Benchmarking Intensity

Anna Pavlova and Taisiya Sikorskaya

解读：雷印如

2023 年 2 月 23 日

Motivation

- The asset management industry has been growing in size and importance over time.
- Benchmarks convey to fund investors information about the types of stocks the fund invests in and act as a useful tool for performance evaluation of fund managers
- Our objective is to link membership in multiple benchmarks to stock prices and expected returns, as well as the demand by fund managers

Literature

- This paper is related to several strands of literature, including equilibrium asset pricing with benchmarked fund managers, index effect, and empirical research on the effects of institutional ownership.
  - Benchmark: None of these works, however, considers heterogeneous benchmarks (Brennan, 1993; Cuoco and Kaniel, 2011; Basak and Pavlova, 2013);Buffa et al., Forthcoming).
  - Index effect: This literature typically measures the average size of index effect (Shleifer, 1986; Harris and Gurel, 1986). The existence of the index effect challenges the standard theories which predict that demand curves for each stock are very elastic (Gabaix and Koijen, 2020).

Contribution

- Among theoretical contributions, heterogeneous habitats of fund managers arise because of the heterogeneity in benchmarks. Our preferred habitat model provides a microfoundation for why stocks are imperfect substitutes.
- Both theoretical and empirical results are related to the index effect literature, we show how it varies in the cross-section with the change in BMI.
- Among empirical contributions, Our analysis delivers an alternative estimate of stock price elasticity of demand and implications of passive ownership for corporate governance.

Model - Basic Setting

- There are two periods, $t = 0, 1$. The financial market consists of a riskless asset with an exogenous interest rate normalized to zero. The cash flows of the risky assets are given by

$$D_i = \bar{D}_i + \beta_i Z + \epsilon_i, \beta_i > 0, i = 1, ..., N,$$

where $Z \sim N(0, \sigma_z^2)$ is common shock and $\epsilon_i \sim N(0, \sigma_z^2)$is idiosyncratic.

- The terminal wealth of a direct investor is given by $W = W_0 + \theta_D'(D - S)$,
- A fund manager's j compensation w_j consists of three parts

$$w_j = aR_j + b(R_j - B_j) + c, a \geq 0, b > 0$$

where $R_j \equiv \theta_j'(D - S)$is the performance of the fund's portfolio and $B_j \equiv \omega_j'(D - S)$ is the performance of benchmark j

Model - Portfolio choice and asset prices

- The portfolio demand of the direct investors is the standard mean-variance portfolio

$$\theta_D = \frac{1}{\gamma}\Sigma^{-1}(\bar{D}_i - S)$$

- The portfolio demand of manager j is given by,

$$\theta_j = \frac{1}{\gamma(a+b)}\Sigma^{-1}(\bar{D}_i - S) + \frac{b}{a+b}\omega_j$$

- The fund manager splits his risky asset holdings across two portfolios: the mean-variance portoflio and the benchmark portfolio. The latter portfolio arises because the manager hedges against underperforming the benchmark.

Model - Market Clear

- By clearing markets for the risky assets, $\lambda_D\theta_D + \sum_{j=1}^{J} \lambda_j\theta_j = \bar{\theta}$, we compute equilibrium asset prices.

$$S = \bar{D} - \gamma A \Sigma \left(\bar{\theta} - \frac{b}{a+b} \sum_{j=1}^{J} \lambda_j \omega_j \right)$$

The index effect manifests itself through the benchmarking-induced price pressure term $\frac{b}{a+b} \sum_{j=1}^{J} \lambda_j \omega_j$.

- The expected return of stock i, expressed as

$$E[\Delta S_i] = \gamma A \beta_i \sigma_z^2 \beta' \left(\bar{\theta} - \frac{b}{a+b} \sum_{j=1}^{J} \lambda_j \omega_j \right) + \gamma A \sigma_\epsilon^2 \left(\bar{\theta}_i - \frac{b}{a+b} \sum_{j=1}^{J} \lambda_j \omega_{ij} \right)$$

Model Prediction

- Stocks with higher benchmarking intensities have lower expected returns.
- If a stock's benchmarking intensity goes up (e.g., because of an index inclusion), its price should rise.
- If a stock's benchmarking intensity goes up, the funds' ownership of the stock ($\sum_j \theta_{ij}$) should rise.
- If a stock enters benchmark j and exits benchmark k, funds benchmarked to index j increase their demand for the stock (θ_{ij}) while those benchmarked to index k decrease their demand (θ_{ik}).

Data

- The main sample is an annual panel of stocks which were the Russell 3000 constituents in 1998-2018. All the constituent weights for 22 Russell benchmark indexes are from FTSE Russell
- The main three pillars of data are historical benchmark weights, fund and institutional holdings, and stock characteristics
- Focus on U.S. domestic equity mutual funds and ETFs and their prospectus benchmarks to build a measure of benchmarking intensity

Empirical measure of benchmarking intensity

- we calculate the benchmarking intensity (BMI) for stock i in month t as
$$BMI_{it} = \frac{\sum_{j=1}^{J} \lambda_{jt}\omega_{ijt}}{MV_{it}}$$
where λ_{jt} is AUM of mutual funds and ETFs benchmarked to index j in month t, ω_{ijt} is the weight of stock i in index j in month t and MV_{it} is the market capitalization of stock i in month t
- Furthermore, stock weight in any value-weighted index j is
$$\omega_{ijt} = \frac{MV_{it}1_{ijt}}{\sum_{k=1}^{N} MV_{kt}1_{kjt}} = \frac{MV_{it}1_{ijt}}{IndexMV_{jt}}$$
- Hence, an additional advantage of this scaling of our theoretical measure
$$BMI_{it} = \sum_{j=1}^{J} \frac{\lambda_{it}1_{ijt}}{\sum_{k=1}^{N} MV_{kt}1_{kjt}} = \frac{\lambda_{it}1_{ijt}}{IndexMV_{jt}}$$

BMI and index effect

- we show stocks with larger changes in BMI have higher returns in June

  $$Ret_{it}^{June} = \alpha \Delta BMI_{it} + \xi logMV_{it} + \phi' Controls_{it} + \tau Float_{it} + \delta' \bar{X}_{it} + \mu_t + \epsilon_{it}$$

  Ret_{it}^{June} is the return of stock i in June of year t, winsorized at 1%.
  BMI_{it} is the difference between the BMI of stock i in May of year t and its BMI in June of the same year
- Consistent with our model's Prediction 2, price pressure is the highest for stocks experiencing the largest increase in BMI, all else equal

BMI change and return in June

- Price pressure is the highest for stocks having the largest increase in BMI
- The size of index effect is proportional to the stock’ s BMI change

	Return in June					$\Delta BMI,\%$
	(1)	(2)	(3)	(4)	(5)	(6)
ΔBMI	0.26**	0.27**	0.28**			
	(2.55)	(2.66)	(2.74)			
1(ΔBMI quartile 1)				−0.010***	−0.010***	−3.02
				(−3.41)	(−3.39)	
1(ΔBMI quartile 2)				−0.004**	−0.005***	−0.39
				(−2.16)	(−2.67)	
1(ΔBMI quartile 3)				0.006***	0.005***	0.49
				(3.62)	(3.50)	
1(ΔBMI quartile 4)				0.008**	0.009***	3.24
				(2.26)	(2.64)	
Fixed effect	Year	Year	Stock & year	N	N	
$\bar{X}$ controls	N	Y	Y	N	Y	
Observations	14,549	14,549	14,549	14,549	14,549	
Adj. R^2, %	17.1	17.5	19.2	1.3	1.8	

Implications for the price elasticity of demand

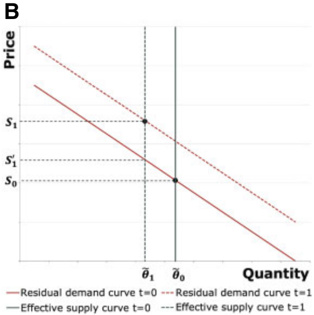
- Most of the existing literature implicitly assumes that active investor demand is fully elastic. Using the change in passive benchmarked assets to measure the price elasticity of demand as $(\tilde{\theta}_1 - \tilde{\theta}_0)/(S_1 - S_0) \times S_0/\tilde{\theta}_0$
- The demand of passive managers benchmarked to index j for any particular stock is fully inelastic. Then, the effective supply of shares available to benchmarked active managers and direct investors is $\tilde{\theta} = \bar{\theta} - \sum_j \lambda_j^P \omega_j$
- Aggregate demand function of benchmarked active managers and direct investors

$$\Theta^{Active+Direct} = \frac{1}{\gamma} A^{-1} \Sigma^{-1} (\bar{D} - S) + \frac{b}{a+b} \sum_j \lambda_j^A \omega_j$$

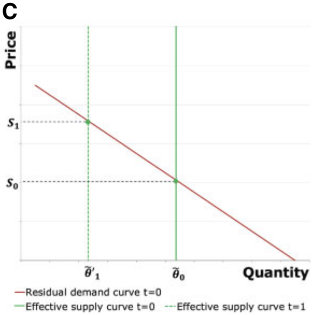
Demand curves and index effect

- One could separate elastic and inelastic components of active managers' demand and subtract the latter from the effective supply

$$\tilde{\theta}' = \bar{\theta} - \left[\sum_j \lambda_j^P \omega_j + \frac{b}{a+b} \sum_j \lambda_j^A \omega_j\right]$$



Inelastic component in active demand



Using BMI to shift effective supply

BMI as an IV

- We estimate price impact of benchmarked investors' trades by examining directly how changes in their ownership of a stock affect the stock's price.

$$Ret_{it}^{June} = \alpha \Delta IO_{it} + \epsilon_{it}$$

  The change in IO is an equilibrium object and hence is endogenous

- The skewness increases with the return measurement horizon, and the percentage of funds that outperform the SPY declines

$$\Delta IO_{it}^{June} = \alpha \Delta BMI_{it} + \xi_1 logMV_{it} + \phi_1^{'} Control_{it} + \tau_1 Float_{it} + \delta_1^{'} \bar{X}_{it} + \mu_{1t} + \epsilon_{i}$$

$$Ret_{it}^{June} = \alpha \Delta \hat{IO}_{it} + \xi logMV_{it} + \phi^{'} Control_{it} + \tau Float_{it} + \delta^{'} \bar{X}_{it} + \mu_{2t} + \epsilon_{it}$$

BMI as an IV

- To further alleviate concerns about the possible endogeneity of BMI, we conduct overidentifying restrictions tests

Change in BMI as an instrument for change in institutional ownership

	Return in June, %				Return in April-June, %
	OLS	2SLS			
	(1)	(2)	(3)	(4)	(5)
A. Second-stage estimates					
ΔIO, %	0.09***	2.27	1.46**	1.47**	2.26**
	(3.75)	(1.44)	(2.55)	(2.57)	(2.80)
B. First-stage estimates					
ΔBMI, %			0.20***	0.19***	0.19***
			(5.90)	(6.34)	(6.43)
D^{R2000}		0.85***	−0.15		
		(2.78)	(−0.54)		
F-stat (excl. instruments)		7.73	20.07	40.20	41.41
Hansen J test, p-value			.19		
Controls	Y	Y	Y	Y	N
Observations	12,862	12,862	12,862	12,862	12,862

BMI adjusted for fund activeness

- Our model, however, implies that passive and active funds should contribute to BMI differently

$$BMI^w = BMI^{Passive} + \frac{b}{a+b} BMI^{Active}$$

	α **estimate**		t-statistic	Adj. R^2, %	**Implied elasticity**	
	ΔBMI^w	$0.5 \times \Delta BMI^w$			ΔBMI^w	$0.5 \times \Delta BMI^w$
$\frac{b}{a+b}$	(1)	(2)	(3)	(4)	(5)	(6)
1.0	0.27**	0.54**	(2.66)	17.53	−3.69	−1.85
0.8	0.32**	0.65**	(2.64)	17.51	−3.09	−1.54
0.6	0.40**	0.81**	(2.62)	17.49	−2.48	−1.23
0.4	0.53**	1.06**	(2.58)	17.44	−1.89	−0.94
0.2	0.74**	1.47**	(2.50)	17.34	−1.36	−0.68
0.0	0.72**	1.45**	(2.29)	17.04	−1.38	−0.69

Net purchases of index additions and deletions

- To see which funds rebalance additions and deletions, we estimate the following equations

$$\Delta Own_{ijt} = \alpha_{1j} D_{it}^{R1000-R2000} + \alpha_{2j} D_{it}^{R2000-R1000} + \xi_1 logMV_{it} + \tau_1 Float_{it} + \delta_1^{'} \bar{X}_{it}$$
$$Own_{ijt} = \alpha_j D_{it}^{R2000} + \phi_j Own_{ijt-1} + \xi_1 logMV_{it} + \tau_1 Float_{it} + \delta_1^{'} \bar{X}_{it} + \mu_{1t} + \epsilon_{it}$$

In the above equations, $D_{it}^{R1000-R2000}$ equals one when stock i is moved from the Russell 1000 to Russell 2000 on the reconstitution day in June of year t.

Net purchases of index additions and deletions

- Russell benchmarks serve as both active and passive funds' preferred habitats.

Change in the aggregate ownership of funds with the same benchmark

	Stocks ranked < 1000				Stocks ranked > 1000	
Benchmark	Russell 1000		Russell Midcap		Russell 2000	
Fund type	Active	Passive	Active	Passive	Active	Passive
A. Change in ownership share						
$D^{R2000\to R1000}$	0.122***	0.105***	0.394***	0.113***	−0.546***	−0.840***
	(2.97)	(3.60)	(4.41)	(3.16)	(−4.95)	(−4.18)
$D^{R1000\to R2000}$	−0.101**	−0.100***	−0.264***	−0.103***	0.123	0.771***
	(−2.22)	(−3.29)	(−3.69)	(−2.90)	(1.47)	(3.61)
B. Change in holding status						
$D^{R2000\to R1000}$	0.356***	0.459***	0.288***	0.437***	−0.319***	−0.921***
	(7.05)	(7.93)	(5.02)	(5.20)	(−7.13)	(−11.47)
$D^{R1000\to R2000}$	−0.298***	−0.828***	−0.237***	−0.694***	0.113**	0.829***
	(−4.68)	(−5.84)	(−5.62)	(−4.27)	(2.39)	(6.87)
C. Ownership share						
D^{R2000}	−0.032	−0.067**	−0.136**	−0.065*	0.267**	0.653***
	(−1.05)	(−2.42)	(−2.24)	(−1.90)	(2.50)	(3.01)
D. Holding status						
D^{R2000}	−0.177***	−0.351***	−0.057***	−0.651***	0.002	0.613***
	(−8.91)	(−6.72)	(−4.92)	(−4.72)	(0.45)	(13.06)

BMI and long-run returns

- In this section, we show that a higher benchmarking intensity leads to lower returns in the long run.
- As earlier, we employ a stock-level specification to estimate α:

$$Y_{it+h} = \alpha \Delta BMI_{it} + \xi_1 logMV_{it} + \phi_1^{'} Control_{it} + \tau_1 Float_{it} + \delta_1^{'} \bar{X}_{it} + \mu_t + \mu_i + \epsilon_{it}$$

Specifically, we consider the 12-, 24-, 36-, 48-, and 60-month excess returns, which are not risk-adjusted

BMI and long-run returns

- As the coefficient on BMI is significantly negative, stocks with an increase in benchmarking intensities have lower returns in the future.
- Inelastic demand from the benchmarked institutions lowers the stock risk premium.

	Excess returns, average over horizon				
Horizon (months)	12	24	36	48	60
A: All baseline controls					
ΔBMI	−0.045**	−0.037***	−0.020***	−0.016**	−0.009**
	(−2.81)	(−3.63)	(−3.87)	(−2.75)	(−2.16)
Observations	13,813	12,318	10,928	9,731	8,633
B: Baseline controls without stock fixed effects					
ΔBMI	−0.039*	−0.034**	−0.016**	−0.015**	−0.010
	(−1.86)	(−2.50)	(−2.31)	(−2.18)	(−1.58)
Observations	14,351	12,800	11,388	10,091	8,988
C: LogMV, Float and BandingControls only					
ΔBMI	−0.039**	−0.034***	−0.020***	−0.016***	−0.011***
	(−2.69)	(−3.63)	(−4.52)	(−3.23)	(−3.15)
Observations	14,700	13,124	11,605	10,279	9,082

Robustness

- Arbitrage limitation: Suppose that there is not enough arbitrage capital in June to prevent the index effect.
- Cash flow channel: Our model assumes that firms' cash flows are fixed and a change in BMI affects firm value through the discount rate.
- Liquidity premium: Stocks added to the Russell 2000 benefit from improved liquidity.
- Financial distress: Firms that have transitioned to the Russell 2000 are lower because these firms have fallen on hard times and their cash flows are deteriorating

Conclusions

- In this paper, we propose a measure that captures inelastic demand for a stock –benchmarking intensity, and document the effects of a change in BMI on stock prices, expected returns, ownership, and demand elasticities.
  - According to our preferred habitat view, active funds are not genuinely active investors.
  - We find evidence of the inelastic demand of active managers in the ownership data
  - Price pressure is the highest for stocks having the largest increase in BMI