Twitter Thread by Darren ■

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@ReformedTrader

1/ What Happens with More Funds than Stocks? (Madhavan, Sobczyk, Ang)

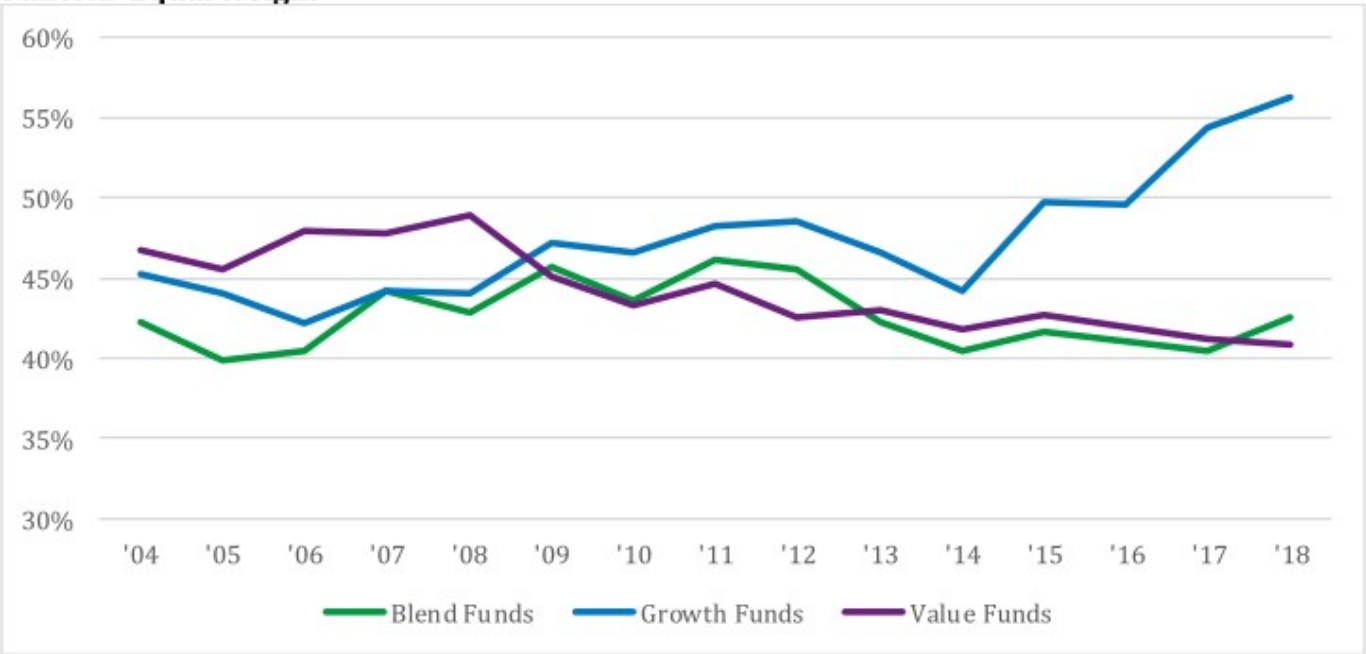
"Funds differ meaningfully in terms of individual stock holdings, and we examine the factor exposures of the typical fund and the cross section of holdings of different funds."

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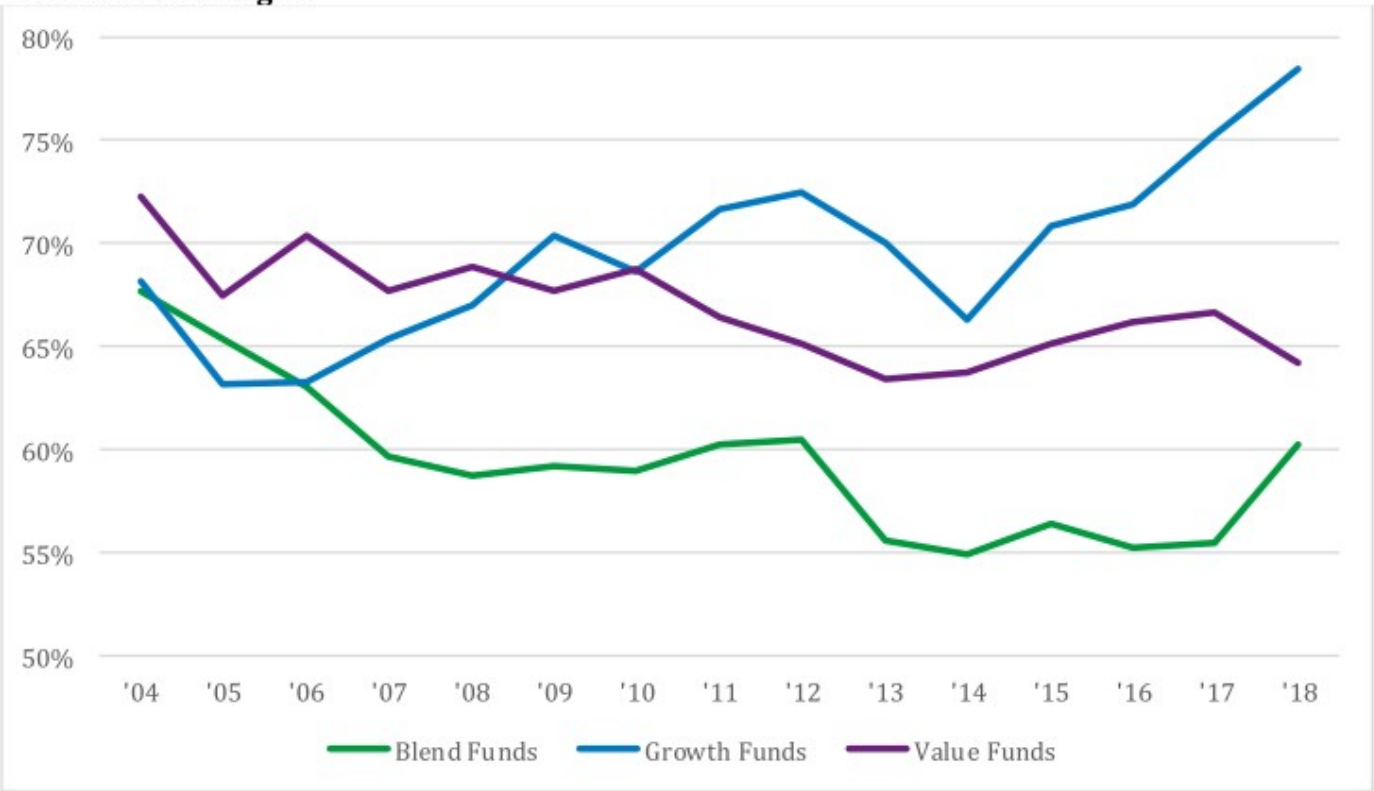
Exhibit 6
Crowding in Growth, Blend and Value Funds

The charts show the fraction of variance explained by the top 10 singular values by Morningstar fund category for the period 2004-2019. Panel A shows equal weight and Panel B is AUM weighted.

Panel A: Equal Weight



Panel B: AUM Weight



2/ * Data on fund holdings are from Morningstar

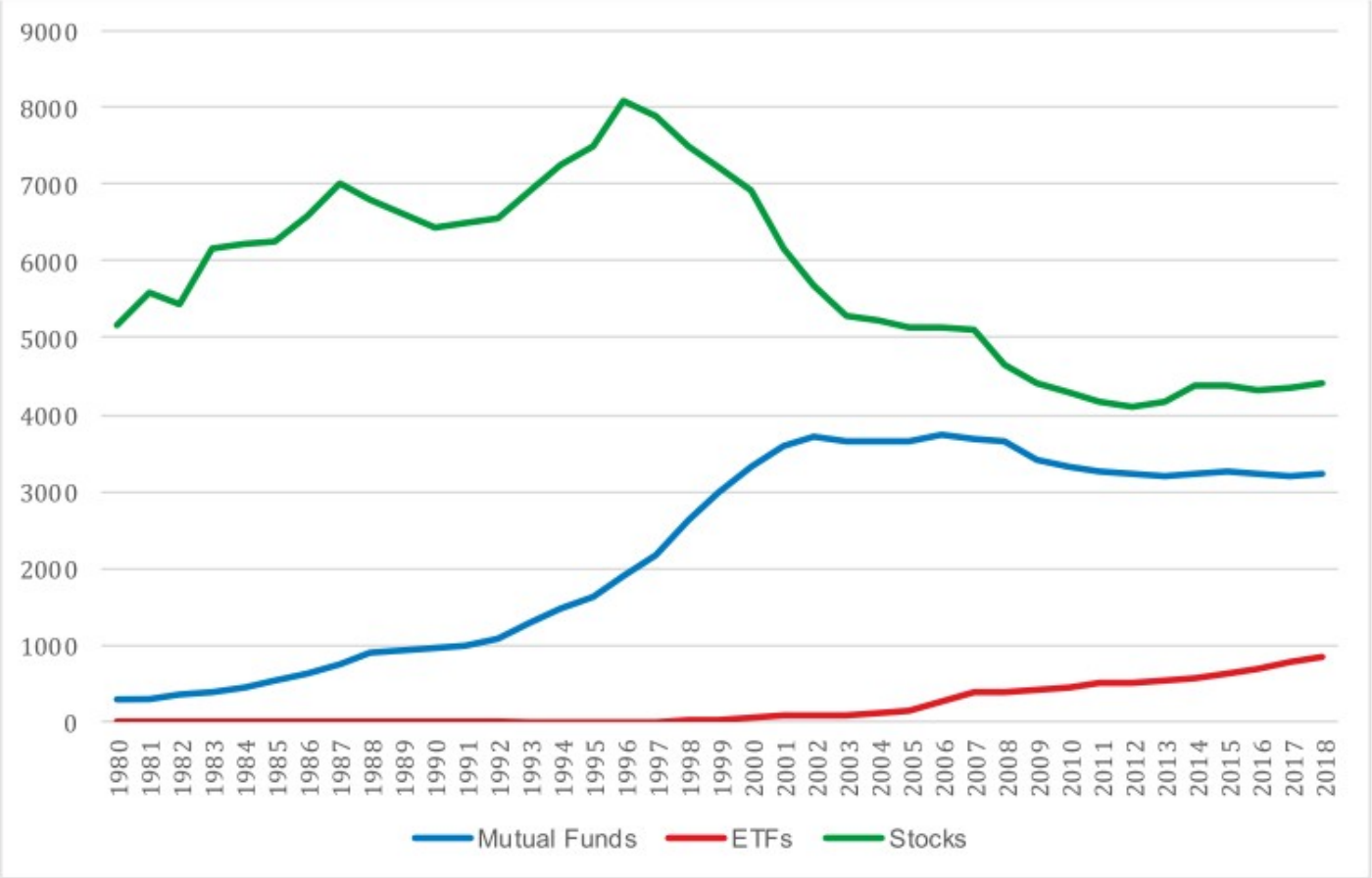
* Sample: Jan. 1, 2007 to Dec. 31, 2018

* Only funds with at least 80% of holdings from the Russell 3000 universe are considered

* Mean AUM-weighted expense ratio for mutual funds (ETFs) is 70 bps (14.2 bps) as of Q4 2018

Exhibit 1
Number of US-Listed, US-Focused Equity Mutual Funds, Equity ETFs, and Stocks: 1980-2018

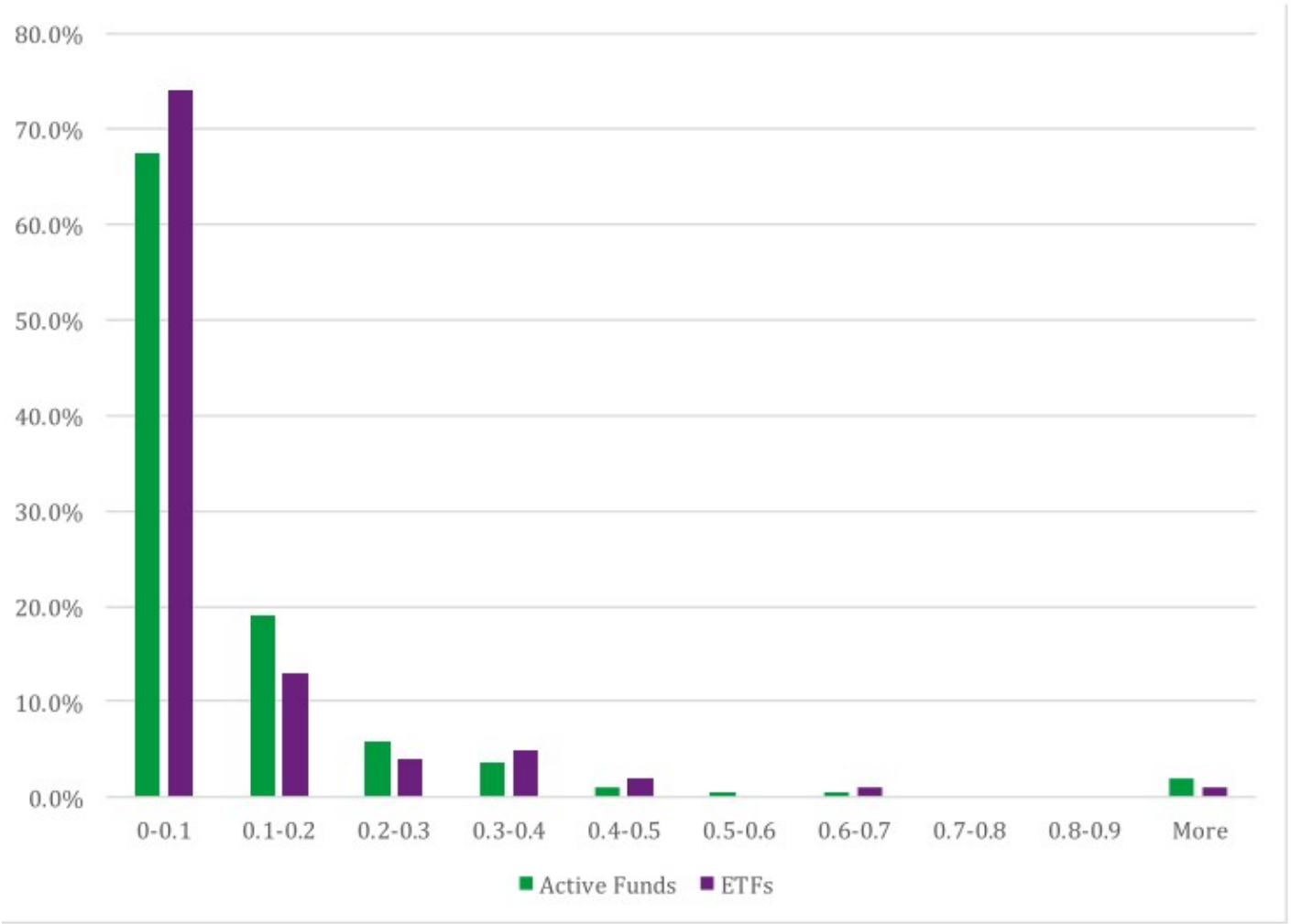
Data on the number of US stocks is drawn from the World Bank (2019); data on funds is sourced from the Investment Company Institute Fact Book (2019). The numbers for ETFs and the mutual fund include only pure US-focused equity funds that are domiciled in the US, and excludes bond funds, money market funds, commodity funds, international funds, and hybrid funds. Mutual funds or ETFs that invest in other funds exclusively and closed-end funds/unit trusts are excluded.



3/ "The holdings of ETFs and active mutual funds across U.S. stocks can be efficiently summarized by approximately 10 canonical funds.

"There is more commonality explained by the first few canonical funds for active mutual funds than for ETFs."

Exhibit 3
Histogram of Largest 100 Singular Values for
Active Equity Mutual Funds and ETFs as of 12/31/2018



4/ "Commonality among equity mutual funds has remained approximately constant, but there has been increased dispersion in ETF offerings.

"We see no apparent rise in concentration or crowding for mutual funds over the period from January 2007 to December 2018."

Exhibit 4
Singular Variance Decomposition for Active Mutual Funds

The exhibit shows the fraction of variance in holding of US-listed, US-focused active equity mutual funds explained by the first 10 singular values, by year, based on quarterly holdings data from January 1, 2007 to December 31, 2018. Panel A shows equal weighted results while Panel B is AUM weighted.

Panel A: Equal Weight

	Fraction of Variance Explained by Each Singular Value (SV)										
Year	SV1	SV2	SV3	SV4	SV5	SV6	SV7	SV8	SV9	SV10	First 10 SVs
2007	0.10	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.31
2008	0.11	0.05	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.30
2009	0.13	0.05	0.05	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.31
2010	0.12	0.05	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.30
2011	0.13	0.06	0.05	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.32
2012	0.13	0.06	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.31
2013	0.11	0.05	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.29
2014	0.11	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.26
2015	0.12	0.05	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.28
2016	0.13	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.29
2017	0.14	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.29
2018	0.15	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.31

Panel B: Asset Weighted

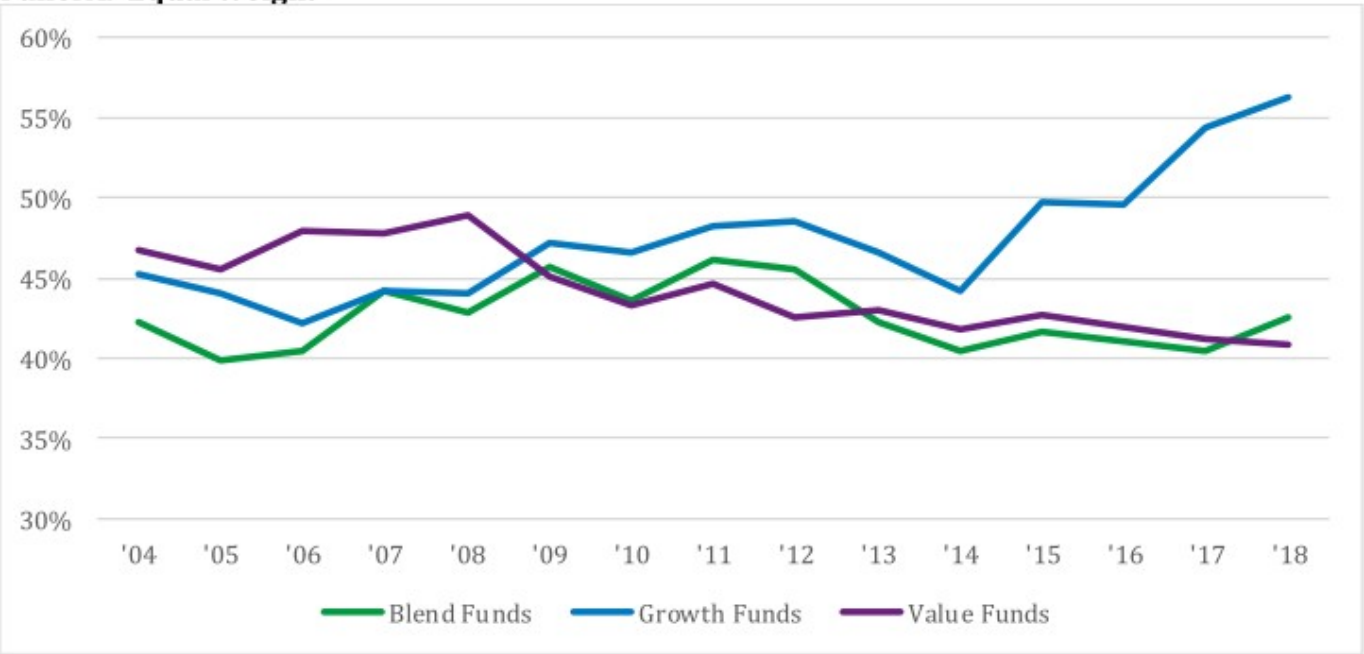
	Fraction of Variance Explained by Each Singular Value (SV)										
Year	SV1	SV2	SV3	SV4	SV5	SV6	SV7	SV8	SV9	SV10	First 10 SVs
2007	0.21	0.06	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.44
2008	0.21	0.07	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.46
2009	0.21	0.08	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.48
2010	0.19	0.08	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.46
2011	0.22	0.10	0.04	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.49
2012	0.21	0.09	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.01	0.50
2013	0.21	0.09	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.46
2014	0.18	0.08	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.45
2015	0.21	0.09	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.48
2016	0.23	0.09	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.49
2017	0.26	0.08	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.50
2018	0.30	0.08	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.54

5/ "We examine commonality in active mutual funds in Morningstar style box categories. While Value and Blend commonality has remained roughly constant over the period 2007-2018, Growth funds have exhibited a marked increase in crowded positions."

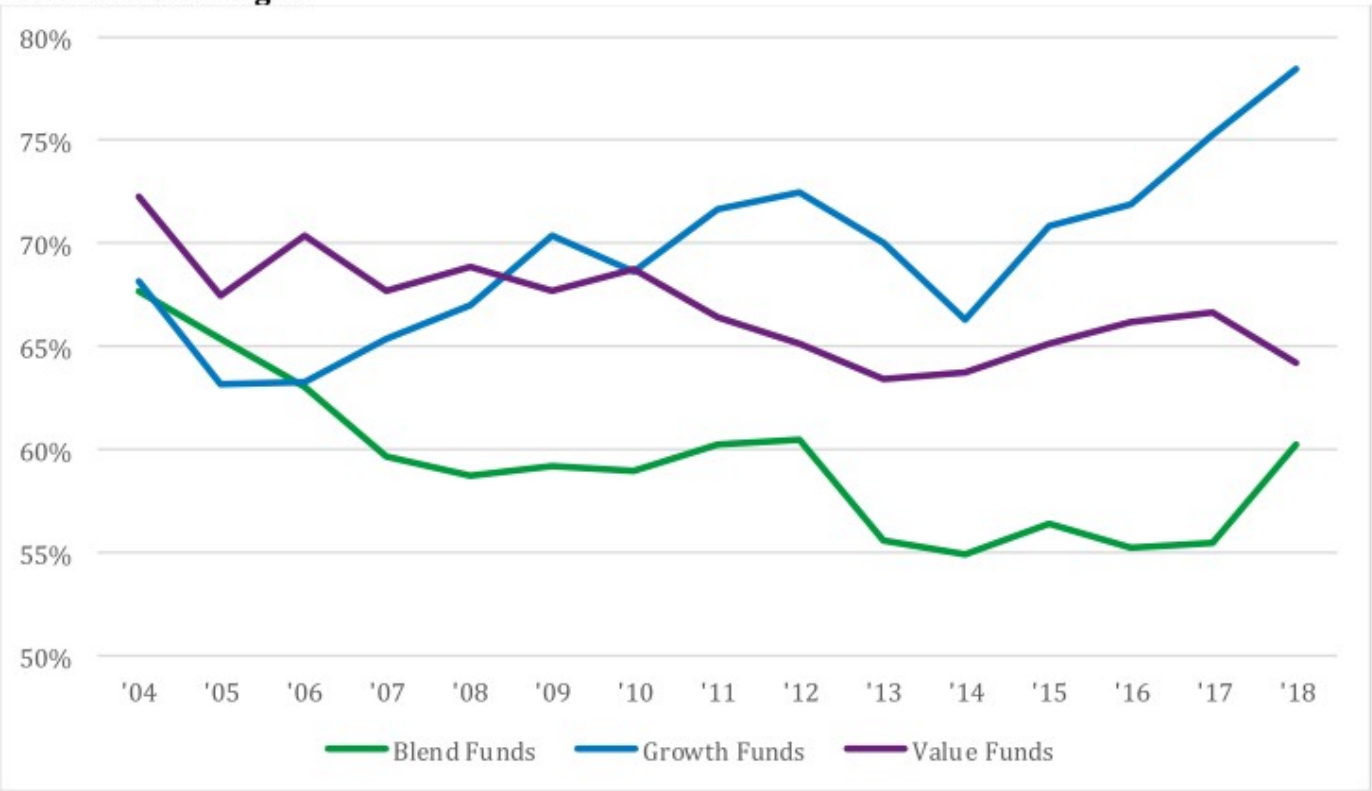
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Panel A: Equal Weight



Panel B: AUM Weight



6/ "Crowding is greater in factors than in individual stocks for both active mutual funds and ETFs. Factor crowding has remained relatively constant over the period examined."

Exhibit 7
SVD Decomposition for ETFs in Factor Space

Panel A: ETF Factor SVD Decomposition (BFRE USAM Model)

Year	Number of ETFs	ETF AUM ($Tn)	Rank of X	Fraction of Variance (in %) explained by each Principal Component (PC)										
				PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	First 10 PCs
2017	663	1.760	60	52.6	20.0	9.2	4.9	3.6	2.0	1.5	1.2	1.0	0.8	96.8
2016	589	1.336	60	54.6	15.3	8.8	7.4	2.7	2.2	1.9	1.4	1.2	0.9	96.4
2015	510	1.098	60	52.6	20.9	11.7	3.3	2.3	1.6	1.4	1.1	0.8	0.7	96.3
2014	434	1.072	60	55.1	18.4	11.3	3.6	2.2	1.8	1.5	1.0	0.8	0.7	96.3
2013	405	0.800	60	55.9	18.7	9.8	3.3	2.7	2.5	1.2	1.0	0.8	0.5	96.4

Panel B: Dollar (AUM) Weighted ETF Factor SVD Decomposition (BFRE USAM Model)

Year	Number of ETFs	ETF AUM ($Tn)	Rank of X	Fraction of Variance (in %) explained by each Principal Component (PC)										
				PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	First 10 PCs
2017	663	1.760	60	72.4	14.9	5.0	2.1	1.7	1.0	0.7	0.5	0.4	0.3	98.9
2016	589	1.336	60	74.6	11.3	5.6	3.3	1.1	1.0	0.7	0.7	0.5	0.3	99.0
2015	510	1.098	60	72.3	14.7	6.6	1.7	1.0	0.8	0.6	0.5	0.4	0.3	98.9
2014	434	1.072	60	73.3	13.5	6.1	2.1	1.1	1.0	0.7	0.5	0.3	0.3	99.0
2013	405	0.800	60	72.5	14.3	5.3	2.2	1.7	1.4	0.5	0.4	0.3	0.2	98.9

7/ "The first archetypal “fund” that approximates the whole active fund universe is a market-cap index.

"The second most important is value-growth exposure.

"For ETFs, unlike active funds, the second degree of differentiation reflects both value-growth and sector exposures."

Exhibit 8
Characterizing Canonical Mutual Funds

We report regressions of the fund eigenvectors (right singular matrix) corresponding to the largest two singular values for 12/31/2018. There are1,666 active equity mutual funds and 2,946 stocks in the sample weight matrix. Note that the coefficient signs in each regression are arbitrary.

	First Eigenvector of Funds		Second Eigenvector of Funds	
	Estimate	**t-value**	**Estimate**	**t-value**
(Intercept)	-0.027	-2.78	-0.019	-1.36
Expense Ratio (Net)	0.003	3.71	0.002	1.99
log AUM	0.000	-1.78	0.000	2.47
No. of Holdings	0.000	-1.18	0.000	-1.88
Russell 1000 Growth	-0.015	-1.60	0.034	2.50
Russell 1000 Value	0.010	1.01	-0.030	-2.24
Russell 2000	0.026	2.65	0.014	1.03
Russell 2000 Growth	0.026	2.63	0.015	1.06
Russell 2000 Value	0.026	2.66	0.014	0.99
Russell MidCap	0.022	2.24	0.010	0.70
Russell MidCap Growth	0.021	2.20	0.016	1.17
Russell MidCap Value	0.023	2.37	0.006	0.43
S&P 500	0.003	0.29	0.000	0.01
Adjusted R-Squared	0.706		0.668	
F-Statistic	334.1		279.8	
Degrees of Freedom	1653		1653	

8/ "Overall, the first approximation of the stocks held by funds is that the stocks tend to be large growth stocks. In an additional second approximation, funds tend to hold stocks that are smaller with higher volatilities."

Exhibit 9
Factor Regressions of Canonical Stock Portfolios

We report regressions of the stock eigenvectors (left singular matrix) corresponding to the largest two singular values for 12/31/2018. There are 1,666 mutual funds and 2,946 stocks in the sample weight matrix. Note that the coefficient signs in each regression are arbitrary. Eigenvectors are scaled by 100 and are arbitrary in sign. Factors are z-scores based on the universe of all US stocks: *Size* increases with market capitalization, *Volatility* is the standard deviation of daily returns, Momentum is the 12-month return less the most recent month's return, *Value* is measured by earnings/price and price/book, *Earnings* is earnings yield based on the 3-year earnings, and *Dividend* is the 3-year dividend yield.

	First Eigenvector of Stocks (×100)		**Second Eigenvector of Stocks** (×100)	
	Estimate	**t-value**	**Estimate**	**t-value**
(Intercept)	1.660	33.088	1.092	19.861
Size	0.801	29.346	0.482	16.119
Volatility	0.050	1.447	-0.092	-2.422
Momentum	0.007	0.264	-0.105	-3.244
Value	-0.209	-6.469	0.005	0.129
Earning Yield	-0.038	-1.244	-0.047	-1.384
Dividend Yield	-0.048	-1.379	0.184	4.831
Adjusted R-Squared	0.251		0.123	
F-Statistic	165.6		68.7	
Degrees of Freedom	2938		2938	

9/ "Price discovery of underlying stocks in the S&P 500 can occur through ETFs or through trades of the stocks themselves—but this has only been the case since 2015. Before then, there were fewer listed ETFs that held S&P 500 stocks compared to number of stocks in index itself."

Exhibit 10
ETF Holding Matrix Rank

We report the rank of the matrix of ETFs (left hand side) and the assets under management (in trillions of dollars) for the S&P 500 universe.

