

Accounting For Survivorship Data on a unique market in an unparalleled time is inherently biased.

Research

- 39 With Structured Notes, It's Buyer Beware
- 45 Sustainable Funds Weather Downturns Better Than Peers

Quant U

- 49 Solving the Asset-Location Problem, Part I

Best Ideas

- 53 Manager: Staying Power
- 54 Passive: Low Costs Seal the Deal
- 55 Equity: A High Bar

RESEARCH

Paul D. Kaplan and Laurence B. Siegel

The U.S. equity market has had a phenomenal run. Since the end of 1870, a dollar invested in a capitalization-weighted market portfolio would have grown to over \$18,000 by the end of May 2020 in real (inflation-adjusted) terms. That's a compound real return of 6.8% per year. This happened despite 18 market declines of more than 20% each in real terms. Each decline was followed by a recovery, and after recovering, the market went on to new heights.¹

As we will discuss, the United States had several things going for it that allowed it to attain such impressive market results, as did a few much smaller countries. Other countries were not as lucky. In 1900, Germany, Japan, the United Kingdom, and Argentina all had good prospects, as did some other countries. However, being on the losing side of a world war or two, the overthrowing of capitalism, or just prolonged poor market performance would have wiped out the capital of investors. In the cases of Germany, Russia, and Japan, most investors would have outright lost their claims to their capital.

Therefore, when analyzing historical performance data on U.S. markets, or other unusually successful markets, and drawing conclusions from those data, our findings may be distorted by survivorship bias.

Not only does the U.S. have a unique capital market history relative to other countries, but the period over which we measure the capital markets is unique in human history. According to economist Deirdre McCloskey and others,² there was essentially no economic progress for most of human history until a little over 200 years ago (more on this later). The past two centuries are the period over which we measure equity market returns, because that is the only period for which data are available. So, we are measuring what happened in a unique market over a unique period in history, a practice that compounds two separate sources of bias.

In this article, we discuss some of the unique history of the United States that led to its resilient equity performance and dominant place in world capital markets today. We will then look at the return and volatility of the equity markets of a number of countries and try to explain why these differ across countries. In doing so, we not only demonstrate the existence of survivorship bias but also offer some explanation as to why the bias exists. We will then discuss the unique period of economic development for which we have stock market data, adding another dimension to the understanding of the biases in the historical market performance data that we rely on.

Incomplete Coverage of the Opportunity Set

Survivorship bias is a potential problem whenever one uses past data to make forecasts. For example, a forecast of the equity risk premium—based only on that achieved in

¹ See Kaplan, P.D. 2020. "Black Turkeys Everywhere." *Morningstar* magazine, Q2, PP. 37–41.

² McCloskey, D.N. 2006. *The Bourgeois Virtues: Ethics for an Age of Commerce* (Chicago: University of Chicago Press).

the U.S. or the U.K. from 1926 to 2020, 1871 to 2020, or even (as Will Goetzmann and others have done³) several centuries of history—is almost certain to be an overestimate. The very existence of a long data series is evidence of greater-than-average survivorship. The right way to forecast, if you believe the future will equal the observable past (itself a contentious assumption), is to gather data on all the investment opportunities that existed in the observable past and measure their aggregate return, including the returns on the opportunities that disappeared because of war, revolution, or any other reason.

This is difficult because gaps in the historical record do not allow us to know exactly what the opportunity set was at any given point—that is, we do not know what proportion of the entirety of the past is observable. For example, data from Dimson, Marsh, and Staunton, or DMS, have started to include Chinese equities starting in 1900 but not Chinese bonds.⁴ Yet a colleague of ours has Chinese railroad bonds from that time framed and hanging on the wall of her office. We assume these are a total loss, because they appear to be worth more as wallpaper than as securities, and they did not make it into the DMS estimates of the historical global bond return. This is no fault of theirs; nobody has the data, which were almost certainly destroyed in the 1911 revolution, the 1949 revolution, or the 1976 “evolution.”

Looking Only at Modern History

The bias from looking only at modern data, even if you could include all countries whose markets did not survive or whose markets went away and then came back, is different and possibly even more severe. At least we know how to adjust, albeit imperfectly, for country survival: We go back and try to include as many countries at the start of the period as we can, knowing there will be some left out (and knowing, more or less,

which ones those are). But with the modern-period bias, there is an infinite number of ways the economy could have evolved, or not evolved, or become extinct.

We can call this the sample-of-one bias, in reference to Paul Samuelson’s famous comment that “we have only one sample of the past.”⁵ His concern, like ours, is that we should not be misled by thinking it is the only past that could have occurred.

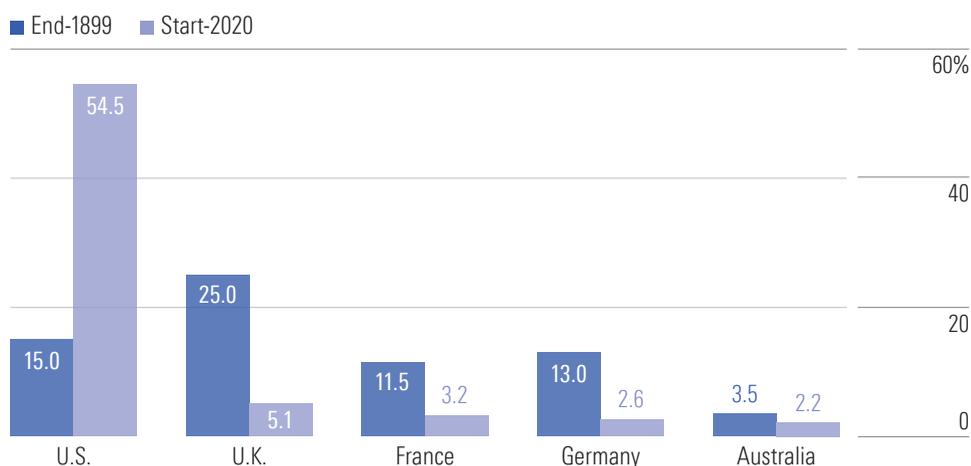
The oldest continuous stock price series is three centuries old. (It is the price series for the Bank of England starting in 1695.) There is no assurance that the next three centuries will in any way resemble the past three. One thing we will definitely *not* do is go from worldwide extreme poverty to modest affluence. The reason is that our starting point, this time, *is* modest affluence.

There was capitalism, and ownership and trading of joint-stock companies, before 1695—quite a bit of it, actually. Some of the returns were probably very good. But there was very little broad-based economic growth; McCloskey, Joel Mokyr, Gregory Clark, and others have made a powerful case that most people in 1700 were not much better off than they were in 700.⁶ They lived just above subsistence level and faced the continual threat of famine and disease.

So, if we are forecasting returns under the assumption that stock market performance since the Industrial Revolution is not only repeatable *but repeatable because the economic growth rates of that period are repeatable*, it makes no sense at all to use our sparse stock market data from before 1695 as an input to any forecast. The data can be used to infer something about the experience of a few investors whose records survived for us to read them but nothing about

EXHIBIT 1

From Emerging Market to Economic Superpower In 1900, the U.S. made up 15% of the world equity market, on par with Germany and France.



Source: Dimson, E., Marsh, P., & Staunton, M. 2020. *Credit Suisse Global Investment Returns Yearbook 2020* (Zürich: Credit Suisse).

³ Goetzmann, W.N. 1993. “Patterns in Three Centuries of Stock Market Prices.” *Journal of Business*, 66(2): 249–270. Mirowski, P. 1987. “What Do Markets Do? Efficiency Tests of the 18th-Century London Stock Market.” *Explorations in Economic History*, 24 (2), 107.

⁴ Dimson, E., Marsh, P., & Staunton, M. 2020. *Credit Suisse Global Investment Returns Yearbook 2020* (Zürich: Credit Suisse).

⁵ Samuelson, P.A. 1994. “The Long-Term Case for Equities (and How It Can Be Oversold).” *Journal of Portfolio Management* (Fall).

⁶ McCloskey, *op. cit.* Mokyr, J. 2016. *A Culture of Growth: The Origins of the Modern Economy* (Princeton, N.J.: Princeton University Press). Clark, G. 2007. *A Farewell to Alms: A Brief Economic History of the World* (Princeton, N.J.: Princeton University Press).



the returns to capital in any broader sense. In these ancient data, we may be observing a needle of gold in a haystack of dung.

The Unique History of the United States

EXHIBIT 1 shows the percentage of the world equity markets made up by the U.S., the U.K., France, Germany, and Australia at the end of 1899 and at the beginning of 2020. Together,

these five markets made up 68% of world market capitalization both at the end of 1899 and at the beginning of 2020. However, their shares of world market capitalization changed dramatically over this 120-year period. In 1899, at 25%, the U.K. had the largest equity market. At 15%, the U.S. market was about the same size as Germany's. One hundred twenty years later, the picture is far different. The

U.S. has become the dominant equity market, with 54.5% of the world's market capitalization, and the U.K. has dropped to 5.1%. Germany has dropped from 13% to 2.6%.

While the figures in **EXHIBIT 1** can be interpreted as evidence of the survivorship bias inherent in the U.S. historical equity market returns, there are also fundamental reasons for the rise of the U.S. to the dominant position in the global equity market that it has today. Over the past 120 years, the U.S. has gone from an emerging market to the world's economic superpower. Over this period, the U.S. greatly expanded in population, mainly through immigration, which gave it a labor force large enough to work its growing industries. U.S. population growth was much faster than that of the major European countries, which suffered emigration. Furthermore, the U.S. is one of the few countries that has an "equity culture" enabling companies to raise capital largely by issuing equity, rather than debt, from a public that does not mind taking risk. So, while the generous returns of the U.S. equity market are part of the story behind its growth, they are not the whole story.

Risk and Return Around the World

EXHIBIT 2 shows the compound annual real return and standard deviation of real return on 21 countries in both local currency and U.S. dollars over 1900–2019. The U.S. shares the top three spots with Australia and South Africa. Although Australia and the U.S. are quite different in size, they both have enjoyed conditions that have allowed their capital markets to flourish, namely political stability, recovery from economic downturns, and limited damage and quick recovery from wars. In the case of South Africa, the gold- and diamond-mining industries have produced handsome returns for investors.

In **EXHIBIT 3**, we plot the compound annual real returns and standard deviations of the 21 countries shown in **EXHIBIT 2**, in local currency. What is striking about this chart is the negative relationship between volatility and return, the opposite of what one might expect. The winning countries (South Africa, Australia, and the U.S.) have also had some of the lowest volatility.

EXHIBIT 2

Winners and Losers, After the Fact In 1900, was it predictable that the U.S., Australia, and South Africa would be the top-performing markets over the next 120 years?

Real Return and Standard Deviation on Equity Markets for 21 Countries, 1900–2019

Country	Compound Annual Real Return (%)		Standard Deviation (%)		Compound Annual Real Return (Rank)		Standard Deviation (Rank)	
	Local Currency	U.S. Dollar	Local Currency	U.S. Dollar	Local Currency	U.S. Dollar	Local Currency	U.S. Dollar
Australia	6.82	6.60	17.50	22.02	2	1	20	18
Austria	0.95	0.09	30.55	37.33	21	21	3	3
Belgium	2.61	2.99	23.35	25.62	19	19	8	11
Canada	5.71	5.55	16.87	19.52	6	7	21	21
Denmark	5.57	5.90	20.71	22.67	7	5	15	17
Finland	5.48	5.43	29.49	32.12	9	8	4	5
France	3.42	3.17	22.90	28.07	17	18	9	9
Germany	3.32	3.42	31.32	79.02	18	17	2	1
Ireland	4.35	4.41	22.89	25.13	13	12	10	13
Italy	2.15	2.13	28.28	32.89	20	20	6	4
Japan	4.21	4.38	29.19	31.36	14	14	5	6
Netherlands	5.10	5.27	21.15	24.34	10	10	13	14
New Zealand	6.43	6.06	19.22	25.14	4	4	19	12
Norway	4.39	4.41	26.48	29.36	12	13	7	7
Portugal	3.64	3.64	33.92	40.74	15	15	1	2
South Africa	7.09	6.09	21.90	29.26	1	3	11	8
Spain	3.59	3.49	21.67	27.83	16	16	12	10
Sweden	5.99	5.66	21.00	23.51	5	6	14	15
Switzerland	4.61	5.34	19.40	20.55	11	9	18	19
U.K.	5.53	5.12	19.60	22.82	8	11	17	16
U.S.	6.51	6.51	19.93	19.93	3	2	16	20
Correlation (%)			-63.99	-43.58			-71.43	-66.23

Sources: Dimson, Marsh, and Staunton (op. cit.), Morningstar Direct. Data as of 12/31/2019.

At the opposite end, the country with the lowest return, Austria, had the highest volatility. (Austro-Hungarian returns are linked to post-World War I Austrian returns to form a single series.) So, if you were lucky enough to invest in a country with a high rate of return, you got the bonus of a less volatile market. In other words, survivorship bias is not only about performance; it is also about volatility.

The volatility of Germany was extreme. Given Germany's history of losing two world wars, going through hyperinflation and a depression, and being occupied, perhaps this should come as no surprise. The extreme annual real returns in local currency are negative 90.8% in 1948 and positive 154.6% in 1949. In U.S. dollars, the extremes are negative 79.7% in 1945 and positive 717%.⁷ To see the impact of such extreme volatility on the accumulation of wealth, we plot the growth of the real value of one unit of currency invested at the end of 1899 over the 120-year period ended in 2019 in **EXHIBIT 4**.

The Anthropic Principle

Survivorship and sample-of-one biases are actually an application of the anthropic principle in philosophy, which says that the world looks as it does because if it didn't, the conditions for our existence would not have been met and we would not be here to observe it. Thus, for example, there is a certain set of cosmological constants that govern how our universe operates. Our existence depends on these constants having the values that they do. There could be, or could have been, other universes in which the constants have other values, and therefore, we could not exist in them. So, why do we live in a universe in which the cosmological constants are right for us? It is because they have to be right for us, or we would not be here to observe the constants and ask this question.

The same principle applies on a less-than-cosmological scale. If apes in the Pleistocene

The Right Time

The period over which we measure country-specific real equity market returns is unique in human history. The economist Deirdre McCloskey calls it "the Great Enrichment." She writes:

"The upshot of the new ideas has been a gigantic improvement since 1848 for the poor, such as many of your ancestors and mine, and a promise, now being fulfilled in China and India, of the same result worldwide. It is a Great Enrichment for the poorest among us. Earlier prosperities had intermittently

*increased real income per head by double or even triple, 100 or 200 percent or so, only for it to fall back to the miserable \$3 a day typical of humans since the caves. But the Great Enrichment increased real income per head, in the face of a rise in the number of heads by a factor of seven — by anything from 2,500 to 5,000 percent."*¹

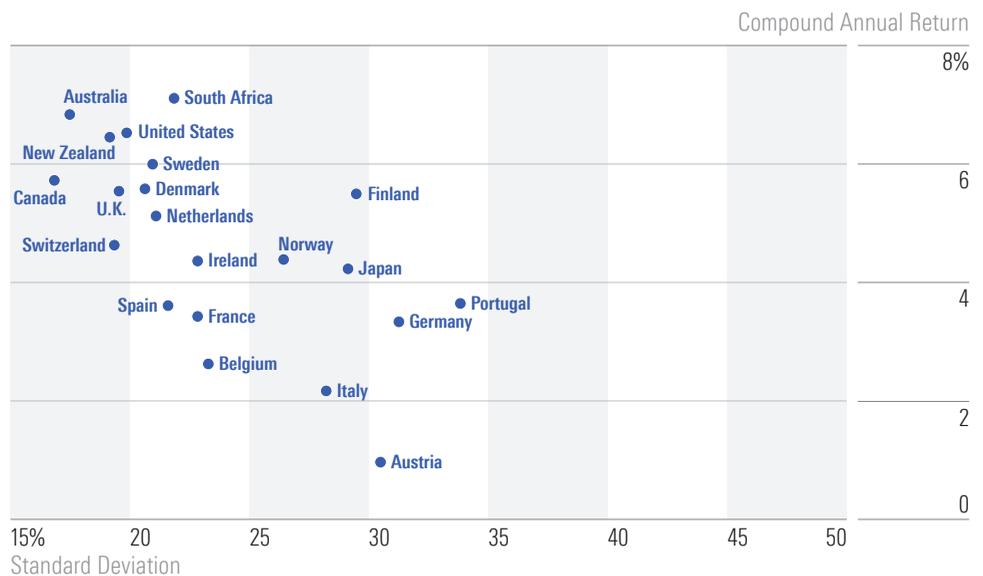
Relying on data from such a unique period of history is a form of bias.

¹ McCloskey, D. 2017. "The Great Enrichment Was Built on Ideas, Not Capital." Foundation for Economic Education, Nov. 22, 2017. <https://fee.org/articles/the-great-enrichment-was-built-on-ideas-not-capital/>.

EXHIBIT 3

A Twist on Volatility If you were lucky enough to invest in a winning country, you got the bonus of less volatility.

Real Return vs. Standard Deviation on Equity Markets, in Local Currency, 1900–2019



Sources: Dimson, Marsh, and Staunton (*op. cit.*), Morningstar Direct. Data as 12/31/2019.

⁷ The 1945–49 returns for Germany are somewhat speculative because of the chaotic currency situation that prevailed at the time. The old currency, the reichsmark, was exchanged for the new currency, the deutschemark, at rates ranging from 1:1 to 10:1. This very wide range makes it impossible to settle on a single and unambiguously correct method of currency translation from deutschemarks to U.S. dollars over that period. It also affects local currency returns because the returns were delivered in two different local currencies, the exchange rate between which varied depending on who held the currency and when. We treat the returns converted by DMS at 1:1 as correct for the purpose of this analysis.



Survivorship Bias in Fund Data

Survivorship bias is also a problem when evaluating investment managers. Managers shut down poor-performing funds, sometimes moving their assets into larger or better-performing funds where the bad record won't be seen. Hedge funds do this even more than long-only managers. Thus, unless survivorship is accounted for, average active manager performance looks better than it really is, as we have already seen with countries.

epoch had faced different evolutionary pressures, a species that developed big brains and an upright posture might have died out and we would not be here. In a similar fashion, we are studying the stock and bond markets as a way to accumulate assets because we happen to live in a time and place where that is possible. There is no law of nature saying that is always and everywhere true.

The Future Will Be Different

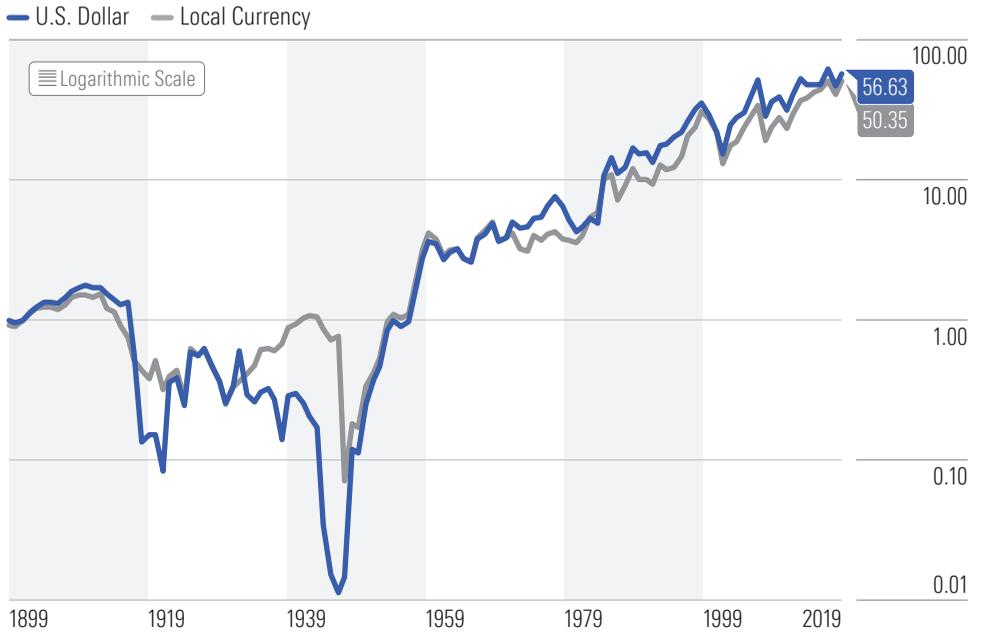
Survivorship bias and sample-of-one bias are separate but related. Survivorship bias almost certainly overstates the return that was earned over the whole opportunity set of investments in our one "run" of the past. Therefore, analysts using that run of the past to forecast the future should consider adjusting their estimates downward.

That is not an ironclad rule because the use of past data to forecast the future mixes several effects: (1) the continuity or stability of basic economic relationships, such as the return required as a reward for risk, and between the past and the future; (2) the amount of risk in the future compared with the past; (3) survivorship bias, as discussed above; and (4) institutional changes, such as the dramatic lowering of investor costs due to innovations such as the issuance of shares to the public, open-outcry trading, mutual

EXHIBIT 4

German Extremes Annual returns in Germany were wildly volatile, the result of losing two world wars and experiencing periods of hyperinflation and depression.

Cumulative Index of Real Equity Returns of Germany, 1900–2019 (Dec. 31, 1899 = 1.00)



Sources: Dimson, Marsh, and Staunton (op. cit.), Morningstar Direct. Data as 12/31/2019.

funds, and in the modern era, index funds and exchange-traded funds.

Sample-of-one bias is harder to adjust for because we cannot know the characteristics of the "population" from which the sample of one was drawn. It is like speculating what you would be like if you had never been born and someone else had been born in your place. Most children ask this question at some point and get a profoundly unsatisfying answer, something like, "You wouldn't exist, so you wouldn't care. You would have a brother or sister who would care." That may be unkind, but it is correct.

So, the resolution to the sample-of-one bias is not an adjustment upward or downward—it is indeed possible that the future will be better than the past 200 or 300 years, just as it might be worse. Instead, it is having modesty about the accuracy of the forecasts. While "future equals past" may be a good first approximation, it comes with wide error bars.

But we can be sure of one thing. While the future may resemble the past in meaningful ways—we will eat, sleep, and make merry the way we always have, because we inhabit human bodies and minds—it will also be very different. ■■

[Paul D. Kaplan](#), Ph.D., CFA, is director of research with Morningstar Canada. He is a member of the editorial board of *Morningstar* magazine.

[Laurence B. Siegel](#), the author of *Fewer, Richer, Greener: Prospects for Humanity in an Age of Abundance*, is the Gary P. Brinson director of research at the CFA Institute Research Foundation and an independent consultant. His website is <http://www.larrysiegel.org>.