



SESSION 2A: SAMPLES AND POPULATIONS IN FINANCE

Session 2
Bias and Noise

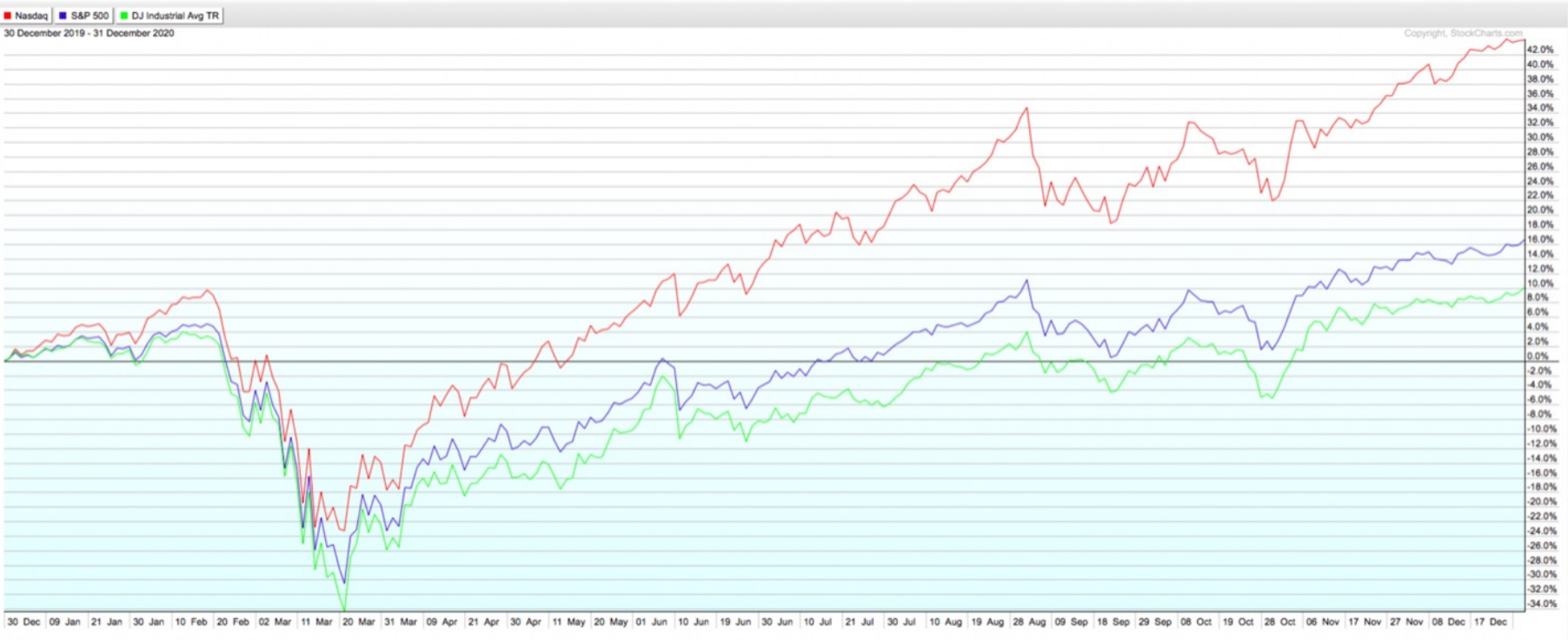
1. Market Indices

- ❑ In most stock markets, you have indices that track how well or badly stocks are doing, in the aggregate.
- ❑ While the way these indices are constructed and returns are computed vary, they all represent samples of stocks that are traded.
- ❑ The question of how well these indices do in measuring how well equities are doing collectively depends on
 - ❑ How many constituents there are in the index
 - ❑ The criteria that went into their selection
 - ❑ The weighting that is attached to the constituents
- ❑ Put simply, a market index is almost never a random sample, and that has to be kept in mind when reading or extrapolating from the index.

Equity Indices in the US

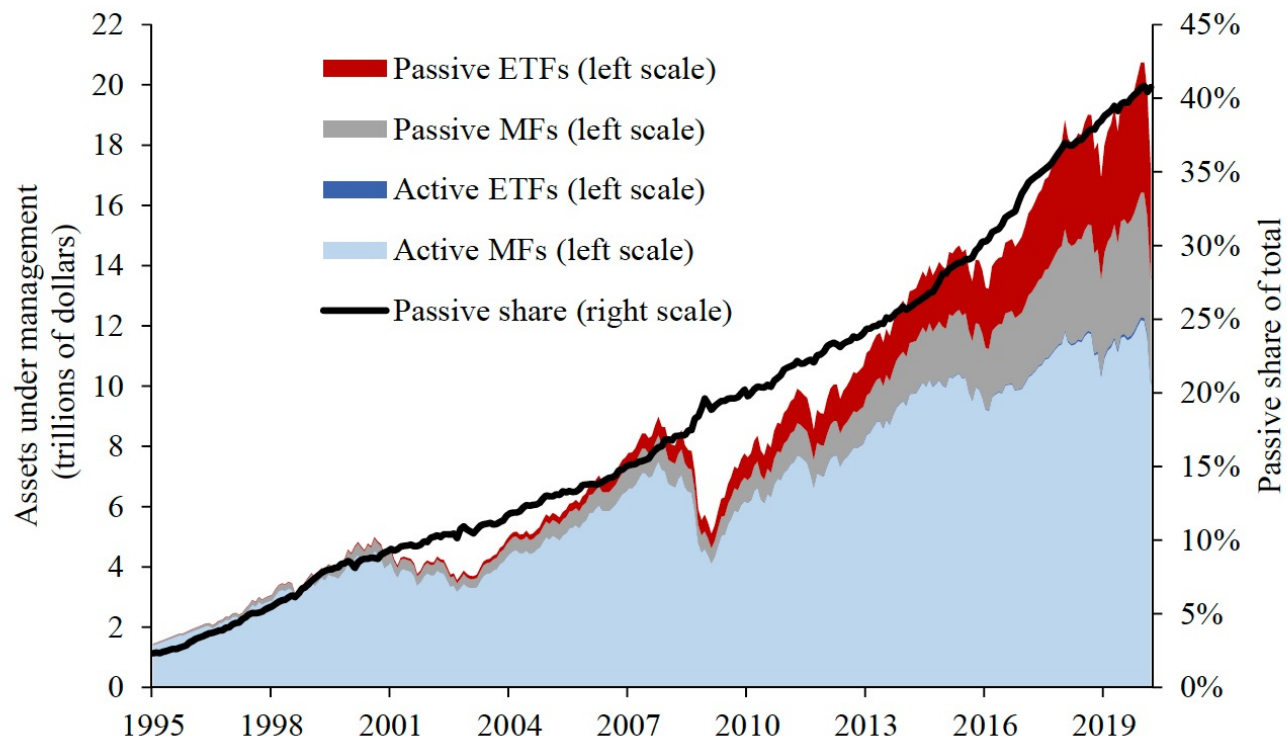
	DAILY					5 DAY		52 WEEK			
	HIGH	LOW	LAST	CHG	% CHG	CHG	% CHG	HIGH	LOW	% CHG	YTD % CHG
Dow Jones											
Industrial Average	35047.44	34790.62	34843.21	-273.19	-0.78	-87.72	-0.25	35192.11	26143.77	28.09	13.84
Transportation Average	14523.29	14266.14	14266.70	-319.31	-2.19	-93.10	-0.65	16170.05	10098.44	39.66	14.07
Utility Average	920.45	908.30	918.61	-2.08	-0.23	2.82	0.31	937.38	780.27	11.30	6.24
65 Composite	11498.47	11388.55	11407.20	-123.86	-1.07	-31.92	-0.28	11860.67	8824.17	28.37	12.85
Total Stock Market	45828.26	45651.94	45729.58	-158.45	-0.35	25.14	0.05	46043.06	32668.83	34.55	16.60
Barron's 400	1030.18	1024.57	1025.50	-4.68	-0.45	10.31	1.02	1030.18	687.57	41.87	20.34
S&P											
500 Index	4416.17	4400.23	4408.41	-14.74	-0.33	7.77	0.18	4429.97	3209.45	32.47	17.37
100 Index	2021.82	2014.06	2018.27	-6.06	-0.30	-5.32	-0.26	2038.79	1487.99	31.45	17.31
MidCap 400	2710.53	2684.20	2685.22	-23.66	-0.87	5.51	0.21	2780.08	1769.05	39.82	16.41
SmallCap 600	1339.28	1321.45	1322.68	-22.49	-1.67	-6.72	-0.51	1417.45	814.65	46.86	18.21
SuperComp 1500	1008.96	1005.20	1006.43	-4.21	-0.42	1.44	0.14	1010.64	732.07	33.22	17.33
Nasdaq Stock Market											
Composite	14812.37	14734.12	14791.93	30.63	0.21	29.34	0.20	14863.64	10519.49	34.49	14.77
Nasdaq 100	15117.38	15017.14	15096.34	34.91	0.23	78.24	0.52	15142.35	10677.85	35.69	17.13
Biotech	5366.94	5223.64	5314.63	65.09	1.24	126.36	2.44	5466.79	3962.38	23.11	11.67
Other U.S. Indexes											
NYSE Composite	16713.46	16610.20	16621.75	-91.71	-0.55	48.19	0.29	16761.24	12228.97	30.56	14.44
Russell 1000	2484.22	2471.72	2476.38	-7.55	-0.30	3.02	0.12	2490.27	1784.46	33.87	16.76
Russell 2000	2223.10	2195.37	2198.37	-25.21	-1.13	-26.59	-1.19	2360.17	1432.57	42.18	11.32
Russell 3000	2626.30	2612.86	2616.86	-9.37	-0.36	0.98	0.04	2635.01	1875.06	34.32	16.39
PHLX Gold/Silver	146.48	141.91	142.10	-1.37	-0.95	1.63	1.16	167.09	128.08	-11.82	-1.45
PHLX Oil Service	54.21	51.69	51.85	-3.38	-6.13	-4.55	-8.08	70.15	25.45	33.66	16.95
PHLX Semiconductor	3450.37	3405.71	3438.53	41.87	1.23	166.08	5.08	3450.37	2102.16	55.76	23.00

And they sometimes diverge .. As in 2020



2. Investable Indices: The Growth of Passive Investing

Figure 1: Total assets in active and passive MFs and ETFs and passive share of total



Source: Morningstar, Inc.

With variation across choices: Energy ETFs

Not Created Equal

A sampling of five energy-themed ETFs shows how different exchange-traded funds—and their returns—can be even when they have a very similar focus. Each fund has its own template for selecting companies within the sector, using criteria such as size, nationality and stock fundamentals. Each fund's performance and expense ratio differs widely, too.

Sources: Morningstar; largest holdings as of Oct. 15 from fund websites
The Wall Street Journal

Energy Select Sector SPDR (XLE)

Holds only large-cap U.S. companies in the S&P Energy Select Sector Index.

NO. OF STOCKS
45

LARGEST HOLDING % OF ASSETS
Exxon Mobil, 19%

AVERAGE MARKET CAP
\$60 billion

EXPENSE RATIO
0.18%

RECENT ASSETS
\$7.7 billion

AVG. DAILY TRADING VOLUME
15,000,000

YTD PERFORMANCE (THROUGH 10/15)
6.85%

Vanguard Energy (VDE)

Invests in large, mid and small-cap stocks.

NO. OF STOCKS
171

LARGEST HOLDING % OF ASSETS
Exxon Mobil, 23%

AVERAGE MARKET CAP
\$45 billion

EXPENSE RATIO
0.19%

RECENT ASSETS
\$2.2 billion

AVG. DAILY TRADING VOLUME
128,815

YTD PERFORMANCE (THROUGH 10/15)
5.26%

iShares S&P Global Energy (IXC)

Tracks the S&P 1200 Energy Sector Index. Only 50% of stocks are from the U.S.

NO. OF STOCKS
92

LARGEST HOLDING % OF ASSETS
Exxon Mobil, 16%

AVERAGE MARKET CAP
\$74.7 billion

EXPENSE RATIO
0.48%

RECENT ASSETS
\$1.1 billion

AVG. DAILY TRADING VOLUME
195,523

YTD PERFORMANCE (THROUGH 10/15)
4.37%

iShares Dow Jones U.S. Oil Equipment Index (IEZ)

Focuses on oil equipment and services companies.

NO. OF STOCKS
47

LARGEST HOLDING % OF ASSETS
Schlumberger Ltd., 19%

AVERAGE MARKET CAP
\$13.4 billion

EXPENSE RATIO
0.47%

RECENT ASSETS
\$354 million

AVG. DAILY TRADING VOLUME
185,663

YTD PERFORMANCE (THROUGH 10/15)
0.04%

First Trust Energy AlphaDEX Fund (FXN)

Ranks stocks based on fundamentals like price appreciation, sales growth and cash flow.

NO. OF STOCKS
52

LARGEST HOLDING % OF ASSETS
Chesapeake Energy, 3.9%

AVERAGE MARKET CAP
\$9.1 billion

EXPENSE RATIO
0.70%

RECENT ASSETS
\$139 million

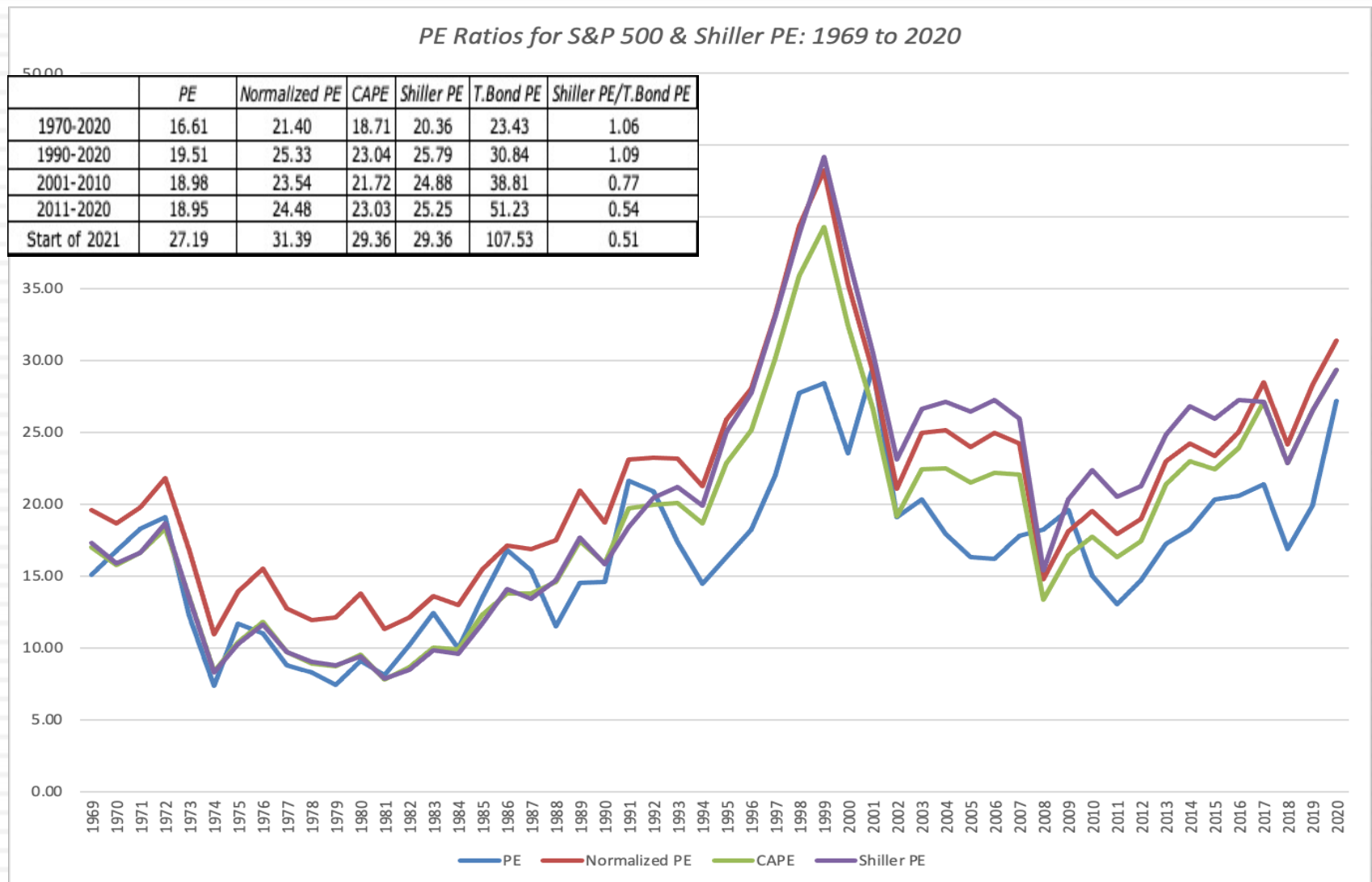
AVG. DAILY TRADING VOLUME
66,911

YTD PERFORMANCE (THROUGH 10/15)
2.39%

3. Time Sampling

- In time sampling, you look at a sub-period of time to make judgments about investments. You do so because:
 - ▣ Data is unavailable or unreliable for other periods
 - ▣ The market has changed structurally, and you want to look at a period that you believe is more representative of the current market
 - ▣ The hypothesis that you are testing is about a specific period of time.

PE Ratios: 1960 - 2020

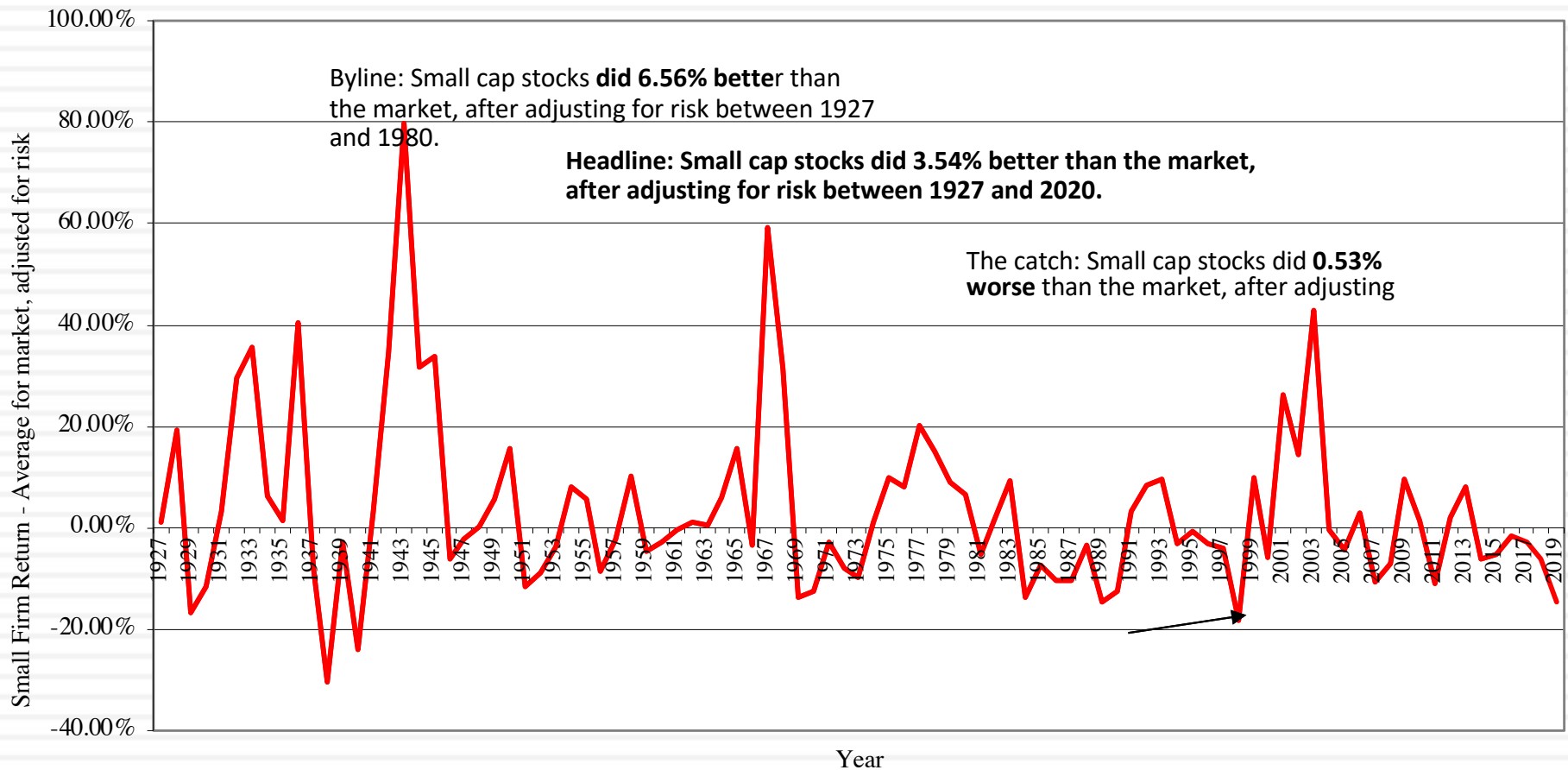


Bias in time sampling

- While there is clearly an advantage to looking at long periods of time to make judgments about investment performance, there is always the danger that the performance can change during the time period studied.
- In 1981, Rolf Banz found that small cap stocks earned significantly higher returns than expected, after adjusting for risk and market performance.
- That finding, formalized as the “small cap premium” has become part of finance lore and practice, with many analysts adding this premium on to get the expected return on small cap stocks.

The Small Cap Premium: Changing numbers over time

Small Firm Premium over time- 1927 -2020



4. Testing Investment Strategies

Sampling bias:

What was the universe of stocks? What was the basis for PE classes? What happened to negative earnings companies?

Value vs Growth: US Stocks, by decade

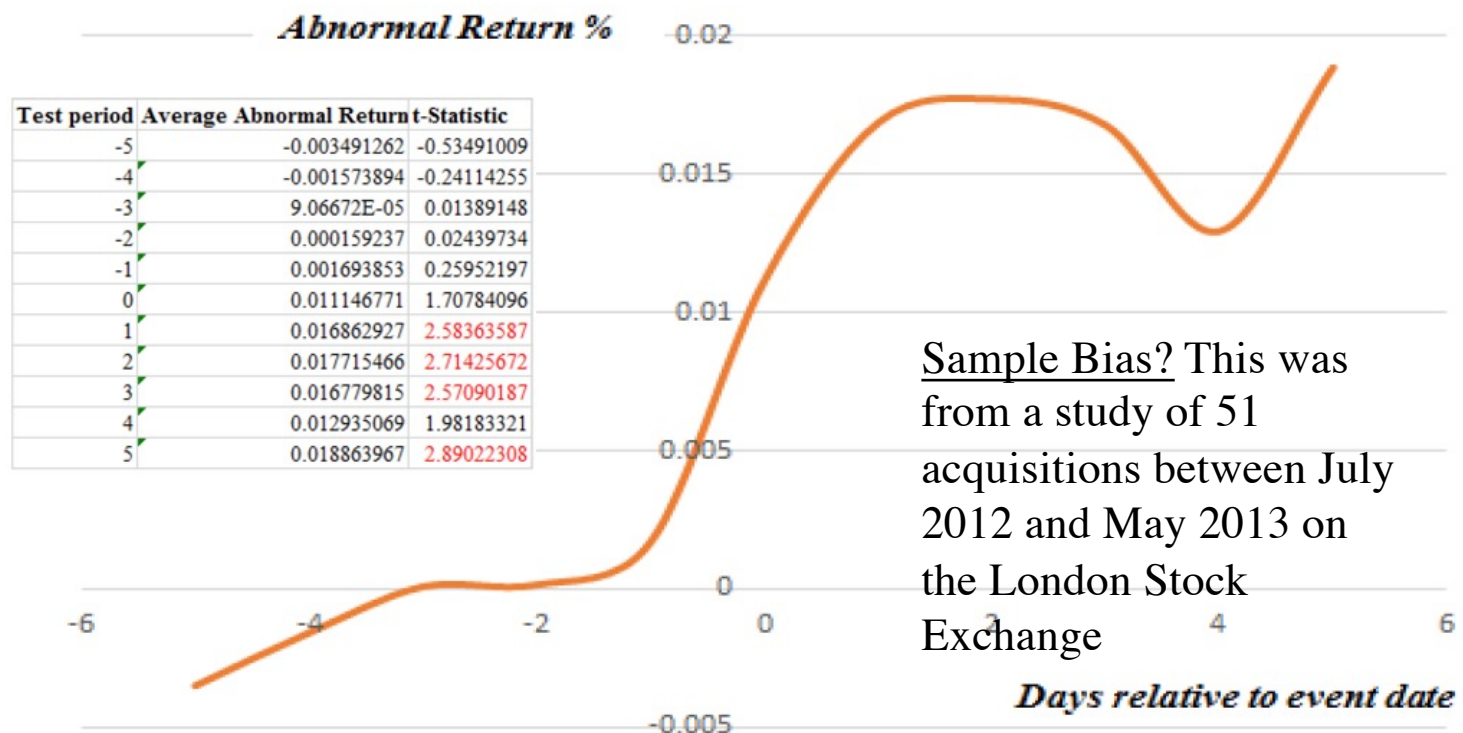
	<i>Lowest PBV</i>	<i>Highest PBV</i>	<i>Difference</i>	<i>Lowest PE</i>	<i>Highest PE</i>	<i>Difference</i>
1930-39	6.04%	4.27%	1.77%	NA	NA	NA
1940-49	22.96%	7.43%	15.53%	NA	NA	NA
1950-59	25.06%	20.92%	4.14%	34.33%	19.16%	15.17%
1960-69	13.23%	9.57%	3.66%	15.27%	9.79%	5.48%
1970-79	17.05%	3.89%	13.16%	14.83%	2.28%	12.54%
1980-89	24.48%	12.94%	11.54%	18.38%	14.46%	3.92%
1990-99	20.17%	21.88%	-1.71%	21.61%	22.03%	-0.41%
2000-09	8.59%	-0.49%	9.08%	13.84%	0.61%	13.23%
2010-19	11.27%	16.67%	-5.39%	11.35%	17.09%	-5.75%

Survivor bias: Did you start with all listed companies at the start of each period? What happened to the companies that were delisted?

Timing bias: Do return patterns change over time? Does picking a different time period change your result?

5. Event Studies

Graph showing the Average Abnormal Return around an Acquisition Announcement



Timing questions: In an event study, you need to identify the date of the event precisely. If you are wrong on that judgment, your study results will be skewed.