression of Returns

	Z=Mispricing		Z=Google Search Vol		Z=% Retail volume	
	Night	Day	Night	Day	Night	Day
$R_{9:45-3:59,t-1}$	-2.7646	-0.5491	-1.0307	-2.1700	-2.7459	0.6721
	(-2.15)	(-1.17)	(-2.72)	(-0.83)	(-3.62)	(2.58)
$Z \times R_{9:45-3:59,t-1}$	0.0642	0.0323	13.6811	1.3157	33.1346	-8.6307
	(2.93)	(3.09)	(6.74)	(0.13)	(6.12)	(-2.71)
Z	-0.0004	-0.0009	0.0322	-3.8893	0.3486	-0.4663
	(-0.89)	(-4.26)	(0.87)	(-1.03)	(3.82)	(-4.25)

Characteristic-sorted portfolios (13 × 10 portfolios)

- ▷ The short-sale constraint is captured by return dispersion of the portfolio
  - As cross-sectional dispersion increases, fraction of stocks with positive returns are higher

	OIB (× 1000)				Returns			
$R_{t-1,9:45-3:00}$	0.979	-0.713	0.929	-0.660	0.030	0.008	0.021	0.004
	(6.67)	(-23.27)	(6.58)	(-23.37)	(8.39)	(1.62)	(6.4)	(1.09)
Lag disp.			0.946	0.405			0.026	-0.039
			(6.16)	(12.96)			(7.67)	(-7.68)
$R_{t-1,3:59-9:45}$	0.030	-0.078	-0.014	-0.098	0.040	0.016	0.038	0.013
	(0.17)	(-1.94)	(-0.09)	(-2.62)	(8.87)	(2.59)	(9.25)	(2.45)
R^2 (%)	12.59	35.62	12.59	36.05	0.49	0.06	0.55	0.26

Extrapolation and overpriced stocks

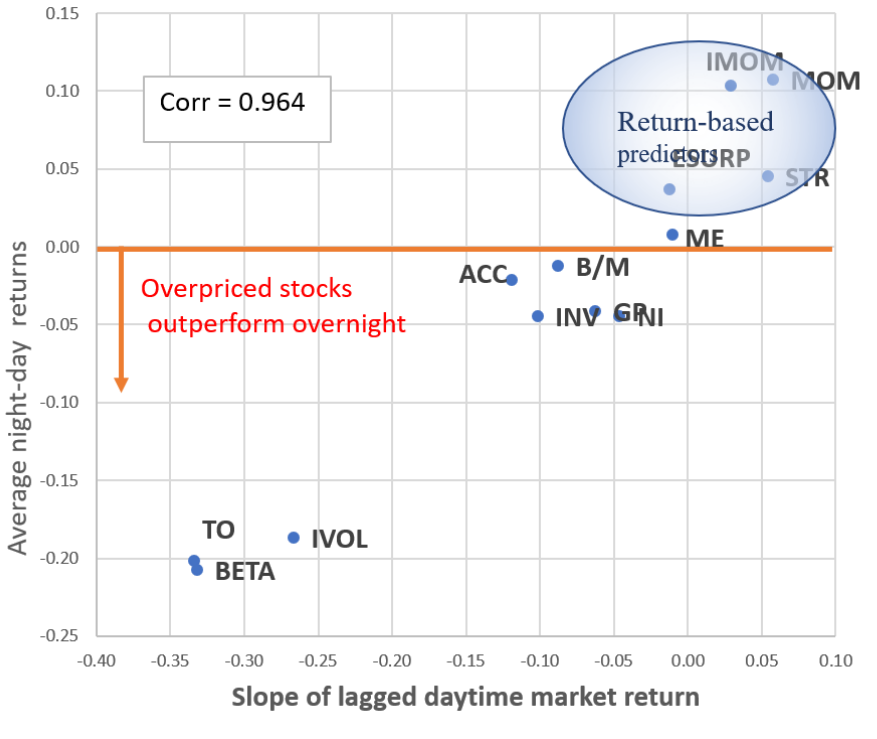
- We further investigate whether market-wide extrapolation is more prevalent for overpriced stocks
- Characteristics are defined so that high (portfolio 10) is underpriced (positive alpha)
- Replace portfolio returns and dispersion with market-wide measure

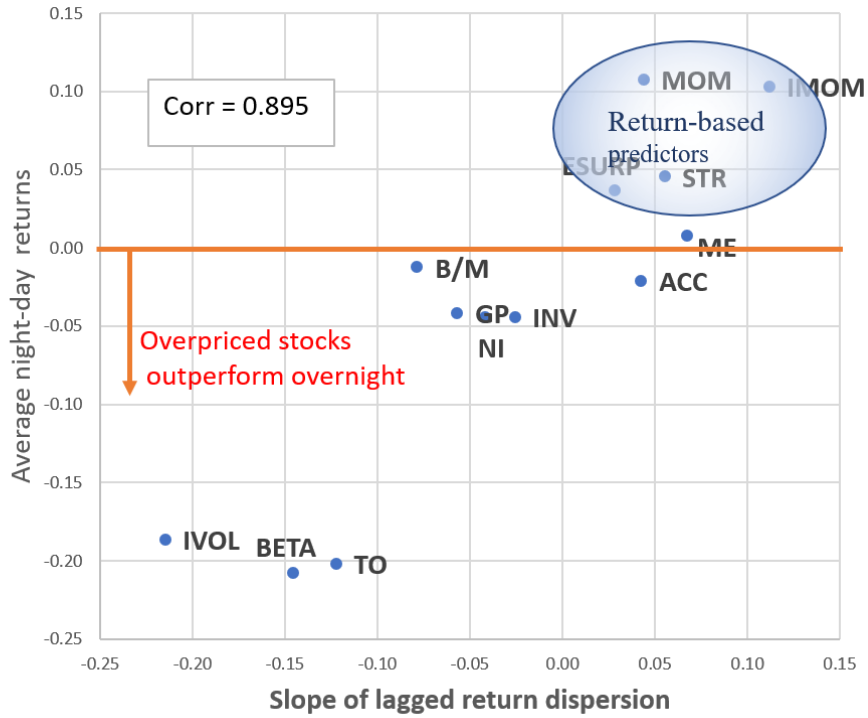
$$HML_{c,t+1} = \alpha_c + \beta_c R_{m,t}(+\gamma_c \text{Disp}_{m,t}) + \epsilon_{c,t+1},$$

HML = night − day returns of the HML portfolio

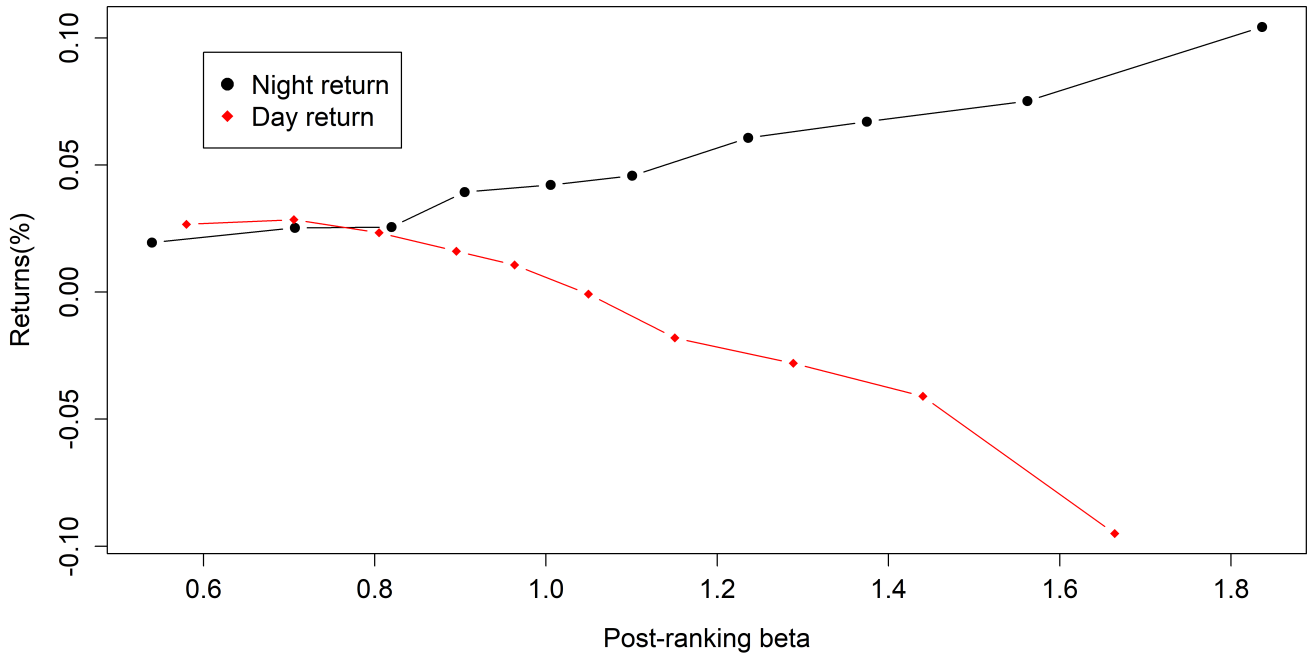
- Compare the slope of this regression with the night-day return difference

Day/night returns vs. slope of lag returns on OIB



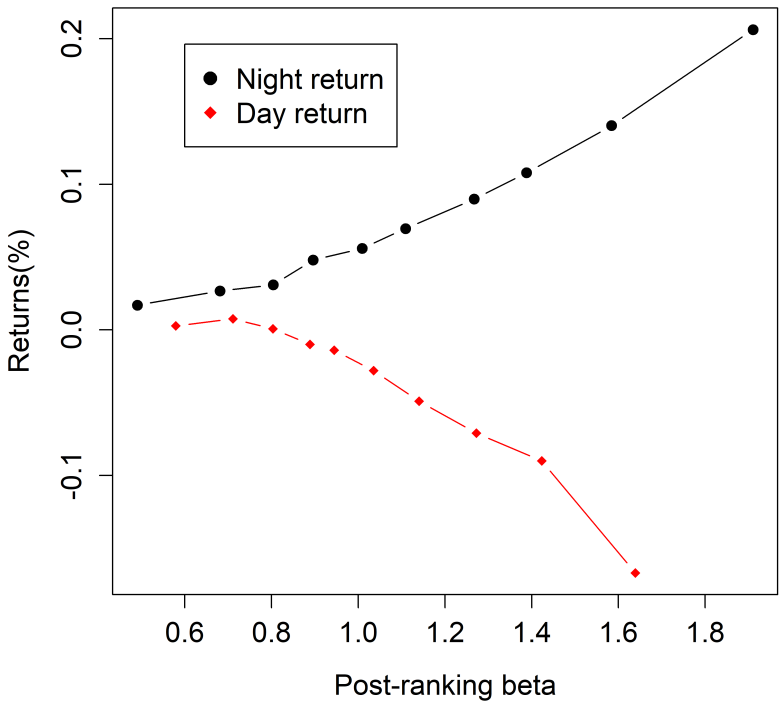


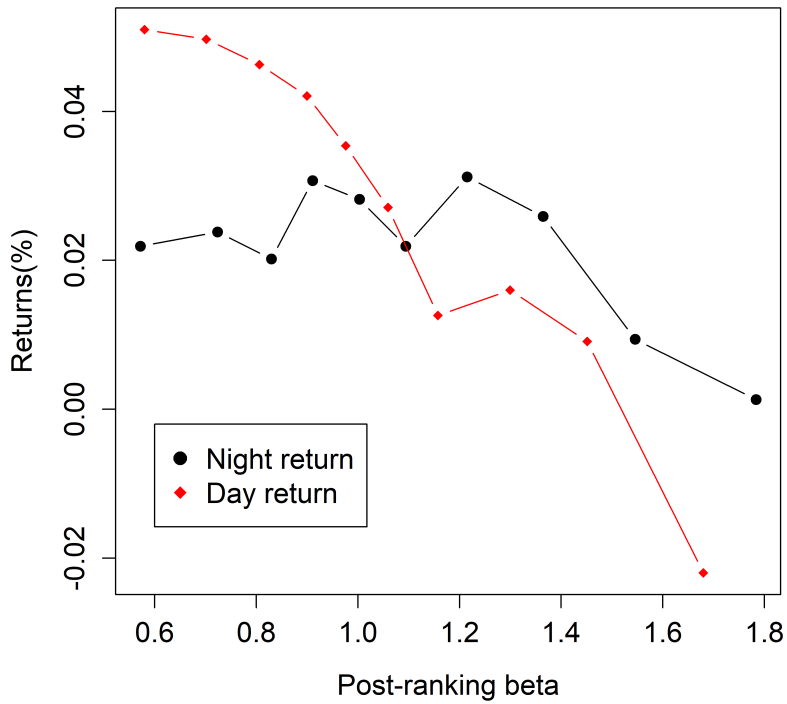
Security Market Line (SML) around the day



- Hendershott, Livdan, and Roesch (2020)
- If investors extrapolate on market returns, we expect high beta stocks to outperform in the morning – consistent with the above figure.
- However, if these patterns are driven by return extrapolation, we expect the night time SML to be steeper following positive day returns (esp. with short-sale constraints)

SML conditional on previous daytime returns





Following positive returns (left) and negative returns (right)

Market return extrapolation at the aggregate level

	Order Imbalance					
	9:30-9:45		10:30-4:00		Difference	
Lag market ret (9:45-3PM)	2.102	1.969	-0.151	-0.242	2.253	2.211
	(6.44)	(5.66)	(-1.26)	(-1.91)	(7.55)	(7.24)
Lag Dispersion		5.002		3.419		1.584
		(11.89)		(20.31)		(4.86)
R^2 (%)	1.06	6.56	0.03	21.62	1.49	2.15

	Returns					
	Night		Day		Night minus day	
Lag market ret (9:45-3PM)	0.039	0.039	-0.055	-0.055	0.094	0.094
	(2.04)	(2.07)	(-2.00)	(-2.00)	(2.90)	(2.91)
Lag Dispersion		-0.019		0.010		-0.028
		(-0.91)		(0.35)		(-0.88)
R^2 (%)	0.17	0.19	0.19	0.18	0.39	0.41

Conclusion

- ▷ We find strong evidence of extrapolative trading near the open.
- ▷ Our results explains:
  - Higher returns at the open for stocks that performed well the past day
  - Higher returns at the open for overpriced stocks
  - Steep SML for overnight returns