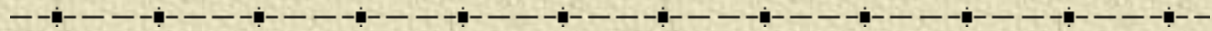




# Do Stocks Outperform Treasury Bills?

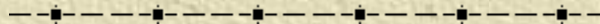


Hendrik (Hank) Bessembinder, Arizona State University

For presentation at

The Q Group

October 15, 2018



# Roadmap

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- ✦ (1) Show some evidence regarding the properties of returns to individual stocks.
  - ◆ Which may be surprising.
  - ◆ Purely descriptive; means, medians, and frequency distributions.
- ✦ (2) Discuss reasons that perhaps we should not be so surprised after all.
- ✦ (3) Discuss implications.



# Do Stocks Outperform Treasury Bills?

---

✦ The question might seem silly.

- ◆ We know the broad stock market handily beats treasuries in the long run.

✦ I want to focus attention on the individual stocks that comprise the overall stock market.

✦ The paper is really about positive skewness in stock returns.

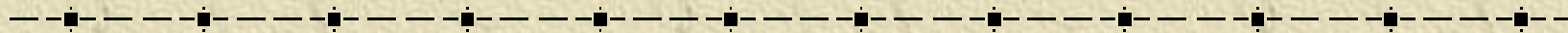
- ◆ Detectable in monthly returns.
- ◆ Stronger in longer horizon returns, due to compounding.

✦ But who reads a paper with “return skewness” in the title?

# The Key Findings:

- 
- ✦ When studying all NYSE/AMEX/Nasdaq common stocks from 1926 to 2016.
  - ✦ Most individual stocks underperform T-bills.
    - Both in the short run, and over their full lives.
  - ✦ Stock market wealth creation is quite concentrated.
    - 0.36% of listed stocks account for half of all dollar wealth creation.

# Monthly returns to all common stocks on CRSP, 7/26 to 12/16.



**Panel A: Individual Stocks, Monthly Horizon (N = 3,575,216)**

Variable	Mean	Median	SD	Skewness	% Positive
Buy-and-Hold Return, T-Bill	0.0037	0.0039	0.003	0.621	92.5%
Buy-and-Hold Return, Stock	0.0113	0.0000	0.181	6.955	48.4%
	% > T-bill	% > VW Mkt Return		% > EW Mkt Return	
Buy-and-Hold Return, Stock	47.8%	46.3%		45.9%	



# Frequency Distribution of Monthly CRSP Returns, 1926 to 2016 (to nearest 1%)

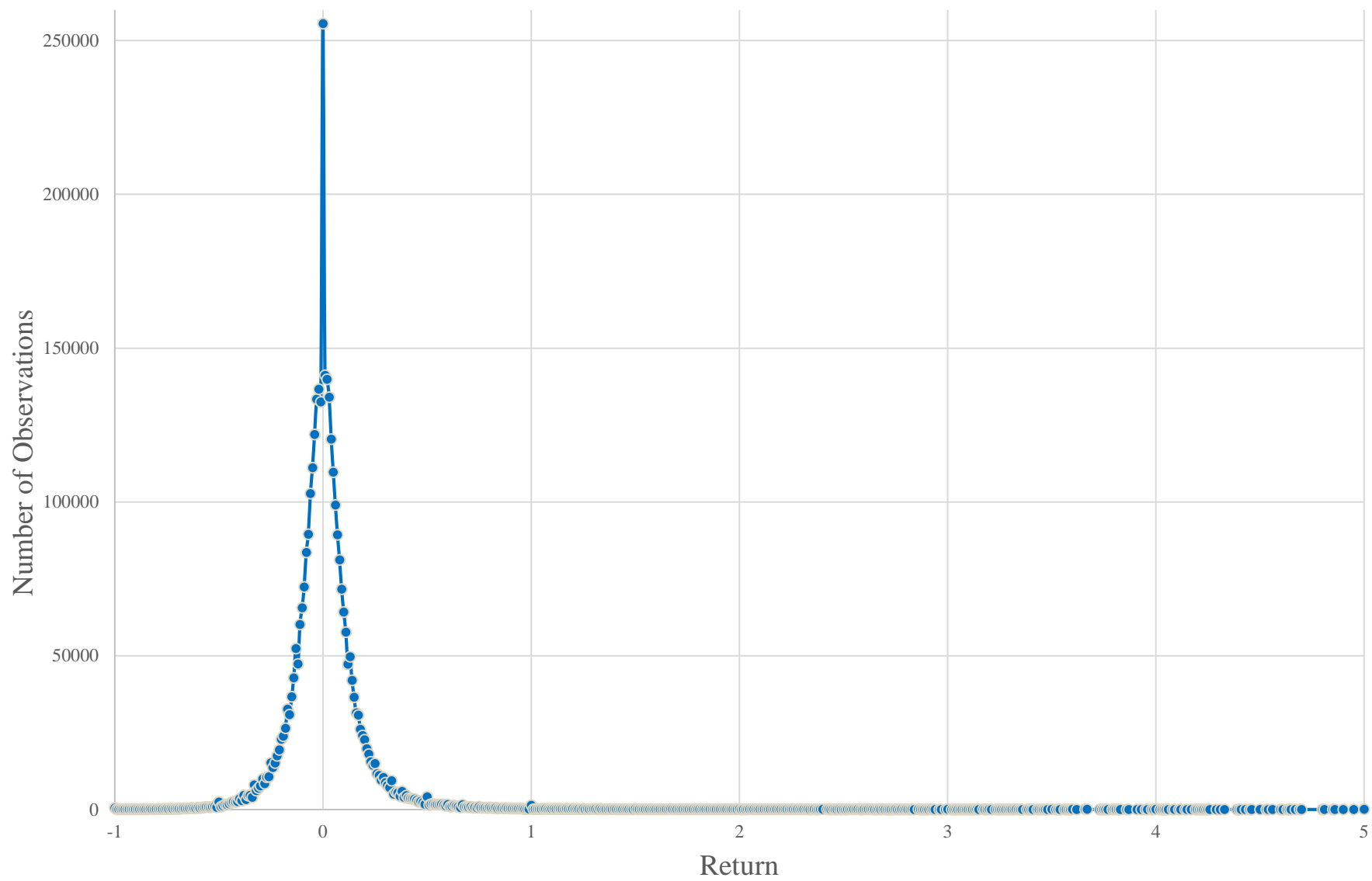


Figure 1A: Annual Buy-and-Hold Returns (Rounded to 2%)

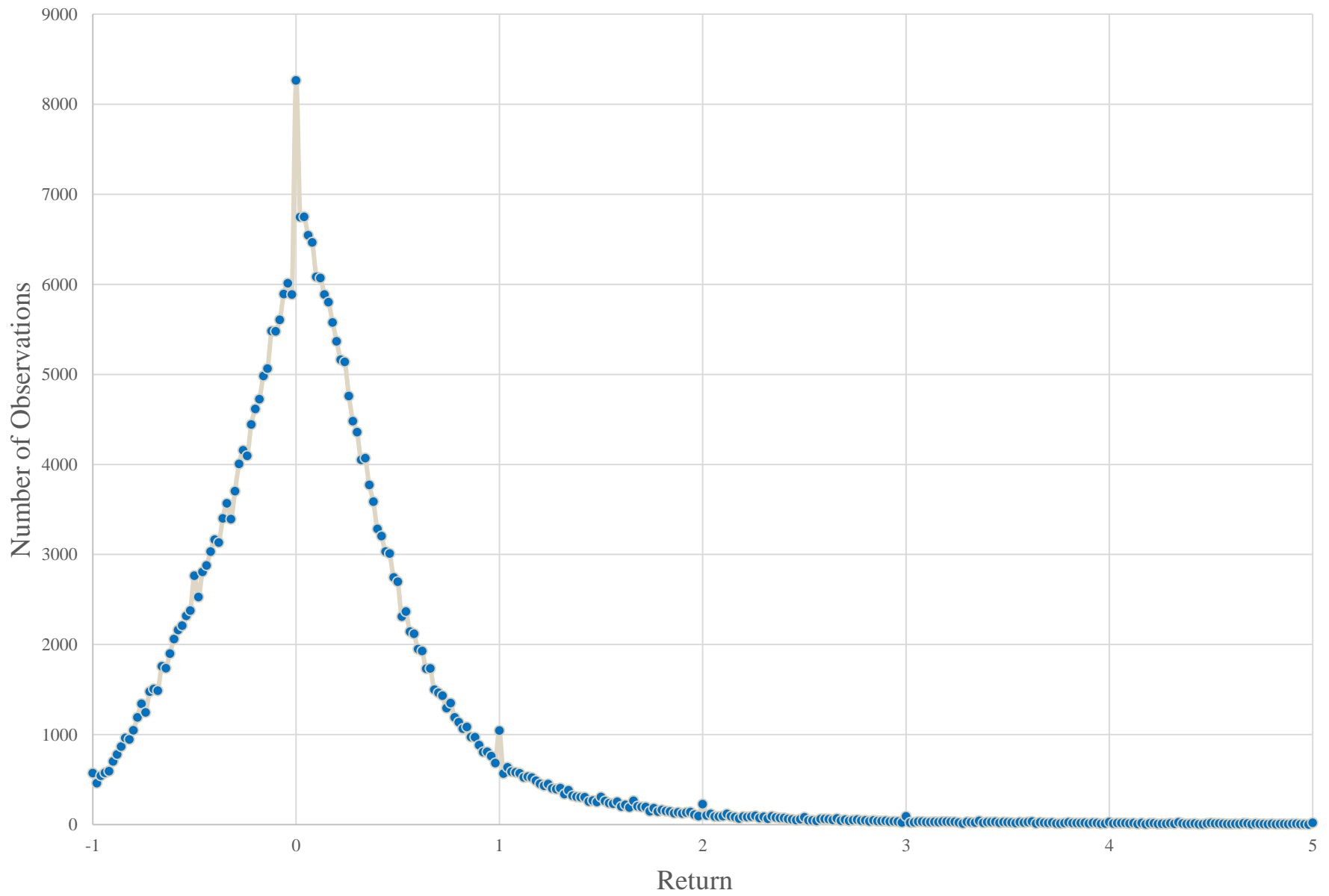
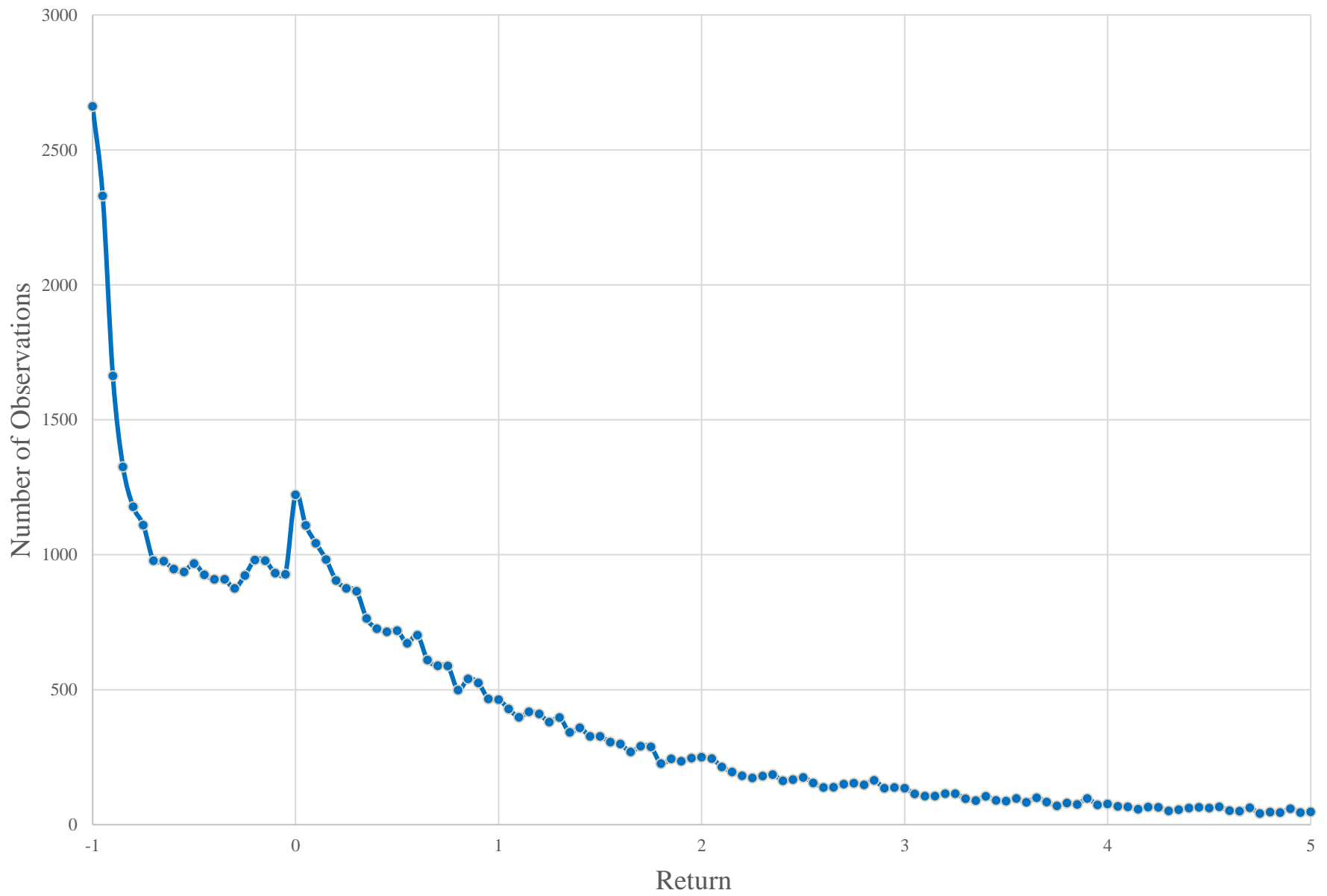


Figure 1B: Decade Buy-and-Hold Returns (rounded to 5%)





# Non-overlapping decade returns to CRSP common stocks

**Panel C: Individual Stocks, Decade Horizon (N = 55,028)**

Variable	Mean	Median	SD	Skewness	% Positive
Sum Stock Return	0.7352	0.6912	1.460	0.476	73.9%
Buy-and-Hold Return, T-Bill	0.3090	0.1876	0.340	1.774	99.9%
Buy-and-Hold Return, Stock	1.0678	0.1605	4.146	16.320	56.3%
Geometric Return, Stock	-0.0110	0.0033	0.063	-3.131	56.3%
	% > T-bill	% > VW Mkt Return		% > EW Mkt Return	
Buy-and-Hold Return, Stock	49.5%	37.3%		33.6%	

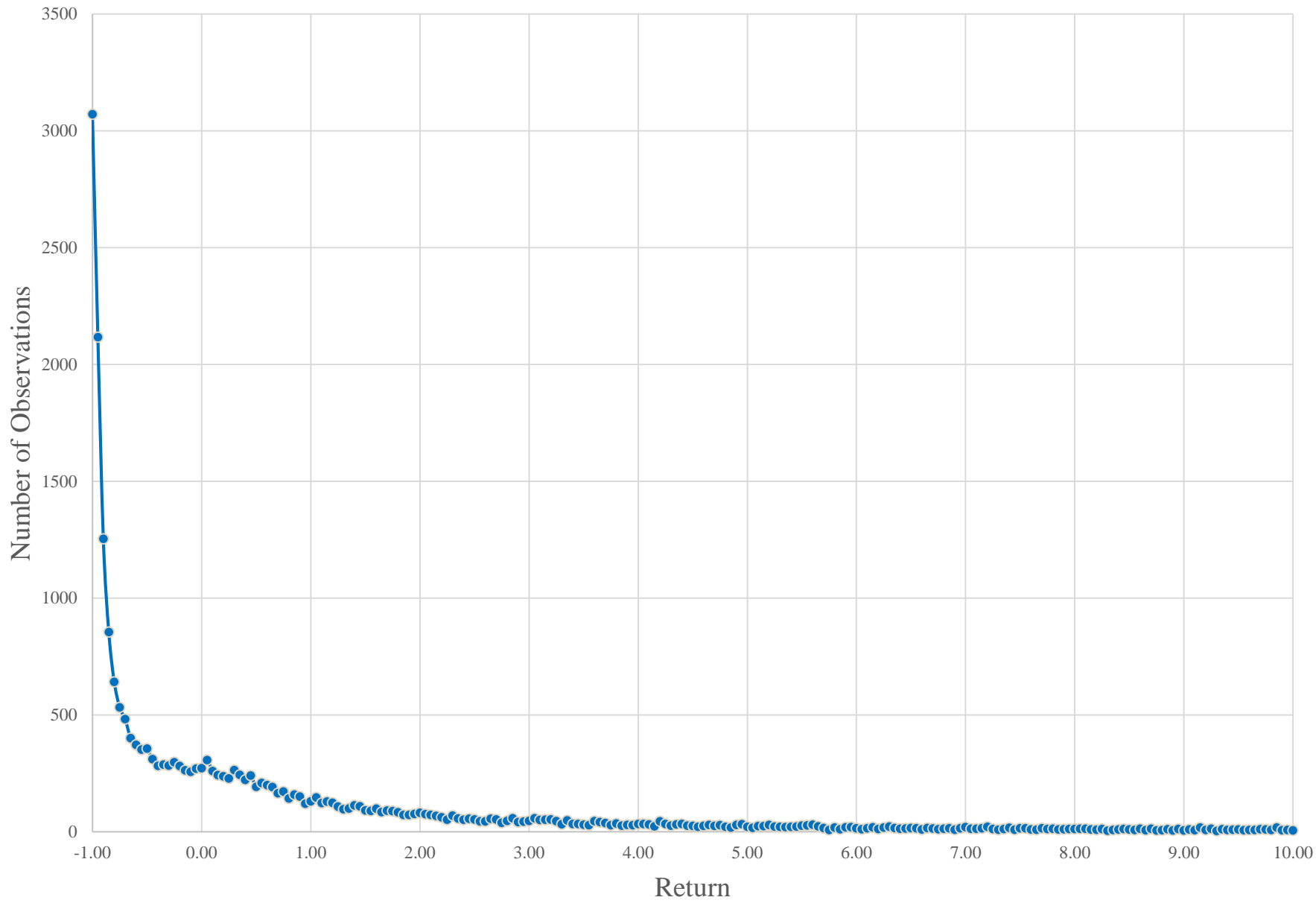
# “Lifetime” returns to CRSP common stocks.

✦ From 1926 or first appearance in CRSP to 2016 or delisting.

**Panel D: Individual Stocks, Lifetime Horizon (N = 25,967)**

Variable	Mean	Median	SD	Skewness	% Positive
Sum Stock Return	1.5580	1.0477	2.821	1.195	71.7%
Buy-and-Hold Return, T-Bill	1.1276	0.3483	2.278	4.120	99.8%
Buy-and-Hold Return, Stock	187.4705	-0.0229	15376.460	154.815	49.5%
Geometric Return, Stock	-0.0196	-0.0003	0.063	-4.428	49.5%
	% > T-bill	% > VW Mkt Return		% > EW Mkt Return	
Buy-and-Hold Return, Stock	42.6%	30.8%		26.1%	

Figure 1C: Lifetime Buy-and-Hold Returns (rounded to 5%)



# The Role of Firm Size, Buy-and-Hold Returns

**Panel C: Individual Stocks, Decade Horizon**

Group (Market Cap)	Mean	Median	Skewness	% > 0	% > T-bill	% > VW	% > EW
						Mkt Return	Mkt Return
1	0.9654	-0.1929	12.552	42.4%	36.6%	29.7%	28.0%
2	0.9976	-0.0843	23.335	47.1%	40.8%	31.7%	29.8%
3	0.9098	-0.0492	11.420	48.3%	42.7%	34.0%	31.2%
4	0.8929	0.0636	8.805	52.6%	46.4%	36.5%	33.3%
5	1.0026	0.0917	9.416	54.2%	47.8%	37.1%	34.0%
6	1.0443	0.1498	10.299	56.3%	49.7%	38.3%	35.0%
7	1.0713	0.2596	7.102	60.2%	53.4%	39.6%	36.0%
8	1.2946	0.4422	5.263	66.5%	58.6%	44.6%	38.4%
9	1.2908	0.5464	10.472	70.0%	61.3%	42.7%	36.2%
10	1.5254	0.9788	6.956	81.3%	70.5%	44.7%	36.3%



# Decade of Appearance and Lifetime Buy-and-Hold Returns

**Panel A: By Decade of initial appearance in the CRSP database**

Initial Decade	N	Mean	Median	Skewness	% > 0	% > T-bill	% > VW	% > EW
							Mkt Return	Mkt Return
1926-1936	920	4624.7200	5.9903	29.188	72.5%	67.4%	31.7%	10.9%
1937-1946	251	897.3600	29.5849	6.778	91.2%	86.5%	43.4%	20.7%
1947-1956	247	402.0400	13.8533	7.952	91.1%	87.0%	40.9%	26.7%
1957-1966	1599	67.6600	1.3975	12.130	74.0%	61.5%	44.8%	29.1%
1967-1976	4548	25.4300	0.5888	17.689	60.7%	46.9%	42.6%	29.4%
1977-1986	5151	7.9700	-0.5258	40.517	39.2%	31.7%	20.9%	23.3%
1987-1996	6860	2.8700	-0.2539	15.758	45.2%	39.6%	26.3%	25.8%
1997-2006	4153	0.9100	-0.4578	38.807	40.2%	37.2%	29.4%	24.7%
2007-2016	2238	0.1900	-0.1134	6.488	45.3%	45.0%	32.9%	34.0%

# Buy-and-Hold Returns vs. Aggregate Wealth Creation

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- ✦ Focus to here has been on Buy-and-Hold returns.
  - ◆ Computed by linking gross (one plus) returns, inclusive of dividends.
  - ◆ Gives the outcome to a hypothetical investor who makes no trades subsequent to initial investment, except for reinvestment of dividends.
- ✦ The Buy-and-Hold return does not tell us the experience of investors in aggregate, because they:
  - ◆ Do not reinvest dividends,
  - ◆ Do receive proceeds of stock repurchases,
  - ◆ Fund new equity issuances.
  - ◆ This was the central point of Dichev (2007).

# Wealth Creation by Stock Investing

I measure, as of December 2016, the difference between the wealth of investors who held common stocks as compared to investing the same capital in one month Treasury Bills.

A few lines of algebra reveals this can be computed for each stock as:

$$W_T - W_0 * FV_{0,T} =$$

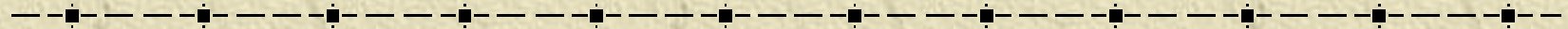
$$I_0 * (R_1 - R_{f1}) FV_{1,T} + I_1 * (R_2 - R_{f2}) FV_{2,T} + \dots + I_{T-2} * (R_{T-1} - R_{fT-1}) * FV_{T-1,T} + I_{T-1} * (R_T - R_{fT}).$$

Where I denotes aggregate investment (i.e. market cap), and FV is a future value factor created by linking subsequent one-month T-bill rates.



# Lifetime Wealth Creation, Top 20 Stocks

(measured as of December 2016, aggregated across share classes)



PERMCO	Company Name (most recent )	Lifetime Wealth Creation (\$ Millions)	% of Total	Cumulative % of Total	PERMNO	Annualized Return	Start Month	End Month	Life (Months)
20678	EXXON MOBIL CORP	1,002,144	2.88%	2.88%	11850	11.94%	Jul-26	Dec-16	1086
7	APPLE INC	745,675	2.14%	5.02%	14593	16.27%	Jan-81	Dec-16	432
8048	MICROSOFT CORP	629,804	1.81%	6.83%	10107	25.02%	Apr-86	Dec-16	369
20792	GENERAL ELECTRIC CO	608,115	1.75%	8.57%	12060	10.67%	Jul-26	Dec-16	1086
20990	INTERNATIONAL BUSINESS MACHS COR	520,240	1.49%	10.07%	12490	13.78%	Jul-26	Dec-16	1086
21398	ALTRIA GROUP INC	470,183	1.35%	11.42%	13901	17.65%	Jul-26	Dec-16	1086
21018	JOHNSON & JOHNSON	426,210	1.22%	12.64%	22111	15.53%	Oct-44	Dec-16	867
20799	GENERAL MOTORS CORP	425,318	1.22%	13.86%	12079	5.04%	Jul-26	Jun-09	996
20440	CHEVRON CORP NEW	390,427	1.12%	14.98%	14541	11.03%	Jul-26	Dec-16	1086
21880	WAL MART STORES INC	368,214	1.06%	16.04%	55976	18.44%	Dec-72	Dec-16	529
45483	ALPHABET INC	365,285	1.05%	17.09%	90319	24.86%	Sep-04	Dec-16	148
540	BERKSHIRE HATHAWAY INC DEL	355,864	1.02%	18.11%	17778	22.61%	Nov-76	Dec-16	482
21446	PROCTER & GAMBLE CO	354,971	1.02%	19.13%	18163	10.45%	Sep-29	Dec-16	1048
15473	AMAZON COM INC	335,100	0.96%	20.09%	84788	37.35%	Jun-97	Dec-16	235
20468	COCA COLA CO	326,085	0.94%	21.03%	11308	13.05%	Jul-26	Dec-16	1086
20606	DU PONT E I DE NEMOURS & CO	307,976	0.88%	21.91%	11703	10.57%	Jul-26	Dec-16	1086
20103	A T & T CORP	297,240	0.85%	22.77%	10401	7.81%	Jul-26	Nov-05	953
21188	MERCK & CO INC NEW	286,671	0.82%	23.59%	22752	13.79%	Jun-46	Dec-16	847
21305	WELLS FARGO & CO NEW	261,343	0.75%	24.34%	38703	13.26%	Jan-63	Dec-16	648
2367	INTEL CORP	259,252	0.74%	25.09%	59328	17.70%	Jan-73	Dec-16	528



Figure 2A: Cumulative Percent of Wealth Creation, all Companies

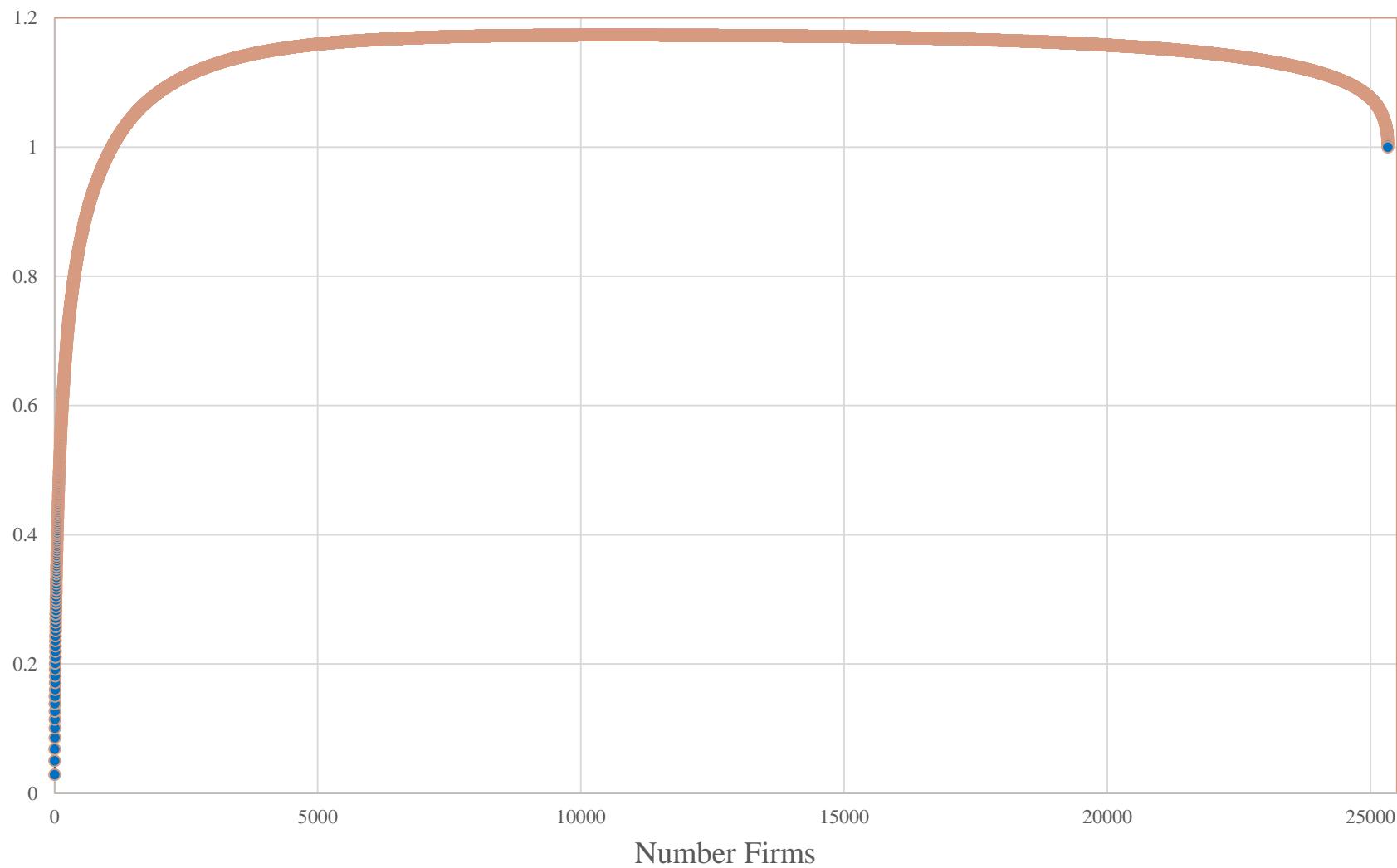
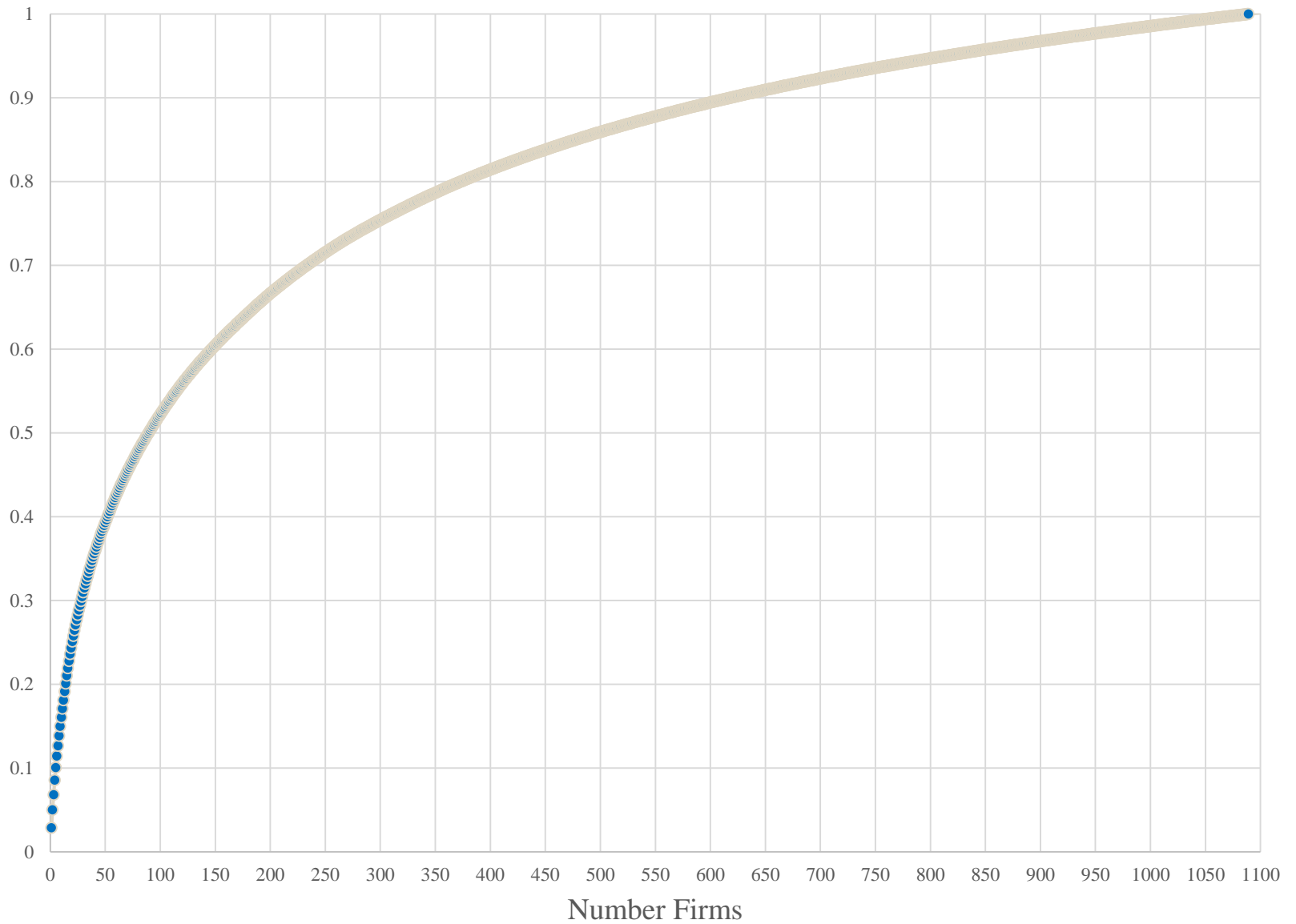


Figure 2B: Cumulative Percent of Wealth Creation, Top 1100



# Interpretation:

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- ✦ All of the dollar value creation in the U.S stock market since 1926 can be attributed to slightly more than 4% of stocks, and over half of the value creation can be attributed to 0.36% of the stocks.
- ✦ Another 38% of stocks created value, but only enough to offset the value destruction of the remaining 58%.
- ✦ So, 96% of stocks collectively matched T-bills, while 4% did better and created value equal to the overall market.
- ✦ But, what should the benchmark be?
  - ◆ We surely didn't expect the value creation outcome to be uniform across the 26,000 stocks.
  - ◆ Successful stocks survive longer and grow, large stocks create more value if successful, etc.



# Should we be surprised?

## Maybe not

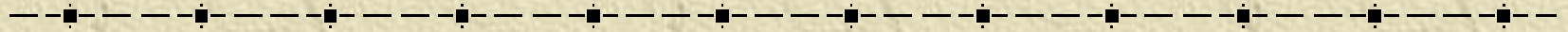
- 
- ✦ The surprise in the findings here may arise because we typically focus on the arithmetic mean of short horizon returns.
  - ✦ These are positive in large stock market samples.
  - ✦ And, arithmetic means tend toward normality as the sample size grows.
  
  - ✦ But, actual investing gains depend on holding period returns, i.e. on multiplicative compounding.
  - ✦ Compounding induces positive skewness.



# The role of compounding

- 
- ✦ Compounding induces positive skewness into multi-period returns, even if single period returns are symmetric.
  
  - ✦ Simple example, binomial distribution:
  - ✦ Single period return are 20% or – 20%, with equal probability.
  - ✦ Two period returns are:
    - ◆  $(1-.2)*(1-.2) - 1 = -36\%$ , with probability .25.
    - ◆  $(1-.2)*(1+.2) - 1 = -4\%$ , with probability .50.
    - ◆  $(1+.2)*(1+.2) - 1 = 44\%$  with probability .25.
  - ✦ While the mean two-period return is zero, the median is -4%, and the standardized skewness is 0.412.

# Further illustrating the role of compounding: What if single period returns are normal?



- ✦ Buy-and-Hold returns are obtained by multiplying (gross) single period returns.
- ✦ The distribution of the product of normals is unknown.
- ✦ I rely on simulations.
  - ◆ IID normal single period returns, with mean 0.5%.
  - ◆ Standard deviations ranging from 0 to 20%.
  - ◆ For each, simulate 100,000 ten year periods (1 million one-year periods).

# Simulation outcomes when monthly returns are iid normal, with mean 0.5%

Standard Deviation of Monthly Returns	0.00%	2.00%	4.00%	6.00%	8.00%	10.00%	12.00%	14.00%	16.00%	18.00%	20.00%
<b>Panel A: Skewness of Buy-and-hold returns</b>											
<b>Horizon (Years)</b>											
<b>1</b>	0.000	0.188	0.385	0.579	0.779	0.997	1.222	1.471	1.724	2.014	2.306
<b>5</b>	0.000	0.460	0.959	1.549	2.322	3.314	4.570	8.352	9.440	15.196	23.814
<b>10</b>	0.000	0.667	1.478	2.618	4.655	8.550	11.058	23.849	61.148	42.597	53.323
<b>Panel B: Median Buy-and-hold return</b>											
<b>1</b>	6.17%	5.94%	5.24%	4.11%	2.46%	0.48%	-1.94%	-4.83%	-8.02%	-11.71%	-15.55%
<b>5</b>	34.89%	33.30%	28.76%	21.42%	11.57%	0.36%	-12.18%	-25.19%	-37.98%	-50.32%	-61.04%
<b>10</b>	81.94%	77.72%	65.60%	47.33%	24.32%	0.14%	-23.48%	-44.56%	-61.98%	-75.74%	-85.28%
<b>Panel C: Percentage of Buy-and-hold returns that are Positive</b>											
<b>1</b>	100.00%	79.77%	64.39%	57.69%	53.49%	50.56%	48.14%	46.00%	44.12%	42.31%	40.73%
<b>5</b>	100.00%	96.82%	79.27%	66.12%	56.99%	50.18%	44.55%	39.66%	35.37%	31.37%	27.93%
<b>10</b>	100.00%	99.57%	87.49%	72.09%	59.68%	50.05%	42.06%	35.24%	29.47%	24.20%	20.02%
<b>Panel D: Ninety Ninth Percentile Buy-and-hold Return</b>											
<b>1</b>	6.2%	24.2%	44.6%	67.1%	92.1%	120.1%	150.8%	184.8%	221.5%	261.5%	304.7%
<b>5</b>	34.9%	90.5%	163.1%	255.2%	366.5%	498.8%	655.1%	819.3%	1017.9%	1205.5%	1414.7%
<b>10</b>	81.9%	194.8%	355.9%	577.2%	839.2%	1168.8%	1525.0%	1915.3%	2258.9%	2485.7%	2726.6%



# Implications: I

## The Nature of Entrepreneurial Payoffs

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- ✦ It is well known that returns to venture capital and other early-stage investments are highly skewed, with most investments losing money (often -100%), but a few generating outsized payoffs.
- ✦ The results here show the strong skewness of returns, including that most investments lose money while a few deliver outside gains, does not cease after the IPO.
- ✦ Obscured by the fact that most studies focus on short horizon arithmetic mean returns.
- ✦ Observing net losses on most investments and big gains on a few seems to be a fundamental attribute of investing in an entrepreneurial economy.



# Implications: II

## Portfolio Optimization

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### ✦ For Uninformed Mean-Variance Investors.

- ◆ The results reinforce the importance of diversification.
- ◆ But, from a different perspective – diversification ensures that you will share in the wealth created by big winners.
- ◆ This is probably the key takeaway for many investors.

### ✦ For those who don't want to be restricted to Mean-Variance.

- ◆ A preference for skewness can be rational, but skewness diversifies.
- ◆ The results show that skewness is strong, especially at longer horizons.
- ◆ The results here show how large the gains to an undiversified portfolio can be, if one is lucky or skilled enough to identify the big winners in advance.

# Implications: III

## Performance Selection and Evaluation

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- ✦ Poorly diversified portfolios chosen at random will underperform market-wide benchmarks more than 50% of the time.
  - Even in the absence of management or trading costs.
  - We will measure negative alphas more often than not, even if all true alphas are zero.
- ✦ Mean-Variance Optimization and the Sharpe Ratio.
  - Often justified by the assumption that returns are (nearly) normal.
  - At longer horizons, they are not.
- ✦ Should portfolio selection and performance evaluation measures be reassessed?