"Style Inattention in Ownership and Expected Stock Returns"

by

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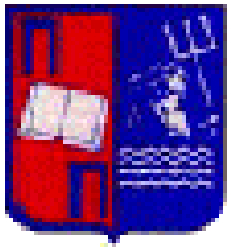

Joint paper with

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Style Inattention in Ownership and Expected Stock Returns

CONTENTS

I. Introduction: Our claim

- Heterogeneity of institutional investor goals and preferences for stock characteristics generates different degrees of inattention across stocks, and this inattention is rewarded a risk premium as described in Merton (1987)
- The inattention is generated because some stocks are in demand by many investment styles , where as others fall in the cracks of investing. For example, extreme characteristics tend to be avoided.
- We capture inattention by a single metric, the level of style heterogeneity in the ownership of a stock. It is the Herfindhal index *H* of style participation in each stock. Higher *H* indicates that fewer styles own the stock, hence high inattention.
- To construct H we use Thomson-Reuters classification of 13-F filers into 31 different styles.

I. Investment styles

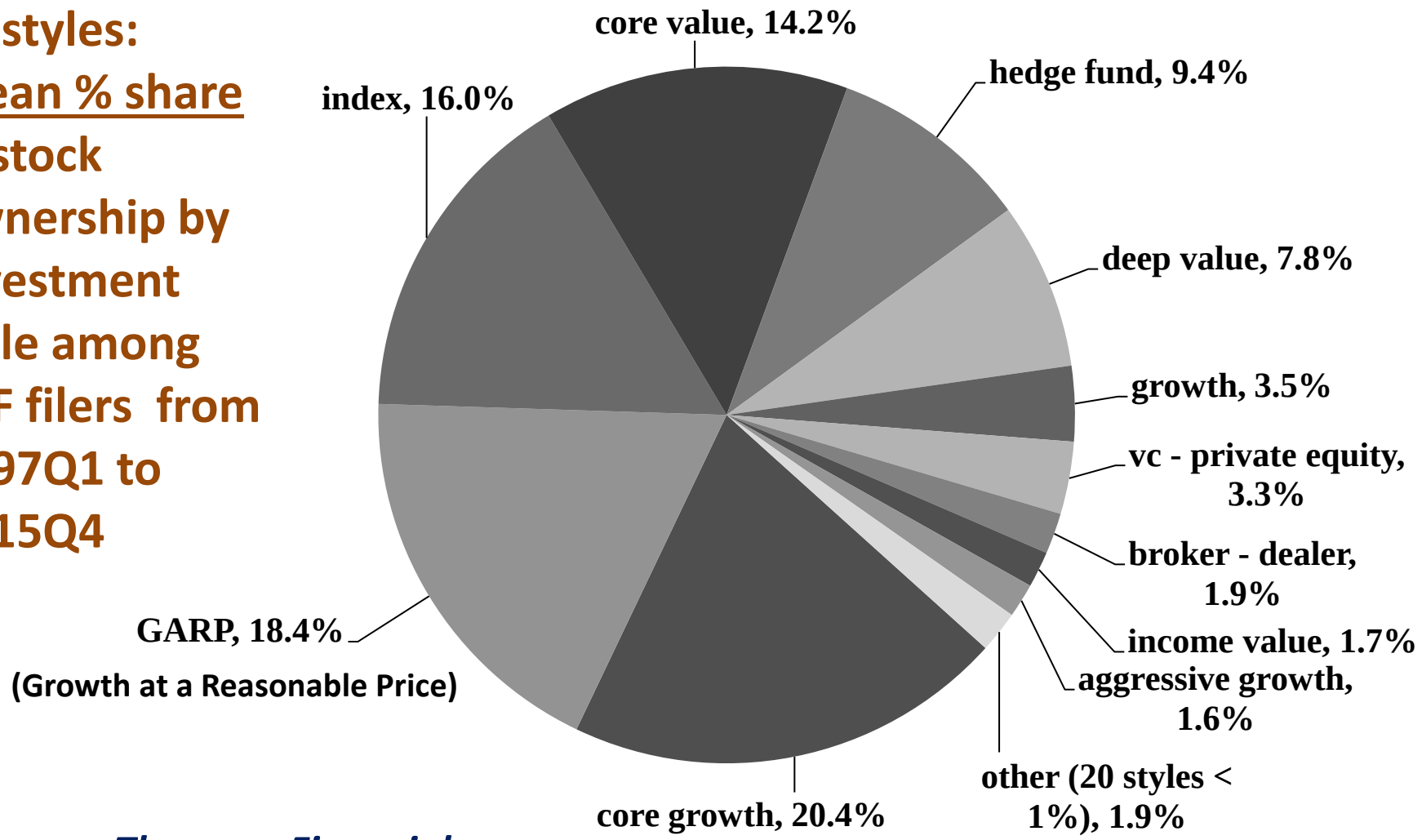
- Institutional investors own up to 80% of the market today and follow Investment styles , defined according to
  - simple quantitative rules based on firm characteristics like size or market-to-book ratio
  - or to their investment practices

  (GROWTH, VALUE, INCOME, INDEX, HEDGE-FUND, VENTURE CAPITAL, etc.)
- Thomson Financial provides a data set on 31 styles and their ownership of each stock
- We focus on the dispersion of stock ownership among the different styles, specifically, on style related inattention
- The literature on style investing accelerated following the behavioral model of Barberis and Shleifer (2003), who claim investors rush to buy winners, generating momentum effects and then reversals, plus increased co-variability within a style
- The literature assigns a stock into a unique style, whereas in reality a stock can be held by different styles

I. Institutional Ownership by Investment Style

Mean Share of Stock Institutional Ownership by Styles

31 styles:
Mean % share in stock ownership by investment style among 13F filers from 1997Q1 to 2015Q4



Source: Thomson Financial

I. Introduction: How dominant are the major styles in stock ownership?

Stock ownership by style in a sample of a 2724 common stocks over 1997-2015 (on average 1598 stocks per quarter). For each stock and in each quarter and among institutional investors, we rank the % style participations into 1st, 2nd, 3rd, etc. The numbers below reflect simple averages across the 121,466 available stock-quarters. Only stocks with institutional ownership above 10% are included.	
Average # of investment styles in the ownership of a stock	10.8
% participation in a stock per quarter	
biggest style	42.4 %
2nd biggest style	23.2 %
3rd biggest style	16.0 %
4th biggest style	11.2 %
5th biggest style	7.3 %

I. Investment styles pick different stock characteristics

- We regressed the shares of the following 10 major styles :

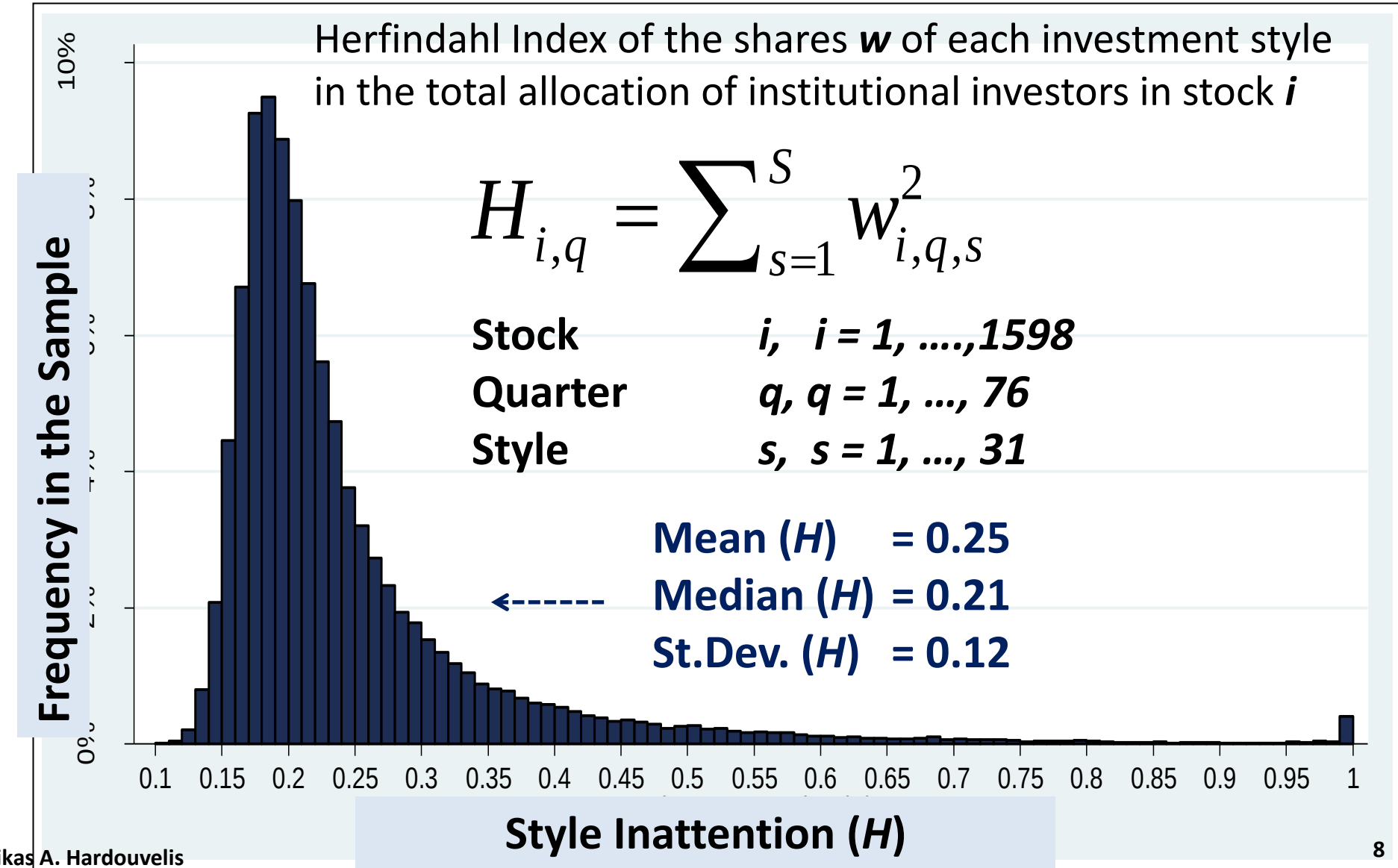
Core Growth	GARP	Index	Core Value	Hedge Fund	Deep Value	Growth	VC/Private Equity	Broker Dealer	Income Value

- on
  1. ln(size),
  2. ln(book-to-market),
  3. ln(id-vol),
  4. momentum,
  5. ln(turnover),
  6. market beta,
  7. SMB beta,
  8. HML beta,
  9. RMW beta,
  10. CMA beta,
  11. age,
  12. ln(price)

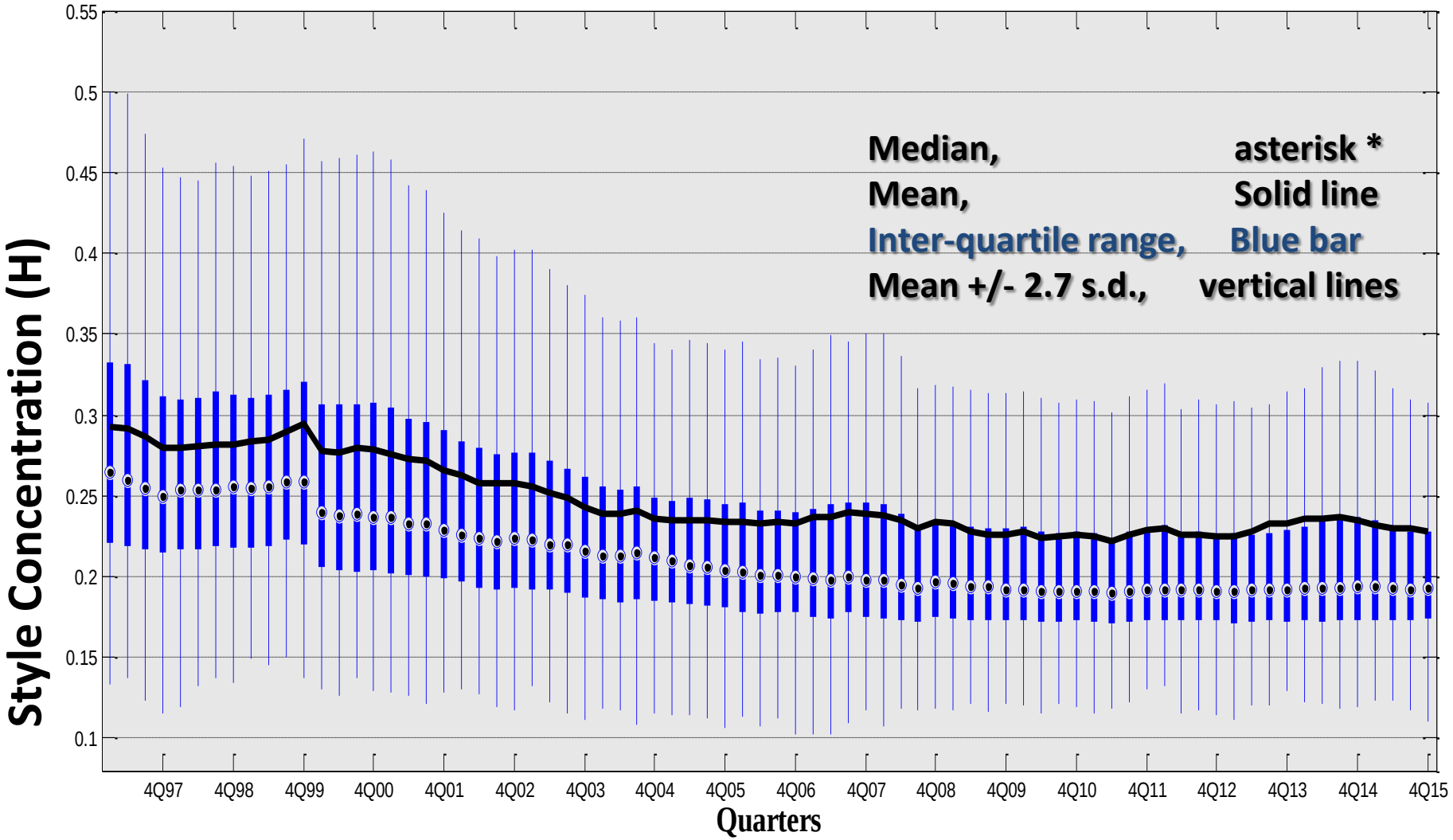
- and tested the null hypothesis of equality of the coefficients of each variable across the ten different styles.
- They were all overwhelmingly rejected (Table 2)

II. Style inattention *H* – its pooled distribution

Total number of stock-quarters in the distribution: 121,466



II. The distribution of *H* over time



1997Q1 Quarters over time 2015Q4

II. The determinants of $H_{(t+1)}$ - Pooled Tobit regressions

in Quarter (t)	(1)	(2)	(3)	(4)		
H	0.89*** (159.2)	0.93*** (299.3)	0.93*** (242.1)	0.92*** (235.0)		
momentum		-0.34*** (-9.78)	-0.37*** (-10.7)	-0.41*** (-11.3)	0.07** (2.42)	extr(mom)
Inst/Owner		-0.020** (-2.03)				
ln(size)		-0.04*** (-4.11)	-0.04*** (-3.82)	-0.12*** (-8.10)	0.24*** (9.08)	extr(size)
market beta		-0.04** (-2.55)	-0.05*** (-2.95)	-0.03** (-2.06)	0.00 (0.11)	extr(beta)
ln(idvol)		0.12*** (3.09)	0.11*** (2.75)	-0.03 (-0.65)	0.14** (5.10)	extr(idvol)
ln(turnover)		-0.09*** (-4.45)	-0.14*** (-6.04)	-0.10*** (-4.68)		
ln(Price)		-0.12*** (-5.80)	-0.09*** (-4.47)	-0.02 (-0.94)	0.19*** (6.65)	extr(price)
ln(B/M)		-0.02 (-0.93)	0.00 (0.21)	-0.01 (-0.30)	0.02 (1.20)	extr(b-t-m)
Time fixed effect	Yes	Yes	Yes	Yes		
Other controls	No	Yes	Yes	Yes		
Style Shares	No	No	Yes	Yes		
Observations	117,363	101,372	101,372	101,372		
Adjusted R2	87%	90%	90%	90%		

III. Style inattention & Merton's Model of limited participation

- The inattention created by style investing is similar to Merton's Presidential address (1987) lack of participation in stock investing.
- In Merton's extended CAPM, investors do not end up holding different fractions of classical "optimum" portfolios. In his model, in each security some investors refrain from buying due to exogenous reasons, and the remaining absorb all the supply. Absentee investors can vary from security to security.
- In general equilibrium, when markets clear, investors who participate in the (lower) demand for the security, absorb the total number of the existing supply of shares (at a lower price), moving away from their optimal portfolio. They are rewarded a premium for the deviation from optimality.
- The premium earned - over and above the market premium, is a function of the product of: (1) Market Size of security k, (2) Idiosyncratic Volatility of security k, (3) The inverse of participation in the total demand for security k:

$$ER_k \sim (size_k)\ (\sigma^2_k)\ (N/N_k),$$ where N is the universe of investors in the Stock Market, and N_k the number of participating investors in Security k

- Merton states his model can be extended to institutional investors, who may or may not be willing (or allowed) to participate in a specific stock.

III. Forming portfolios based on *H*

- We form 10 equally-weighted portfolios on *H* from CRSP
- Rebalancing at the end of each quarter q.
- Every quarter, we allocate the same number of stocks per portfolio
- We measure their returns both in quarterly and monthly frequency
- We then use the monthly returns series of each *H*-portfolio and estimate the alphas and the betas of 5-factor Fama-French (2015) model (excess market return, size factor (SMB), value factor (HML), profitability factor (RMW) and investment factor (CMA)).
- We also estimate a 10-factor model, by adding 5 more factors: LIQ (Pastor and Stambaugh (2003), IVOL (long high id-volat. stocks and short low id-volat. stocks), MGMT and PERF (Stambaugh and Yuan (2017) and BaB (Frazzini and Pedersen (2014)).
- We have checked the robustness of the results using value-weighted portfolios, an alternative four-factor model, etc.

III. Portfolios on *H*: Quarterly Results and Other Characteristics of the *H*-portfolios

	Low *H*	2	3	4	5	6	7	8	9	High *H*	high minus low H
average return	3.78% (3.06)	3.72% (3.24)	3.76% (3.25)	3.40% (3.08)	3.55% (3.23)	3.86% (3.46)	3.96% (3.40)	4.17% (3.57)	4.40% (3.64)	6.06% (4.58)	2.23% (3.06)
mean *H*	0.16	0.18	0.19	0.20	0.21	0.22	0.24	0.26	0.31	0.52	
mean size $bn	3.19	5.36	7.22	10.54	11.90	12.03	8.43	4.24	1.69	0.55	

- Positive relation between *H* and returns from portfolio 4 to portfolio 10. Average quarterly return of long-short portfolio 2.23% (9.22% per year), with a t-statistic = 3.06
- Size first rises and then falls as *H* goes up
- Merton (1987) states that in order to observe significant cross-sectional differences in expected returns (from factors other than market risk), the investor participation should be significantly low. (q<<1 in his setting, or H>>0 in our setting)

III. Portfolios on *H*: Monthly Results – quarterly returns, accounting for risk

	low *H*	2	3	4	5	6	7	8	9	high *H*	high minus low H
alphas	0.46% (1.12)	0.64% (1.78)	0.44% (1.47)	0.29% (1.04)	0.50% (1.60)	0.74% (2.33)	0.85% (2.53)	1.17% (3.20)	1.47% (3.20)	3.57% (5.25)	3.10% (4.43)
market beta	1.18 (33.4)	1.10 (35.4)	1.16 (46.1)	1.10 (45.3)	1.07 (39.7)	1.10 (40.40)	1.08 (37.2)	1.02 (32.2)	0.99 (25.0)	0.92 (15.9)	-0.26 (-4.31)
SMB beta	0.57 (12.4)	0.54 (13.3)	0.55 (16.3)	0.51 (16.0)	0.49 (13.8)	0.49 (13.7)	0.63 (16.6)	0.69 (16.7)	0.77 (14.8)	0.70 (9.21)	0.13 (1.63)
HML beta	0.32 (5.31)	0.38 (7.25)	0.25 (5.70)	0.33 (8.14)	0.24 (5.28)	0.26 (5.70)	0.30 (6.04)	0.38 (7.15)	0.30 (4.57)	0.25 (2.56)	-0.07 (-0.65)
RMW beta	0.15 (2.35)	0.17 (3.14)	0.27 (5.78)	0.19 (4.40)	0.12 (2.44)	0.18 (3.69)	0.12 (2.25)	0.05 (0.97)	0.02 (0.32)	-0.22 (-2.17)	-0.37 (-3.49)
CMA beta	0.08 (0.94)	-0.09 (-1.20)	0.03 (0.47)	0.00 (0.06)	0.12 (1.94)	0.05 (0.73)	0.00 (0.02)	-0.05 (-0.73)	-0.06 (-0.71)	-0.14 (-1.03)	-0.21 (-1.55)
adjusted R-square	0.90	0.91	0.94	0.94	0.93	0.93	0.92	0.91	0.87	0.76	0.17
	10 factor model adds the following betas: LIQ, IVOL, MGMT, PERF, BaB										
alphas	0.51% (1.27)	0.67% (1.91)	0.49% (1.70)	0.38% (1.44)	0.66% (2.27)	0.89% (3.01)	1.02% (3.35)	1.27% (3.95)	0.96% (2.64)	2.78% (5.21)	2.26% (3.46)
adjusted R-square	0.92	0.93	0.95	0.95	0.95	0.94	0.95	0.94	0.93	0.87	0.37

III. Portfolios on *H*: Remarks on the results

- The main empirical finding:
  - when *H* is sufficiently low, the average raw returns originate from risk premia of the known systemic risk factors, but
  - when *H* is higher, there is an extra "abnormal" return, which is related to inattention and limited style participation.
- In the 5-factor Fama-French model,
  - the alpha of the long-short portfolio on *H* is 3.10% per quarter (13.0% per annum) with a t-statistic equal to 4.43, confirming that the effect of *H* is substantial and does not stem from any systematic risk factor.
  - Market beta and the profitability factor explain some of the variation in the long-short (High *H* minus Low *H*) portfolio.
  - Only a small part of the *H* effect is attributable to the systematic risk factors (adj-R-sq. of hedging portfolio is only 17%)
- Boosting the model to 10 factors adds explanatory power in each decile portfolio, explains 37% of the variation in the long-short *H* portfolios, yet it does not change the basic conclusion:
  - The alphas remain positive and statistically significant from portfolios 5 to 10
  - The alpha of the long-short portfolio on *H* is 2.26% per quarter (9.35% per annum) with a t-statistic equal to 4.43.

IV. Econometric Setup

- Stock returns of quarter (q+1) are regressed on the style concentration (*H*) and on other control variables (Z) of the earlier quarter (q):

$$r_{i,q+1} = \alpha + \beta \cdot (H)_{i,q} + \Gamma' \cdot Z_{i,q} + e_{i,q+1}$$

- A pooled cross-sectional - time-series framework is used
- Quarterly dummies are included to address the "time-effect" and improve the estimation of standard errors (Petersen, 2009). They result in high R-bar^2
- The quarterly stock returns are not serially correlated, hence there is no need to correct for a "firm effect"
- The pooled framework with time dummies provides equivalent results to the traditional Fama-MacBeth regressions (Petersen (2009))
- We compute panel White (1980) standard errors to address the conditional heteroskedasticity of the error terms
- In multi-period returns, Newey-West (1987) standard errors are used to also address the serial correlation of returns, which is induced by construction from the overlapping of the predictive time intervals

IV. Description of Variables

- **DEPENDENT VARIABLE:**
  - The stock return of quarter q+1, is the percentage change of the stock price from the end of the previous quarter (q) to the end of the current quarter (q+1) plus the dividend yield that corresponds to quarter.
  - Multi-period stock returns (1, 2, 3 and 4 years) are the cumulative products of the individual gross quarterly returns.
- **ADDITIONAL INDEPENDENT VARIABLES:**
  - 5 Risk factors: classical CAPM market beta, the beta of the small-minus-big portfolio (SMB), the beta of the high-minus-low market-to-book portfolio (HML) , the beta of the robust-minus-weak profitability portfolio (RMW) and the beta of the conservative-minus-aggressive investment (CMA). (Fama and French, 2015)
  - We estimate them by running rolling time-series monthly regressions (24-36 months), of the excess monthly returns on the monthly prices of the factors.
  - The classic Market beta is also one of the determinant variables in Merton's model.

IV. Description of Variables (cont.)

- We use the natural logarithm of market capitalization of each stock since:
  - Size is a known determinant of stock returns
  - Size is included as determinant in Merton's model
  - Size is a major variable used to define the styles
- We use the natural logarithm of the market-to-book value ratio of the stock, which is also a well-known determinant of stock returns, and a major variable used in the style definition
- We use the natural logarithm of idiosyncratic volatility of each stock as an additional control:
  - It is included as a determinant of stock returns in Merton's model
  - It is found in many studies to predict future stock returns.
- We include the illiquidity related control (share turnover), the momentum of each stock,
- We include as "other controls": Amihud's ln(ILLIQ), the SMB, HML, RMW and CMA betas, and ln(price)
- Finally, we include the share of each style in the ownership of stocks or their sum , IO, which is the level of institutional ownership)

IV. Basic Econometric Results

$$r_{i,q+1} = \alpha + \beta \cdot (H)_{i,q} + \Gamma' \cdot Z_{i,q} + e_{i,q+1}$$

From **Table 7**	(1)	(2)	(3)	(4)
H	0.069*** (5.83)	0.051*** (3.38)	0.051*** (3.10)	0.055*** (3.51)
ln(size)		-0.004*** (-8.64)	-0.013*** (-6.25)	-0.013*** (-5.98)
market beta		0.006*** (4.86)	0.005*** (3.52)	0.005*** (3.51)
ln(id-volatility)		0.020*** (9.22)	0.017*** (6.13)	0.016*** (6.15)
ln(B/M)			0.010*** (6.36)	0.009*** (6.36)
momentum			0.009*** (3.66)	0.008*** (3.17)
ln(turnover)			-0.007*** (-2.86)	-0.006*** (-2.76)
I/O				-0.020*** (-3.93)
% style shares	-	-	YES	-
other controls	-	-	YES	YES
Adj-R^2 (%)	0.18	0.19	0.20	0.20
# of obs.	116,317	106,031	102,570	102,570

IV. Multi-period Econometric Results

Panel A: Univariate regressions of cumulative returns

	6 months	1 year	2 years	3 years	4 years
H	0.140*** (6.83)	0.304*** (7.39)	0.527*** (6.64)	0.735*** (4.84)	1.163*** (5.33)
observations	113,841	108,858	99,282	90,516	82,246
Adjusted R2	0.17	0.13	0.10	0.08	0.10

Panel B: Full specification regressions of cumulative returns

	6 months	1 year	2 years	3 years	4 years
H	0.111*** (3.59)	0.192*** (3.21)	0.206* (1.88)	0.336 (1.58)	0.687** (2.30)
momentum	0.010** (2.25)	-0.024*** (-3.16)	-0.103*** (-9.65)	-0.100*** (-7.27)	-0.108*** (-6.29)
observations	100,523	96,540	88,816	81,381	74,244
Adjusted R2	0.18	0.16	0.13	0.12	0.15

- The effect of *H* remains present in the longer horizons (does not diminish at the rate suggested by the auto regression of *H*)
- The effect of style inattention and the effect of style investing co-exist

IV. The coexistence of style inattention with style investing

- The transient effects of style investing (Barberis and Shleifer, 2003) and the risk-premium that is created by the style inattention (Merton (1987)) co-exist
- Both effects are related to demand for stocks
- The transient effects are related with short-term demand variations that create momentum and reversal phenomena
- The effect of inattention is more permanent, generating a risk premium
- Investment institutions focus on specific stock subsets to differentiate themselves

V. Robustness tests

Full model results, corresponding to regression (4) of Table 7

Table 9	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
H	0.015*** (3.05)	0.014*** (3.21)	0.015** (2.37)	0.047*** (2.76)	0.032** (2.35)	0.045*** (2.76)	0.047*** (3.85)	0.051*** (2.93)
obs.	253,282	179,734	131,717	93,745	102,570	102,570	102,558	89,920
AdjR^2	14%	17%	21%	18%	21%	20%	20%	20%

1) Criterion of IO > 10% relaxed. All observations are used.
2) Criterion of IO > 10% relaxed, but stocks with price < $5 in either of q-1, q, q+1, q+2 are excluded
3) Criterion of IO > 10% relaxed, but stocks with size that fall in the NYSE lowest decile in either of q-1, q, q+1, q+2 are excluded
4) The seven quarters of the financial crisis 2007Q3-2009Q1 are excluded
5) Variables are winsorized at 0.5% of each tail (except for style shares)
6) *H*-broad, which aggregates styles into 8 categories, replaces *H.*
7) *H*-mutual uses only mutual fund styles, and replaces *H*
8) *H*-inv uses individual institutional owners and replaces *H*

V. More on robustness: Could H measure high demand instead of inattention?

- The excess demand eD measure for stock i, is created first from subtracting the market weight of style s from its specific weight in stock i. The result is either a positive or negative number θs.
- Then, a weighted average of the θs across the styles (with weight s are the market shares of the styles) gives eD for stock i.

$$r_{i,q+1} = \alpha + \beta \cdot (H)_{i,q} + \Gamma' \cdot Z_{i,q} + e_{i,q+1}$$

	(1)	(2)	(3)
H		0.061***	0.055***
		(5.02)	(3.44)
eD	-0.129***	-0.081***	0.022
	(-4.39)	(-2.70)	(0.62)
Controls	No	No	Yes
Observations	116,317	116,317	102,570
Adjusted R^2	18%	18%	20%

- The evidence shows that when excess demand eD for stock i in quarter q is high, the return of next quarter q+1 is low.
- When controls are included the negative association of eD disappears
- Yet the positive association with *H* remains intact

VI. Conclusion

- There is clear evidence of an equilibrium effect due to style inattention in investing
- The effect of style inattention is described in Merton (1987) and co-exists with the style momentum and style reversals, as described by Barberis and Shleifer (2003)
- Inattention *H* is highly auto-correlated, positively correlated with idiosyncratic volatility and negatively correlated with size, market beta or share turnover
- A long-short strategy based on *H* produces an alpha > 9% per year
- The unconditional annual premium for one standard deviation of style concentration is 3.36% (t-stat = 5.83)
- The relation continues to hold in a multi-period setting, indicating that the effect is not transient and is very different from the style investing effects which switch signs, showing reversals after their original momentum

VI. Future research

- The relation of H with idiosyncratic volatility, illiquidity, comovement
- The relation of H with a flatter security market line, the betting-against-beta strategy and the premium of idiosyncratic volatility
- How the preferences for characteristics could create endogenously momentum and reversal effects

Style Inattention in Ownership and Expected Stock Returns

Thank you for your attention!

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Appendix A: *H* and Individual Styles

Correlations of *H* with the shares of individual styles (pooled across all stock quarters)

Core Growth	GARP	Index	Core Value	Hedge Fund	Deep Value	Growth	Private Equity	Broker Dealer	Income Value
-0.29	-0.29	-0.48	-0.25	0.11	-0.22	-0.14	0.32	-0.11	-0.18

- Index style, the most passive style, has the lower correlation with *H* (-0.48). Index style funds hold stocks that everyone holds.
- Hedge Fund and Private Equity styles, the two most active styles, have a positive correlation with *H* (0.11 and 0.32, respectively). It seems that on average these two styles hold stocks that are neglected by the rest and exploit part of the alpha that is created by *H*.
- Our results are not driven by the distinction between passive indexers – active smart money managers.
- In our regressions we control for the share of the individual styles.
- In addition, in our robustness tests we use an alternative *H*, on which the shares of Index, Hedge Funds and Private Equity are not taken into account. The results remain qualitatively the same and the statistical significance is higher.
- The effect of *H* is related with all the styles.

Appendix B: *H*, IDVOL and BaB

10 factor model: the betas of IVOL and BaB factors

	low *H*	2	3	4	5	6	7	8	9	high *H*	high minus low H
IVOL beta	0.11 (3.60)	0.09 (3.42)	0.08 (3.62)	0.06 (3.12)	0.07 (3.36)	0.08 (3.32)	0.09 (3.94)	0.14 (5.65)	0.26 (9.22)	0.40 (9.87)	0.29 (5.83)
BaB beta	-0.08 (-0.02)	0.04 (1.32)	0.01 (0.22)	0.02 (0.68)	-0.02 (-0.88)	-0.01 (-0.43)	-0.01 (-0.21)	0.06 (2.14)	0.26 (7.76)	0.39 (7.96)	0.39 (6.50)

- The betas of IVOL are positive and significant across the ten portfolios of *H*. However, they increase a lot at the three portfolios with higher H. IVOL explains some of the variation in the long-short (High *H* minus Low *H*) portfolio.
- The IVOL evidence is consistent with the model of Merton (1987), according to which the idiosyncratic volatility premium is higher when the participation is lower (in our case higher *H*).
- The betas of BaB alternate signs and are insignificant up to the seventh portfolio of *H*. They become positive and significant at the three portfolios with higher *H*. BaB explains some of the variation in the long-short (High *H* minus Low *H*) portfolio.
- *H* could be the driver of the betting-against-beta anomaly (and the flatter security market line). Stocks with higher *H* have lower betas because of lower comovement with the market (Barberis and Shleifer (2003)) and, at the same time ,they gain an alpha (Merton (1987)).