Class 2: Equity Quant Investing: Approach and Insight

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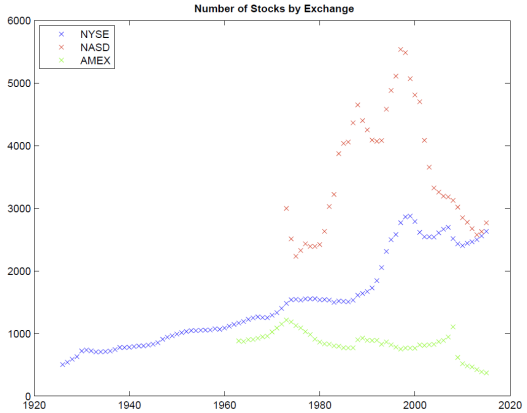
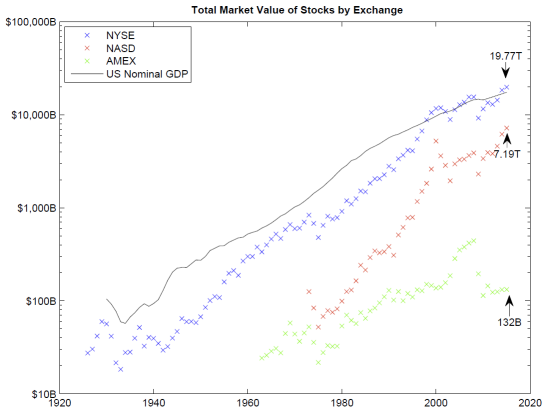
Outline

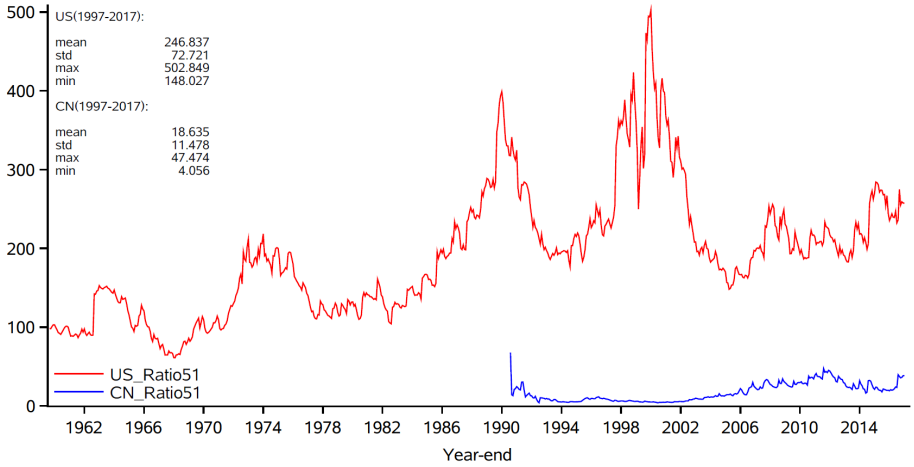
- Quant investing uses quantitative signals to form portfolios:
  - Size: small-cap stocks minus big-cap stocks.
  - Value: high book-to-market stocks minus low book-to-market.
  - Momentum: past winners minus past losers.
- The key insight of the equity quant strategy:
  - Quant signals: separate the cross-section into high- and low-alpha stocks.
  - Factor investing: diversify away the unwanted idiosyncratic risk.
  - Long/short: take out the unwanted systematic.
- The economic interpretations:
  - The CAPM.
  - Market efficiency.
  - Behavioral finance.

Quant Investing in the US

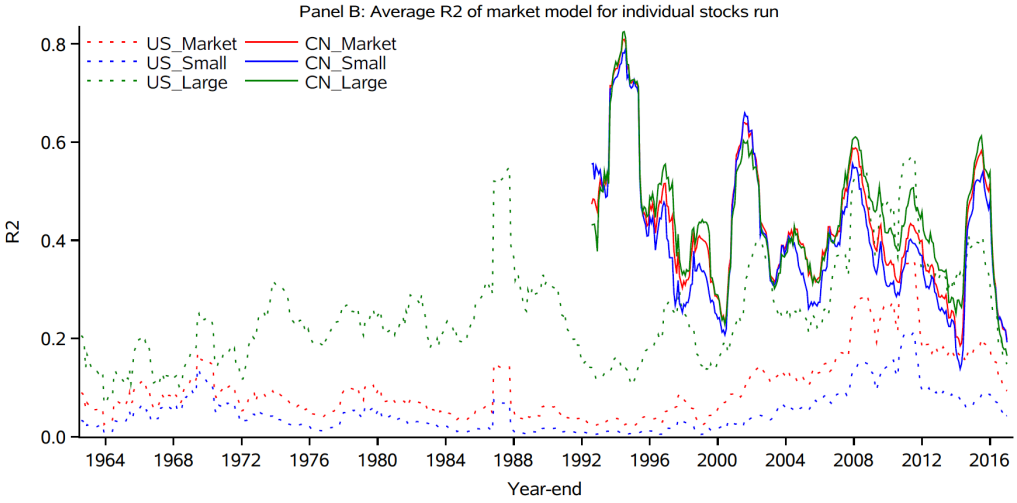




Cross-Sectional Equity in China: Size Distribution



Cross-Sectional Equity in China: R-Squared Distribution



Size Sorted Portfolios

Market Capitalization = Stock Price $\times$ Number of Shares Outstanding

	Size Decile	Size (m$)	# of Stocks
Small	1	116	1362
	2	472	470
	3	912	378
	4	1,509	304
Med	5	2,308	233
	6	3,378	207
	7	5,212	225
	8	8,890	182
	9	17,244	182
Big	10	83,791	173

As of July 2015. Source: Prof. Ken French's Website.

Book-to-Market Sorted Portfolios

$$\textbf{BtM} = \text{book-to-market ratio} = \frac{\text{book value of equity}}{\text{market value of equity}}$$

	BtM Decile	BtM	# of Stocks	Size (m$)
Growth	1	0.095	432	8,440
	2	0.196	338	9,895
	3	0.269	330	10,430
	4	0.348	276	10,210
Neutral	5	0.431	314	4,726
	6	0.547	319	7,310
	7	0.654	333	2,586
	8	0.817	327	5,728
	9	0.972	378	2,878
Value	10	1.339	371	2,359

As of 2015. Source: Prof. Ken French's Website.

Sorting is Done Dynamically

- Stock characteristics fluctuate over time:
  - Periodically update and re-sort.
  - The stock composition of the sorted portfolio changes over time.
  - The turnover rate is higher for signals that move more frequently.
- Sorting frequency depends on the variability of the signals:
  - Fama and French re-sort size at the end of each June.
  - The momentum strategy re-sorts stocks every month using past returns.

The Fama French 25 Portfolios

- Size labels: A (small), B, C, D, and E (big).
- BtM labels: 1 (low), 2, 3, 4, and 5 (high).

	1	2	3	4	5
A	A1				A5
B					
C					
D					
E	E1				E5

A1 $\rightarrow$ small growth A5 $\rightarrow$ small value
E1 $\rightarrow$ big growth E5 $\rightarrow$ big value

Number of Stocks in Each Portfolio

- Each month, we have a cross section of stocks.
- The size of the cross section varies from month to month.
- So the portfolio size also varies from month to month.

July 2015

	1	**2**	**3**	**4**	**5**
A	269	208	285	347	542
B	159	115	134	141	82
C	107	89	89	78	55
D	120	103	75	51	35
E	115	91	50	43	35

January 1962

	1	**2**	**3**	**4**	**5**
A	7	12	32	56	92
B	25	28	46	48	50
C	31	47	43	51	29
D	60	57	47	26	18
E	81	62	35	22	11

Average Market Cap and Book-to-Market

Average Size ($M) as of July 2015

	1	2	3	4	5
A	246	235	243	240	149
B	1,220	1,201	1,211	1,135	1,084
C	2,831	2,944	2,720	2,753	2,819
D	6,860	6,863	6,895	6,806	6,737
E	48,736	56,086	56,500	44,859	40,072

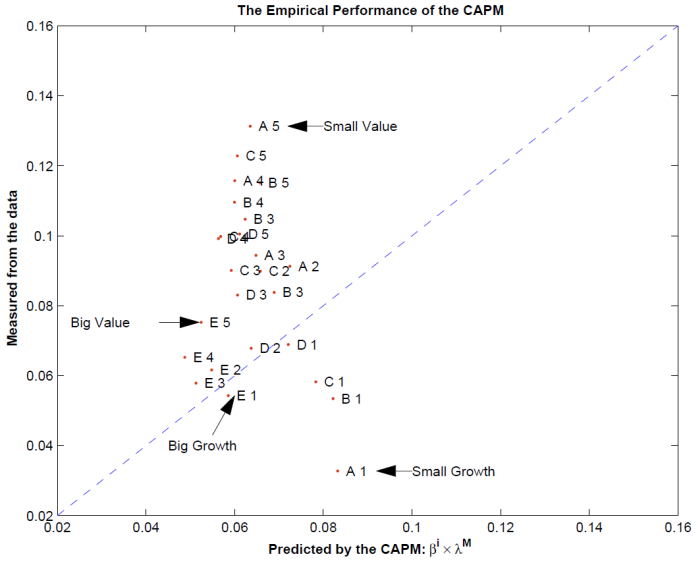
Book-to-Market as of July 2015

	1	2	3	4	5
A	0.15	0.31	0.49	0.72	1.36
B	0.14	0.32	0.49	0.71	1.18
C	0.13	0.30	0.48	0.73	1.33
D	0.15	0.31	0.49	0.72	1.11
E	0.14	0.30	0.51	0.78	1.10

Testing the CAPM using 25 Fama-French Portfolios

1. For each portfolio i, we perform regression to obtain an estimate for beta:
$$R_t^i - r_f = \alpha_i + \beta_i \left(R_t^M - r_f\right) + \epsilon_t^i$$
2. Estimate the market risk premium:
$$\lambda^M = \frac{1}{T}\sum_{t=1}^{T}\left(R_t^M - r_f\right)$$
3. The risk premium of portfolio i predicted by the CAPM:
$$\beta_i \, \lambda^M$$
4. Estimate the risk premium of portfolio i using realized returns:
$$\frac{1}{T}\sum_{t=1}^{T}\left(R_t^i - r_f\right)$$

The Empirical Performance of the CAPM



The CAPM Alphas of Fama-French 25 Portfolios

Annualized CAPM Alpha (in %) with t-stat's

	1	2	3	4	5
A	**-5.05** [-2.19]	1.88 [0.95]	2.95 [1.80]	**5.57** [3.46]	**6.78** [3.82]
B	-2.88 [-1.68]	1.49 [1.08]	**4.23** [3.27]	**4.96** [3.78]	**4.94** [3.06]
C	-2.01 [-1.41]	**2.40** [2.23]	**3.08** [2.83]	**4.29** [3.68]	**6.22** [4.31]
D	-0.32 [-0.30]	0.40 [0.45]	**2.24** [2.21]	**4.28** [3.96]	**3.94** [2.81]
E	-0.43 [-0.56]	0.68 [0.91]	0.66 [0.70]	1.65 [1.50]	2.28 [1.57]

Monthly data from January 1962 through July 2015.

Fama-French in 2020 and 2021

	September 2020	Last 3 Months	Last 12 Months
Fama/French 3 Research Factors			
Rm-Rf	-3.63	9.71	16.98
SMB	0.10	-2.38	-1.65
HML	-2.59	-7.13	-47.69
Fama/French 5 Research Factors (2x3)			
Rm-Rf	-3.63	9.71	16.98
SMB	0.10	-3.93	-11.78
HML	-2.59	-7.13	-47.69
RMW	-1.18	3.57	0.12
CMA	-1.81	-2.36	-11.98
Fama/French Research Portfolios			
Size and Book-to-Market Portfolios			
Small Value	-5.74	2.10	-17.76
Small Neutral	-4.34	3.08	-5.62
Small Growth	-0.66	8.37	28.83
Big Value	-4.31	4.45	-15.10
Big Neutral	-2.52	3.80	-8.17
Big Growth	-4.21	12.45	33.68

	March 2021	Last 3 Months	Last 12 Months
Fama/French 3 Research Factors			
Rm-Rf	3.09	5.92	64.64
SMB	-2.48	7.53	48.10
HML	7.40	18.99	10.69
Fama/French 5 Research Factors (2x3)			
Rm-Rf	3.09	5.92	64.64
SMB	-0.98	11.27	52.19
HML	7.40	18.99	10.69
RMW	6.43	3.74	12.24
CMA	3.44	6.67	2.06
Fama/French Research Portfolios			
Size and Book-to-Market Portfolios			
Small Value	7.07	28.90	125.78
Small Neutral	2.95	18.74	92.74
Small Growth	-2.80	8.76	129.72
Big Value	7.25	19.96	87.01
Big Neutral	5.08	11.74	55.23
Big Growth	2.33	2.10	61.69