



2nd Quarter Commentary

July 2026

Table of Contents

First: Solving an Insolvable Problem.....	3
Indexation and Us	6
<i>Our Commonality With Indexation: John Bogle Style</i>	8
<i>Which brings us to why we've produced our own ETFs (of the active variety)</i>	9
<i>Our Gratitude For Indexation, Industrial Style</i>	11
IPOs and Us	12
Compounding and Us	14
<i>The Repetitive Language Model (RLM) of Compounding</i>	14
<i>A Math Model of Compounding—From a Water Glass to a Snowball to Amazon and Bitcoin..</i>	17
<i>Waiter!!!</i>	18
<i>Snowball Fight.....</i>	19
<i>Amazon.com is a Snowball</i>	20
<i>Bitcoin is a Snowball...but then, it was designed that way.....</i>	20
Why Did We Reduce or Sell Precious Metals Royalty Companies?	22
<i>Some Then-and-Now History</i>	22
<i>Valuations Have Meaning</i>	24
The Securities Exchanges: Perpetual Futures, Prediction Markets, “Stunning” Price Declines ..	25
<i>How are the Exchanges Doing?</i>	25
<i>The Day the Shares Went Down</i>	26
<i>Back to Exchanges and What They Do</i>	29
What's With the Price of Bitcoin?	31
<i>The Supply Side of Bitcoin's Value</i>	33
<i>The Demand Side of Bitcoin's Value</i>	34
Appendix.....	37
Important Disclosures	40

The Time & Compounding Edition

First: Solving an Insolvable Problem

To paraphrase Apollo 13's Jim Lovell's actual fateful utterance to Mission Control in 1970—not the word-smithed movie version, but the real one—"Okay, Houston, we've had a problem here," Horizon Central had a problem several weeks ago, too. But a good one, to be sure, which is a lot of client questions. Not too many, that's not the problem. Just too many to do them all justice in one sitting.

Why not just answer and move on? Some *can* be answered succinctly. Others require a certain minimum background and defining of terms. The standard P/E ratio might be a meaningless or misleading valuation measure for a certain type of company, but the reason needs to be explained, as well as why an alternative one is more suitable. It might be necessary to describe a scenario for how the valuation realization will develop over time. Enough information so that the explanation makes sense and isn't just a planted axiom—an unsupported assertion that can make an argument seem logical at the start, with everything thereafter resting on a false foundation, or no foundation at all.

Like this sort of familiar, breezy assertion: "We like XYZ-sector here, it's pulled back from its risk-on highs and offers pretty good value now at the lower end of its recent trading range, and consensus earnings estimates have bottomed out." Does that really tell you anything useful other than what the share price has done and what other people think about that?

Mag 7 stocks are trading at cheapest valuation in more than a decade

It's a rarity to see the "Magnificent Seven" tech stocks this cheap.

Yahoo Finance • 2h ago +0.60%

Thu, July 9, 2026 at 9:19 AM EDT • 2 min read

Me, I'm just asking questions here, but are we talkin' the Mag 7, at a P/E of only 24.8, which is cheaper than the 29.6 of 12 months ago? I heard that just recently. Or are we talkin' the Mag 7, two of which have negative free cash flow and one of which trades at 700x free cash flow? Ordinarily, analysts don't include negative figures in valuation averages. Let's give these two companies the benefit of the doubt, and just call it an even 100x, so that all seven companies can be averaged. The group trades at 150x run-rate free cash flow, based on the most recent reporting periods.

In typical calculations, non-cash stock compensation is usually adjusted in free cash flow. We did NOT do that in this exercise. If a company didn't utilize stock options, you'd think employees would demand cash instead, so it really is an operating expense—and dilutes shareholder returns even as stock.

Because, on a run-rate basis across the Mag 7, it amounts to \$108 BILLION!

One approach to a superfluity of questions is to:

(i) divide and conquer.

That's why we held a roundtable-type webinar several weeks ago about the rapidly deteriorating business model of the five AI data-center hyperscalers, four of which are members of the Mag 7. The plan was to spend a generous amount of time on a topic that's relevant to anyone exposed to the equity markets, thereby freeing up time at this Quarterly Commentary for issues more directly relevant to our portfolio holdings. At the table was one of our analysts and private fund managers, Fredrik Tjernstrom, along with James Davolos, our Director of Research and manager of the Inflation Beneficiaries ETF. Fredrik writes our short-

sale report, *The Devil's Advocate*. His May fundholder [letter](#)¹ was essentially a sell recommendation on those AI data-center companies. We couldn't accommodate a live audience at that roundtable, since we're moving offices, but we will be able to at the next one.

As best-laid plans of mice and men—and luck—would have it, there were way more questions about other topics than about the data centers. We addressed many of them at the roundtable, but the overflow will supersede some of what had been planned for today, and there remain more than we can adequately handle today.

Questions, for example, about—and I quote—the “stunning” decline in the price of Miami International Holdings stock in response to the potential threat of the new prediction markets like Kalshi. MIAX, by the way, has actually done better than the other securities exchanges, and it's no lower now than it was a few months ago.

There were specific questions about the other exchanges and the negative implications of the recent regulatory approval of perpetual futures contracts. And about why we liquidated mineral royalty positions. And about the short- and long-term outlook for cryptocurrency, and whether our bitcoin thesis is still the same as in 2015. And about gold. And about data center project development on TPL land, plus requested updates on related companies like LandBridge, PriairieSky, and WaterBridge. And a request to describe some initial new portfolio positions that relate primarily to Spin-Off strategy accounts, which are somewhat different than Core Value. You should contact your relationship manager about that one—and, if necessary, ask for me. All legitimate questions. Plus a couple more that will be addressed here, because they pretty much require a response.

Oh, and we were asked to please keep this Commentary to a maximum of 90 minutes.

Another approach to an excess of topic demand per topic-minute supply is to:

(ii) *employ a central theme* that ties them together.

For us, that is to emphasize—in new ways that keep it fresh and top of mind—the power of financial compounding and the power of being able to employ a very long time horizon. We try to do both. In fact, one can't happen without the other; it's easy to say, hard to do, rarely practiced.

It's a reason we favor securities exchanges and royalty companies, among other asset-light businesses. Many of the world's national securities exchanges have been operating since the early to late 1800s. The nature of their business is what gives them this rare economic persistence.

It's a reason that royalty companies are unique: their life-of-mine and 20-year contracts, which well-exceed the duration of ordinary business cycles, support their revenue and profit margin persistence.

And, of course, land. It's a rare public market investor who buys land. How would you even do it? It's not an uncommon asset class among the extremely wealthy. We once listed the largest of them; it's not a short list and they own a LOT of land. Why do you think that is?

Ted Turner died in May: He owned 2 million acres of land.² He could not possibly have been thinking, when making those purchases, about merely the next 10 years. Land is a perpetuity, the longest-lived of

¹ [Under the Hood Revived: What's in Your Index? The Metamorphosis of the Mega-Cap IT Company Business Model](#)

² Source: <https://landreport.com/land-report-100/ted-turner>

assets, and can compound forever. It has the additional property that it can often be repurposed for higher, better uses. Can't do that with a tractor or a data-center server. In Turner's case, land and species restoration was one goal.

Importantly, the available supply of land is always shrinking—in acres per person—because the world population is always increasing. Even land in remote areas of Texas and Canada is not isolated from expanding resource demand elsewhere in the nation or the world, whether it's for oil and natural gas. Or for compute power for AI, which translates into demand for water to cool the electric power plants that provide the electricity for a multi-thousand-acre 10-gigawatt campus that could power 2x Chicago's electricity demand.

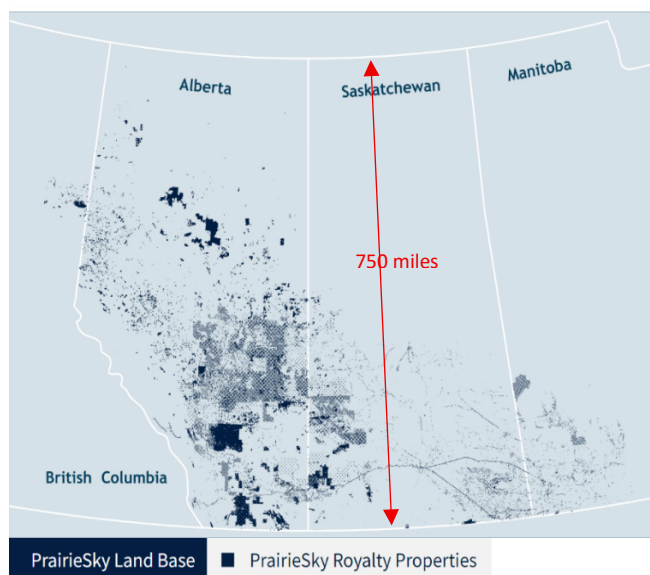
If the capital allocators at those land companies understand the ultimate value (and valuation multiple) difference between a perpetuity like surface acreage and the depletable minerals that come with it, they can enhance that value.

PrairieSky, the subject of one of the roundtable topic questions, is a land and royalty company that has done just that. In the 12 years since its IPO, even while more than tripling its acreage from 5 million to 18 million acres, it managed to double its *acres per share*. That's about 6% annually, in addition to whatever revenue and earnings growth it managed to achieve.

That astoundingly large and largely unexploited land portfolio, which sprawls along a roughly 750-mile axis across three Canadian provinces, gives PrairieSky the advantage of not having to reinvest profits in additional royalty contracts. Its large cash flow budget is fully available to pay dividends, repurchase shares, and make expansion-type land acquisitions. That consistently applied capital allocation plan by an executive team that requires of itself to, within three years of appointment, make cash purchases of enough PrairieSky stock to be worth 2x to 5x their salary. This is separate from their direct stock-based compensation. It is a strategy toward ensuring itself of a very long stretch of financial compounding possibilities.³

Those of us gathered here happen to know that it's possible to own land in the public sphere, even though this largest of all physical resources is not even listed as a sector in the equity indexes. *That* was the idea—land, not oil—in the original buy recommendation for Texas Pacific Land Trust over 30 years ago: to own the internal, frictionless compounding benefits of share repurchases to increase the *per-share* acres held.

(iii) *Alarm-bell client questions* are another way to determine which topics should take precedence.



³ <https://www.prairiesky.com/wp-content/uploads/2026/06/PrairieSky-Information-Circular-March-2026.pdf>

Two were asked during recent events that caught my ear. The type that pretty much requires a response. If seeming shifts in our investment choices don't make sense to a client, then the fault lies with the communicator. These questions will initiate today's discussion. Here they are:

I find it interesting that as an active investor who dislikes index funds, you are suddenly producing ETFs. Why?

Would you address how you've have been absent from the IPO market for decades but, more recently, have participated more. I always thought IPOs and value investing were like water and oil.

As different as these questions appear to be, they both relate to how we practice our long-horizon value philosophy. It's a difference between semantic form—the terminology that's being asked about—and investing substance. I won't cover the entirety of the ETF question response—though it's a separate response, it largely overlaps the Roundtable version, plus there's no need to burden those who attended the Roundtable. Instead, I'll just cover the conclusion and add a sidebar. The sidebar is not about indexation today, but about how it came into this world, the origin story. The real story is not what we imagine.

Indexation and Us

First, here's the crux of the misunderstanding: We're *not* antagonistic toward indexation as a concept, nor as it was first practiced in the 1970s by Vanguard's founder John Bogle. It can be a valuable tool, and did much good for many. We don't disdain overvalued or misrepresentative index funds any more than we disdain an overvalued common stock or mis-labeled industry sector. If an index offers an attribute we can employ to good effect, we'll use it, no differently than any other security.

The Alerian MLP ETF, for instance, which tracks an index of natural gas pipeline companies, can help solve the wasting asset problem of bonds due to inflation. It has a 7%-plus distribution yield without the K-1 tax reporting problem, and receives regulated increases in earnings over time to compensate for the inflation-driven increased costs of replacing and operating their pipeline networks. Those few extra percentage points of return do the trick. This ETF is one inflation-beneficiary instrument we've used in income-oriented portfolios.

But the ETF industry is a very different creature than it once was. The origin story, of which this is only one part, is instructive.

John Bogle's espoused idea of indexation in 1974, was: Don't try to pick and choose among the many actively managed mutual funds and their different strategies, and which the average investor was wholly unequipped to evaluate. (And certainly not individual stocks.) Instead, went the liberating idea, just dispense with trying to outperform the market, and instead own the entire market so as to simply participate, through corporate profit growth, in the expansion of the overall economy. Without the high fees, which at the time could average over 2%.⁴ The academic theory already existed, but no one had tried to implement it.

Part of the idea was that if you just passively participate in the entirety of the market, you can get the benefit of the "true" clearing prices as collectively determined by all the jousting of active investors—one person

⁴ <https://www.sec.gov/news/studies/feestudy.htm>

buying what the other was selling. That free ride on the efficient market works just fine so long as indexed assets are some modest proportion of the total, so that index investors don't themselves impact the prices.

The idea caught on and Vanguard indexed mutual funds were hugely successful at gathering assets. In the 2000s, though, arose the ETF industry. It was a lower-cost instrument and had the very attractive feature of intra-day trading, which mutual funds do not. The asset-gathering combine that arose eventually collected more indexed dollars than there were actively managed dollars. That changed how prices were determined. Each new ETF dollar had to go toward buying more of the very same indexed company shares. With new dollars always coming in, ETFs became the marginal price-setting buyer of what they already owned. Thus did the business end of indexes, the ETFs, cross over from passively *participating* in the price discovery, to having a hand in *making* the prices.

Which is kind of weird. You once knew if your stocks were expensive or performing relatively well because they could be compared, arms-length-basis, to the whole market. But now the market price is partly set by the index's associated ETFs as a profit-making business, not merely as a measuring tool. How can you reference the S&P 500 as a benchmark when the ETFs are the ones setting the benchmark?!

Other scale-based distortions came about. Out of practical need, the ETF organizers changed the rules of security inclusion to accommodate the trillions of dollars they had to handle. It was unworkable to try to include companies that were too small or didn't have enough share-trading liquidity. That created an artificial bifurcation of winners (index constituents) and losers (the excluded class of companies). The losers had less access to fund flows, which impacted their cost of capital, and received less research attention, all of which suppressed their valuations. (We have reason to like that, though—more of which later.)

That money influx also created a self-reinforcing cycle whereby the largest, highest-weight constituents received a disproportionately larger share of new ETF inflows. The indexes became less and less representative of the broad economy. You don't need an MBA to know that the makeup of U.S. GDP does NOT look like these S&P 500 index weightings. Does anyone think the mix of corporate activity in the accompanying sidebar is what supports the formidable economic power of the U.S.? Here are some of the index weightings. Reflect a moment upon how large those economic sectors are—not how big the companies are, but where the populace spends its weekly and monthly money even if indirectly through intermediate goods and services.

U.S. GDP Profile, according to the S&P 500:

- *3% from Energy (that's Oil & Gas Exploration; Refining; Storage & Transportation, like pipelines; etc.)*
- *5% from Consumer Staples (that would be Food & Staples retailing like Costco, Walmart, drugstores; the Food Products companies themselves, like General Mills; Beverages; Household Products like Procter & Gamble; Personal Products; etc.).*
- *6% from Consumer Discretionary (need more be said than: Automobiles, household furniture, electronics, apparel, hotels, restaurants, media & entertainment, retailing, and beyond?)*
- *But, 49% in Information Technology!! Or should that be a question mark instead of an exclamation point? Is 49% of the economic output of the entire U.S. really and truly from the services of Meta and Google and Nvidia and their cohort? Or anything remotely close to that figure?*

Whether this misallocation of investment capital will have a remunerative outcome or be a tale of woe is not germane to this discussion. The point is that the market indexes have long ceased to be the holistic solution for the financially uninformed, for Main Street as Mr. Bogle would say. How are non-professionals equipped to select from thousands of ETFs, including leveraged sector and single-stock ETFs, when the intent was to provide a simple, low-selection-risk long-term asset allocation vehicle? “Long-term” is the operative concept, and what paradoxically joins us to John Bogle’s vision of indexed investing. The original experiment was undone by its own success as a good idea.

Our Commonality With Indexation: John Bogle Style

I had the honor of debating John Bogle about active vs. passive management—and the friendliest debate it was—at a Grant’s Interest Rate Observer event in 2017. As I said in my opening remarks:

I came here to do “debate.” Except I ran into a problem. As I review your writings and interviews about investing and the markets I realized I basically agree with 95% of what you say; we’ve conducted some of the same research and drawn some of the same conclusions, and written or said the same things.

Subject to one condition, we even share common ground on the active/passive point of debate. Because, when I listen to you, I realize I don’t have to think from a public policy perspective—my clients can afford access to consultative resources. You think deeply about public policy. And with that condition, I found I agree with you: Main Street, the little guy and gal, need basic, safe modes of investing, protected from what they don’t know and from the predations of Wall Street. We’ve written and said as much ourselves, albeit from a different vantage point.

I went on to observe how that model of paternalistic altruism had lately fallen victim to the unintended consequences of Vanguard’s success in driving down management fees. Once the ETF market began to take off after the mid-2000s, it couldn’t live on 3-basis-point fees, even if investor-owned Vanguard could. The ETF providers began to dismantle the experiment—bringing investors right back to square one—by balkanizing the holistic market index into ostensibly value-added strategies like country-specific or industry- or style-specific funds for which they could charge 20x more. It is toward the 85-basis-point funds that their marketing prowess drew new investment dollars.

Horizon’s essential concord with John Bogle’s investment philosophy was that the great power of compounded earnings growth could not be achieved except by holding to a very long-horizon, unbroken chain of it—“staying the course” in his everyman tongue. His vehicle of choice for his constituency was a whole-market index. Our choice for ourselves and our clients is to identify the rare business models that can sustain such a long period of high-order financial compounding.

Peter Doyle recently described the John Bogle/Vanguard creation story, along with some other misunderstood modern portfolio theory creation stories, like the development of security price volatility (standard deviation) as the appropriate measure of risk. His observation was about how mechanistically such practices are followed once they become institutionalized. Not much thought is now given to how and why they were created and if they even—if looked at squarely—make sense.

A Side Note on the Birth Pangs of Indexation:

John Bogle didn't set out to democratize equity investing as a societal good. Hired out of university by Wellington Management, he wanted to be a superior active fund manager, and publicly disdained buy-and-hold strategies. Within 15 years, he was President. This was near the final years of the Nifty Fifty bubble, on the heels of a merger he orchestrated with a Go-Go growth fund group that was riding that bull market. The conservative Wellington, with its allocations to bonds and preferred stocks, naturally lagged the market, and Bogle led it into high-growth, high-profile companies with P/E ratios about twice that of the market. In 1970, at 38, Bogle was appointed CEO. In 1974, amidst the Nifty Fifty bear market, he was fired. Those bluest of blue-chip growth stocks declined 40% from their year-end 1972 high to their year-end 1974 low.

Bogle negotiated hard to stay in the mutual fund business, countering a buyout offer from his Wellington partners with his own proposition. He proposed that Wellington could lower its cost structure by selling him its internal mutual fund administration operations, which he would turn into a low-cost provider by mutualizing so as to be owned by its unitholders—becoming a non-profit institution. This became Vanguard. But, he was restricted by the Vanguard charter from providing any investment services to those funds, from actually managing money. Nor could he own any of the profits, only be a salaryman. In a sense, he was stuck. But not without ideas and some necessity-based inspiration.

Bogle saw a twinned opportunity: Actively managed funds underperformed the S&P 500 index by well over a whole percentage point, yet, as a mutualized fund administrator Vanguard had a far lower fee structure. Plus, who would possibly compete with him on a cost basis? Any such person would have to forego profit participation and likewise settle for a salaried position like Bogle was forced into.

The bigger challenge: Bogle needed to scale up and raise more assets, but how to skirt the non-compete restrictions of his Wellington agreement, which forbade him from managing a fund?

He could do it if he created a fund with no investment management. How is that even possible? Seemed like a contradiction in terms. By, simply, a passive replication of the S&P 500 index. He had a competitive cost advantage, was pretty sure he had a going-forward performance advantage, and was very sure he had a marketing advantage. It was a big business idea and a laudatory de facto public policy idea. But there was sausage-making, too.

Which brings us to why we've produced our own ETFs (of the active variety)

Some Horizon clients prefer an ETF structure, or for various reasons can't open a standalone account and require an ETF. Other prefer the ETF model but are restricted from doing so and therefore do open individual accounts. Meaning that an ETF can be a valuable tool to access one of our strategies.

It might also offer differentiated portfolio exposure; we wouldn't bother if we thought otherwise.

Example: the sum total of all the holdings in the **Inflation Beneficiaries ETF** that are also S&P 500 constituents amount to a 0.57% weight in the S&P 500 and 0.59% in the Russell 1000.⁵ Excuse me for a moment...!!!

If that is a fair indication, then most equity investors lack countervailing exposure to the risk of commodity price inflation, which is one of the principal few systemic risks to the stock market—meaning the ones it’s very difficult to avoid or diversify away.

The looming shift in the supply/demand imbalance of the past decade—from an oversupply condition—runs across global hard commodities: oil and ultimately natural gas, iron ore, copper, and other electrification metals like cobalt and lithium. These raw inputs infuse every facet of the economy, which means that higher prices in these commodities can be particularly inflationary for the general price level. Price increases can degrade profit margins throughout the companies in the index.

Moreover, even if such price increases don’t seriously impact the CPI, there is great optionality in localized inflation in individual resources, sometimes geographically localized as well. Might as well add in land and water. The S&P 500 will not benefit from that optionality to any measurable degree.

The *disinflationary* era had its day, if that’s not a Yogi Berra-ism. The *inflationary* era is not quite here. That’s a curve that’s nice to be ahead of. At the very least, the Inflation Beneficiaries ETF is a form of completion fund: providing what the index is missing. We think it’s more than that, relative to what passes for but isn’t actually an inflation hedge, like mining and chemicals companies. We think it’s a better mousetrap.

Another valuable function that a Horizon Kinetics ETF or other fund can provide for us is exposure to an otherwise inaccessible market or which would not be well-executable as a sub-strategy of individual holdings within a client account. *Example:* In Japan, as elsewhere, ETF exposure is typically limited to the large- and mega-cap companies. Those are usually global in scope and generate much or most of their revenues outside their home market. There is little direct exposure to the companies that form the local economy, and which might be quite vibrant and undervalued.

In Japan, we have two distinct and entirely local strategies that operate beneath the indexed large-cap umbrella that asset allocators believe provides diversified exposure to the Japanese economy. One of them is the **Japan Owner Operator ETF**. The other—the **Japan Special Opportunity strategy**—buys publicly traded captive subsidiaries of corporate parents that the government is determined should be made independent or be wholly taken private. That’s the value recognition catalyst. As to the value part, many of these subsidiaries are priced at classic Graham and Dodd style discounts, and bit by bit they are indeed being acquired at substantial premiums. Sometimes the parents are undervalued, too. In this case, we *wish* we had an ETF! So far, clients open a separate investment advisory account in which the few dozen positions are individually purchased.

Hopefully that answers the question as to whether our often-robust criticism of the ETF industry, or at least aspects of it, is categorical as opposed to just evaluative and pragmatic.

⁵ As of June 30, 2026. Calculated against the iShares Russell 1000 ETF and iShares Core S&P 500 ETF.

Our Gratitude For Indexation, Industrial Style

Thank goodness for the market-structure-distorting impact of ETFs. The ranks of company analysts have been decimated these past 20 years; those who didn't leave the business shifted to be ETF and asset allocation analysts. Less competition for us.

The active rejection of smaller-cap companies, of companies that don't fit standard business models, or which reduce their trading liquidity through share buy-backs, means that they are not being efficiently priced. Or maybe they really are; maybe they reflect exactly the liquidity risk discounts and the uncorrelated performance risk discounts that the ETFs as price-makers impose.

But since *we* don't consider those to be risks, maybe the lunch *is* free.

Example: It shouldn't be feasible to be able to buy one of the fastest growing **Asian airports** at a discount to book value and a single-digit cash earnings multiple when the typical publicly traded airport company—including a comparable-region airport company—trades at an EBITDA multiple of about 25x.

In this case, the airport company is a wholly owned subsidiary of another company that is in a different industry, and the parent has a market value of only several billion dollars. Making matters worse, about half of the parent company shares are held by, in turn, its own larger parent company, so the float-adjusted market cap is smaller still. And it is illiquid; one can only buy a relative handful of shares at a time, so it would be a very lengthy process for any institutional buyer to establish even a miniscule position. And impossible to exit rapidly unless they were willing to crater the stock price.

We like it, though. Airport companies trade at high valuations partly because they have usually have little direct competition, having long-term government-granted operating jurisdictions. They have significant investments in property and plant, but generate high operating margins, on the order of about 30%, as a mid-point. They are fairly stable businesses and have many ways to create more value through the real estate they are usually granted for development around the airport itself, such as for hotels, convention centers, and the like.

In any case, this one is uncommonly cheap. And that's because in the ETF era the market does not care that a wrong-shaped micro-cap company without a proper industry designation has a subsidiary that is growing like a weed, is worth more than its parent company, and for which an IPO may well feature in the foreseeable future.

There are any number of other portfolio holdings that are of too high a quality and too deep a discount to make economic sense in a healthily functioning market. Unless we're missing something and courting NFL risk (No Free Lunch risk), which seems to be a universal constant across all sectors of life. But if we're not missing something, if the reason for the anomalously favorable pricing is either a separate or joint operation of EYC and ETFD factors, then we'll earn a free lunch. Those acronyms are for:

- The Equity Yield Curve, which operates when the timing of value realization of a security is just too far away or too indeterminate for the short-term relative-return-based asset-management class; and
- The ETF Divide we've been discussing, which imposes discounts on companies for entirely non-economic or non-fundamental risk reasons.

Other such holdings—for illustrative use—could be **AutoNation** and **Penske Automotive Group**.

For instance, why would a company that increased its per-share earnings since 2000 by 13.7% a year trade at 11x net income? Why would another company that increased its 15-year earnings per share by 14% trade at a P/E of 11x? In the cases of AutoNation and Penske, whose stock market values are \$7 billion and \$11 billion, AutoNation has repurchased 58% of its shares via free cash flow in the past 5 years, (which is entirely the wrong direction relative to the expanding trading liquidity needs of ETF organizers). Penske’s inside-ownership is over 50%, so the float-adjusted market cap is only half that \$11 billion.

At over \$11 billion, the two smallest-cap companies in the S&P 500 are larger than Penske and have weights of 0.1% and 0.0%. Moreover, another 20% of Penske’s shares is held by a Japanese company, Mitsui, so Penske’s float, despite an \$11 billion market value, is more like \$3 billion. And Penske has bought back 18% of its shares in the past 5 years. Interestingly, if the company buys back 2.5% of its total shares each year, that’s more like 7.5% of its publicly traded shares.

Note: Last week, subsequent to the writing of this paragraph, Penske Automotive—the publicly traded company—received an offer from the privately held Penske Corporation and Mitsui & Co. to buy the remaining 17% of the shares they don’t yet own. This proposal will now go through the standard independent special committee review process.

AutoNation and Penske Automotive Group

	EPS			P/E
	2011	2025	Ann % Change	
AutoNation	1.91	17.04	15.7%	11x
Penske Group	1.94	14.13	14.2%	11x

	Shares Outstanding (mm)		% Change
	2020	2025	
AutoNation	83.5	35.2	-58%
Penske Group	80.4	65.8	-18%

IPOs and Us

Similar to the question about why we’ve changed our stance on ETFs, the second question is why we’ve changed our stance on IPOs. The answer is much the same; we haven’t.

It remains true that a decisive majority of IPO share prices finish lower than where they started. There are evergreen financial incentive and social finance reasons for this, most of them intuitively logical. While the precise IPO performance figures depend on the selection and calculation tradeoffs that shape the methodology of any given study, the results are mutually consistent. Using an academic-provenance study, for the 9,000-plus IPOs over the 46 years to 2021, three years after their IPO, 56% of those companies were lower than their IPO price. For people who bought shares at the end of the first day of trading, the figure is 60%. After five years, the figures are a bit worse.⁶

The confusion in the IPO question is one of language: the challenge of communicating non-unidimensional thoughts clearly. This goes right back to the opening remarks about how many questions can be answered satisfactorily in a brief-answer format. Still, let’s keep this one short.

If we participate in an IPO, the decision is definition-agnostic. It’s about the business and valuation analysis. Not that we can’t be wrong about any given company, but that’s the difference. The label or form is

⁶ Initial Public Offerings: Updated Statistics Jay R. Ritter Eugene F. Brigham Department of Finance, Insurance, and Real Estate Warrington College of Business, University of Florida, July 7, 2026

irrelevant; we're particular about the substance. Most IPOs are decidedly unattractive; they've been engineered to be sold to the public.

Example: mentioned earlier was an IPO that might happen within the body of another company, and that the available data show that both the subsidiary and the parent are demonstrably and almost certainly unsustainably *undervalued*. This is the mirror image of the typical IPO risk/reward proposition. This particular IPO would be a value realization catalyst within a client portfolio.

An IPO in which many of our strategies recently participated was **LandBridge Corp** in July 2024, anchored by Horizon Kinetics. Our connection with LandBridge as a private company was through our long association with TPL and other adjacent property transactions in the Permian Basin. LandBridge management understood through our history that we both understood their business and would be long-term holders of their shares.

LandBridge embodies just the sort of rare hard assets, profitability, and business persistence that we seek. It now has over 300,000 acres of strategically assembled surface acres in the Delaware Basin of Texas. It is from that land position that its current and future revenues will emanate. Its core business for the time being is leasing its land for water transportation, treatment, and remediation purposes, which largely manifests in a royalty-like fee based on the volumes of water that are either piped across its acreage or stored in its subsurface pore space.

There is an unusual inherent and rather high level of passive growth and inflation-beneficiary element to LandBridge. The unique hydrogeology of the Delaware Basin, which is the remains of an ancient inland sea, means that as wells age or get deeper, greater volumes of brackish water come up the well with each barrel of oil. Presently, that averages about four barrels of water per barrel of oil. By 2030, the estimate is for a six-to-one ratio. The progression from four to six barrels amounts to about 9% annualized water volume increases, even without expansion of oil output by the Chevrans and ExxonMobils—which, in fact, is expanding—and absent any active growth efforts by LandBridge.

Moreover, the company's water handling and storage contracts, which typically run for 10 years, contain inflation escalators. Based on typical inflation indexes like the CPI, one can already anticipate 12% or greater revenue growth, which requires no capital spending on Landbridge's part. Then, as demand for pore space increases in future years, new contracts are likely to be priced higher than the current roughly \$0.11 per barrel, which would add to the revenue growth rate.

Looking forward, LandBridge was the first company to introduce the concept of "powered land" as a strategy to facilitate the development of private power generation, transmission and ultimately large-scale data centers. LandBridge's contiguous surface land has the latent potential to capture developments from the data center itself, related roads, power lines, wind and solar, carbon capture, and water, all of which generate recurring, high-margin "royalty-like" revenue streams. It's important to note that because LandBridge acreage sits above a significant aquifer, the company can supply necessary water to the oil and gas drillers. Aquifer-based source water is priced in the \$1/barrel range, though some of the gross revenue is shared with water handling companies that extract it from LandBridge's acreage. Again, LandBridge takes a royalty-like interest in it.

So, yes, this was an IPO, but no, it was not of the typical IPO character. It was precisely the type of asset and business character we believe a portfolio should contain.

The few other IPOs we’ve participated in, lately, such as WaterBridge and White Hawk Minerals, also share the type of qualitative and valuation characteristics that suit our selection criteria.

Compounding and Us

This is what I wanted to get to. Because now, care of a Horizon Kinetics analyst, we have a better—certainly a different—way to explain the power and, most important, the TIME function of compounding. In the client relations part of the portfolio management biz, expectations and edification loom large: hardly a Quarterly Commentary or roundtable passes without a pressing question being a variation of “Is it time to sell?” or “Why haven’t you sold?” Usually asked when a particular stock is up or down a lot; often the same stock from year to year, and sometimes from decade to decade.

Our responses tend to be in word language form—analogies, metaphors, pictures. A fresh sample of which follows. But, on occasion, a bit of math can add clarity to otherwise mostly qualitative notions. In a recent research meeting, while we all were discussing how to again explain the periodic and (for us) anticipated decline in bitcoin relative to its long-term expected value progression, one of our analysts began wondering if the recent questions might be addressed with an “intuition pump,”⁷ so to speak. A single, simple mathematical function whose properties seems to describe the price of bitcoin—and, surprisingly, all sorts of other things, like the size of snowballs and the price of Amazon stock!—quite well but whose properties, through no fault of our own, are not intuitively obvious. A function that would explain why people have such difficulty truly “getting” the extraordinary benefits of WAITING for the cornucopian rewards of long-term compounding.

First, though, another language- and picture-based version.

The Repetitive Language Model (RLM) of Compounding

Near-term volatility looms large in the mind and jangles the nerves. Someone recently pressed me about “What is the matter with TPL?” He felt something was amiss because the share price was down 30% from its all-time high. I responded that TPL has been down many times during the three decades that he’s owned it. He responded—and he is a talented securities analyst and fund manager in his own right—“Yeah, but not for this long.” Of course, I had to look.

In just the past eight years, TPL has declined by between 40% and 53% on four separate occasions. Despite those dizzying drops, the shares today are up 4-fold from their high of eight years ago.

Intra-year price swings of that magnitude are statistically normal for almost any stock.

Just the Past Eight Years – TPL

Dates	High	Low	Decline	Duration
11/24 – 12/25	\$583	\$278	-52%	13 months
11/22 – 6/23	304	140	-53%	7 months
4/21 – 1/22	186	110	-40%	9 months
9/18 – 12/18	<u>97</u>	<u>47</u>	-51%	3 months
Total Change (9/18 - 7/26)	4.1x	8.3x		

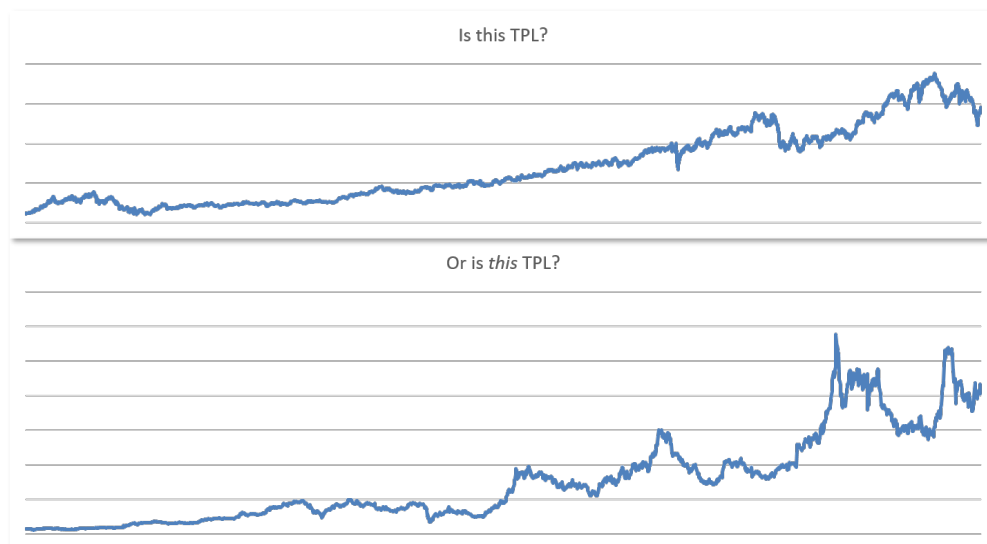
⁷ [Amazon.com: Intuition Pumps And Other Tools for Thinking: 9780393082067: Dennett, Daniel C.: Books](https://www.amazon.com/Intuition-Pumps-And-Other-Tools-for-Thinking/dp/9780393082067)

MARKET COMMENTARY

2nd Quarter 2026

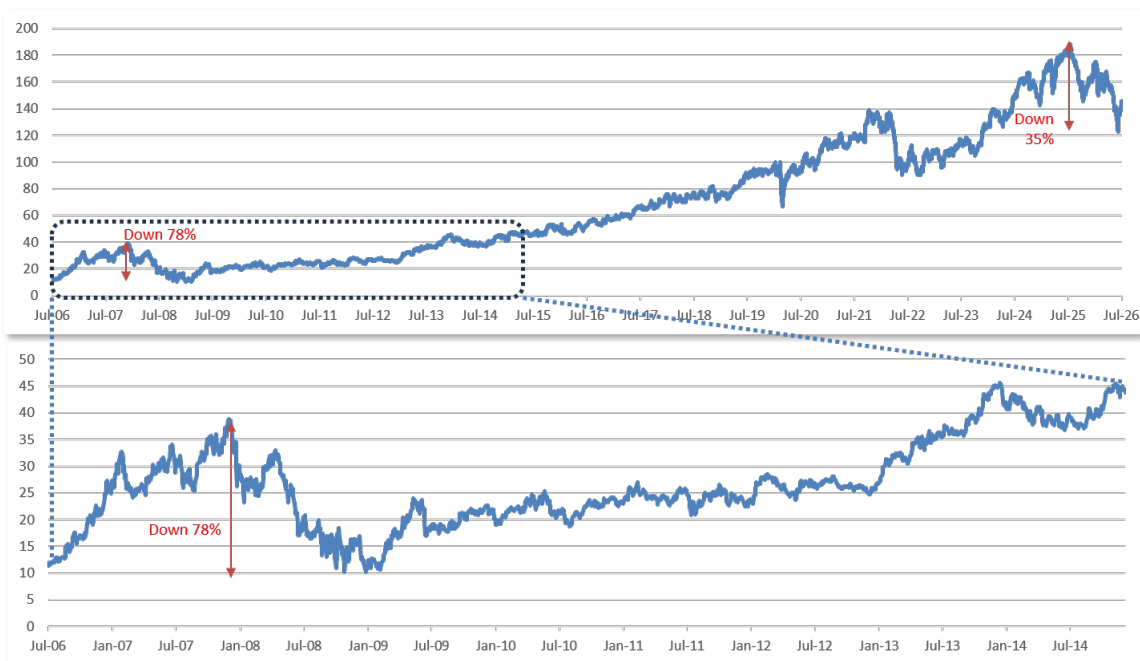
July 2026

Fun exercise: Is this TPL, or is this TPL? Which is the pretender in these long-term charts?



Source: FactSet. TPL constitutes a large holding in many of the accounts and funds managed by HKAM and is also a substantial holding on behalf of the officers and employees of HKAM.

Before the answer, take note, below, of the left-hand portion of the top chart. Until the very obvious recent volatility, the early years show a relatively smooth upward rising curve. That's a mirage, a misimpression wrought by time and compounding.



The bottom chart magnifies a short period from a decade and a half ago. It shows that the volatility then was no different than today. This is like a fractal in mathematics. The share price dropped almost 75% over about a year, far steeper than the visible and very steep declines of the recent past. Imagine the discussions that were had!

MARKET COMMENTARY

2nd Quarter 2026

July 2026

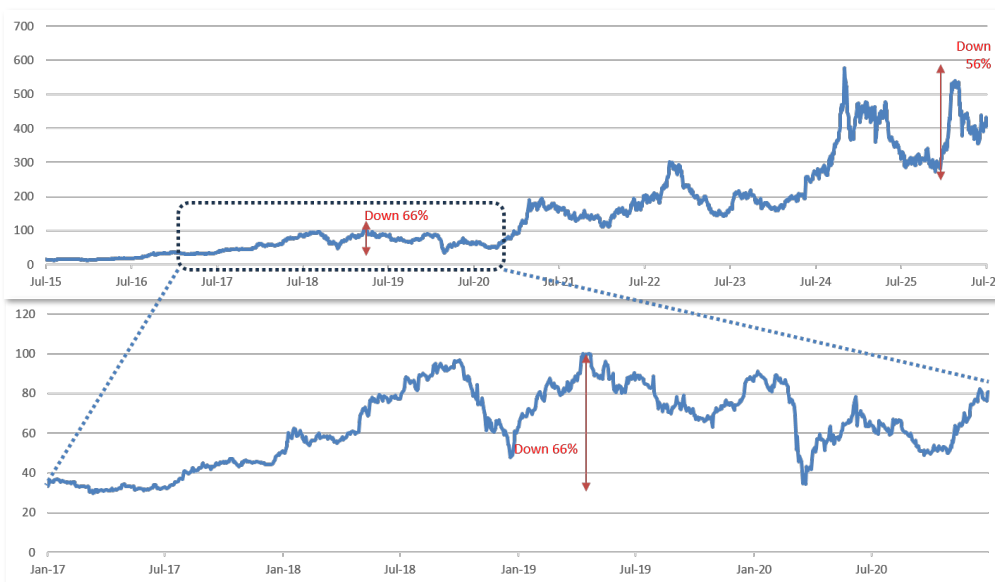
As to the other company, which might or might not be TPL, the similar two charts—the look-back view of volatility vs. the in-the-moment view—look like this. The mild-seeming look-back version was in fact a 66% price decline, also over about a year and change.

Without the tools of business model and valuation analysis and an appreciation for the time element in the compounding class of investments, one has only stock price behavior as a reference point. But, if you can believe your lyin' eyes and these charts, short term price behavior offers no predictive information, and using price as a decision-making tool is likely to lead to the wrong long-term outcomes.

These two companies have little in common with one another in the indexation or asset allocation world. They don't share the same industry and they're not in the same market cap class. What they do share is a fairly high degree of financial compounding over an extended time frame. The failure to easily recognize their decade-old volatility without the aid of these nifty charts is the pattern-recognition-failure of a brain evolved for the physical world of the veldt and the steppes.

It's a good brain for spotting a charging lion in the first place (a sudden pattern change at the edge of the grasses) and for judging how fast the lion might catch up with you (because acceleration or compounding of speed stops after a few strides, so was never a real issue). Our brains have trouble with geometric—as opposed to arithmetic—functions and with extended time frames that are below our sensory or neuronal excitation threshold.

Over a long enough stretch of compounding, what was once an alarmingly high bout of volatility becomes attenuated to the point of being a blip on a chart. The companies are **Intercontinental Exchange** and **Texas Pacific Land Corp.**



Source: Factset

MARKET COMMENTARY

2nd Quarter 2026

July 2026

A not infrequent question: Why we don't just sell at these periodic highs and buy something else? A vibrant and lengthy debate could be had on the efficacy of this proposition. This table illustrates one of the many risks and costs entailed when breaking a compounding chain in pursuit of such an active and presumably repeatable trading tactic over a long time frame.

In this instance, you sell a holding that has appreciated by many multiples above its cost in order to buy a new security that after much analysis and review is believed will grow at a rate 25% faster. You pay your gains taxes and reinvest your post-tax 85¢ on the dollar in the new company.

Lo and behold, it turns out you're right. The new company does grow 25% faster. You won't find out if you're right, though, until year seven. That's how long until, being that skilled or prescient or lucky, you break even and start to do better. The more interesting question is whether you will have held the second stock long enough to find out. It takes a lot of time to develop excess value through growth. It's a perpetual challenge.

To quote two of our co-founders:

Peter Doyle recently said, "The hardest temptation to resist is to trade something good for something average."

And about a decade ago, Murray Stahl wrote, "Although it might seem hard to believe, patient inactivity is hard, demanding, and exhausting work."

The idea of a better way to explain this is what everything before this sentence has been leading up to.

A Math Model of Compounding – From a Water Glass to a Snowball, to Amazon and Bitcoin

The following is a four-sample series of familiar yet seemingly unrelated real-world phenomena. It was authored by the aforementioned analyst. The simulations run from the simple to the complex, yet with a startling sameness or universality about both the actual power of the almost cliché term "power of compounding," and its confounding and sometimes misleading nature to those of us without the conceptual and quantitative tools to define them.

To hew to our 90-minute limit, this analyst's eloquent and wry description of the inquiring train of thought that led him to this exercise is appended to this Commentary. It is commended for your reading.

Each of these exercises is about the different rates at which A) time passes and B) value compounds. Time progresses in a linear, arithmetic way: count the seconds or years; the rate of the ticking of the clock doesn't

	Original Holding	New Holding
Future Growth Rate	12%	15%
Higher Growth Rate by		25%
	Stay On Course	Turnover
	Keep Original Holding	New Holding w/ post-tax proceeds
Years to Catch Up	\$100,000	\$85,000
1	112,000	97,750
2	125,440	112,413
3	140,493	129,274
4	157,352	148,666
5	176,234	170,965
6	197,382	196,610
7	\$221,068	\$226,102

For Illustrative Purposes Only. Past performance is not indicative of future result.

change. Value compounds geometrically: slowly at first, then eventually at a rapidly rising rate. When the two are paired, our experience of them can be woefully distorted if we don't know HOW that happens.

Waiter!!!

This exercise takes place sometime in the future when waiters no longer fill patrons' water glasses. That task is done by carbon-based nanobots, molecule-sized and invisible, which precipitate water from the air. It's all the rage in uber-fancy restaurants. At the bottom of each glass is a starter portion of nanobots-as-waiter, which fill the glass over the course of about an hour. To be precise, 64 minutes: their population ingeniously doubles every 8 minutes, so the process starts slowly while patrons are still looking about and sampling the varietal olives, and have yet to work up a thirst, and finishes after eight generations or time steps.

The evening at Table 2 goes like so: In time step 1, less than 1% of the glass has been filled. In time step 2, that doubles to nearly 2% filled, and then to 3%. The pace does pick up, doubling again with the next generation so the glass is 6% filled at time step 4. But half, 50%, of the hour has passed and the whole table walks out in a huff, because they see the glass as essentially empty. At least with respect to the amount of water, which is what they were focused on. But on a time basis, the glass is half full.

Table 5 is more patient. The couple there waits until time step 7 of 8. They're 88% of the way there in terms of TIME, or 56 minutes, and ONLY ONE TIME STEP AWAY from the end. But their glasses are only 50% full! The service is awful! They take their leave, too. The remaining 50% of the water fills the glass in the final time step, the last 12% of the remaining time. If only they'd waited for the whole 64 minutes.

The Amazing Nanobot Restaurant Water Glass Filler			
function 2^t	time step	% full	
	8	100%	
	7	50%	
	6	25%	
	5	12%	
	4	6%	
	3	3%	
	2	2%	
	1	1%	
	0	0%	

50% of the water delivered in the final 8 minutes, or 12%, of the hour.

The service here is awful! Time: 88% of the way. ONLY ONE TIME STEP AWAY...but still only half full.

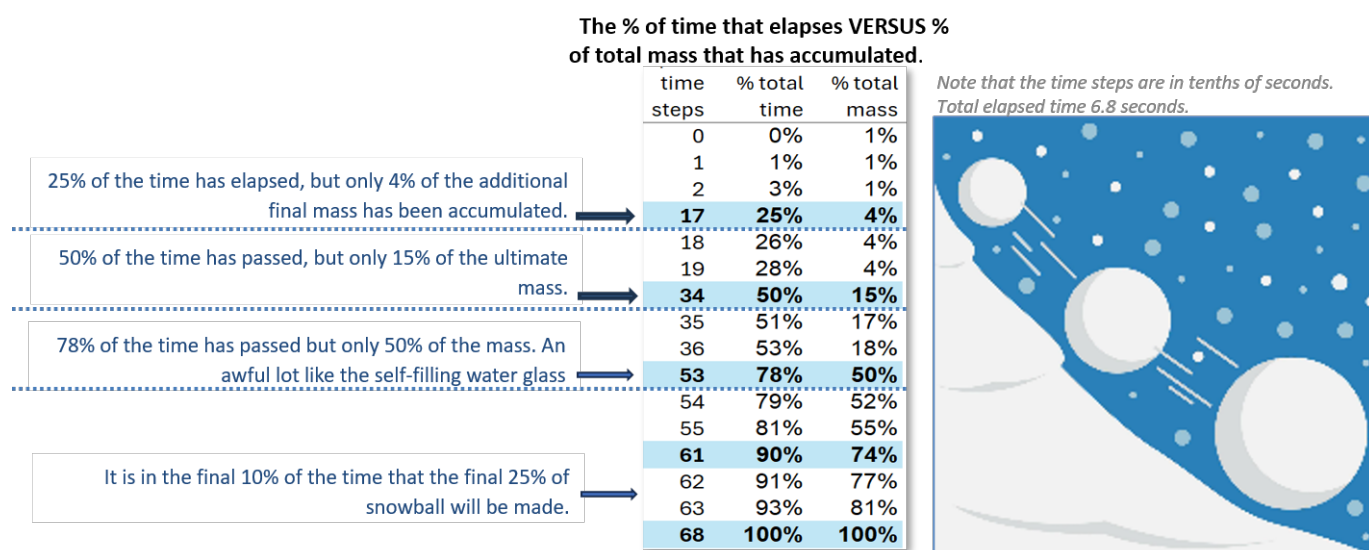
Fully half of the TIME elapsed, yet only 6% full. So, is the glass half full (time-wise) or essentially empty?

The value progression in this case was an exponential function, 2^t , or to the power of each time interval, which is not linear: Its rate of change, volume per unit of time...changes. Restaurant Tables 2 and 5 were watching the contents of the glass, like a stock price or an account statement balance. If they knew of the operative function, they would instead have been watching TIME. Linear models train us to watch time OR price, with the idea that one time step should equal one price step or vice versa. But compounding doesn't work that way.

Snowball Fight

In this exercise a cartoon snowball—which is to say idealized for our purposes by ignoring friction and such—rolls downhill, picking up volume and mass with each rotation. It accelerates more slowly than, say, a stone dropped from a building, because the formula uses a 20-degree slope. Unlike the hour required for the water glass to fill in a futuristic restaurant, this snowball, which starts at a few pounds, takes only 6.8 seconds to reach its final almost 3-foot width and 200-plus pounds. Only 6.8 seconds, but long enough to reach 36 miles an hour (or for a stone to fall 50 stories).

The accompanying table divides each second into tenths, so there are 68 time steps. For visual ease, most of the intermediate time steps have been hidden. Of the many fascinating aspects of this series, the key thing to notice—which you probably couldn’t in just seven seconds watching a real snowball—is this:



For Illustrative Purposes Only. Most of the rows in this table have been hidden for ease of viewing, except for those immediately around the notable time and value stops.

Strangely similar to the water glass: at the halfway point in time,⁸ only 15% of the snowball’s ultimate mass has been accumulated.

At the 78% of time mark—or at 5.3 seconds—the snowball is only 50% of its final weight. Or, 50% of the weight “return” happens in the final 22% of the time horizon.

At the 90% time mark, the snowball is less than three-quarters of its ending mass. Rephrasing, 25% of the final weight accrues in the final 10% of the time, between 6.1 seconds and 6.8 seconds.

⁸ Though the water glass filled as an exponential function, not a power law function.

MARKET COMMENTARY

2nd Quarter 2026

July 2026

Amazon.com is a Snowball

This next exercise is straight out of real life, comprised of strictly and obviously arms-length data, no simulation. These are the closing weekly share prices of Amazon.com from its very first week of trading in May 1997 through April 2026, all 1,512 prices. As before, most of the rows in this table have been hidden for ease of viewing, except for those immediately around the notable time and value stops.

	Share price	% total time	% total "mass"
5/12/1997	\$ 0.09	0%	0%
5/19/1997	0.07	0%	0%
5/26/1997	0.07	0%	0%
8/29/2011	10.50	49%	4%
9/6/2011	10.57	49%	4%
9/12/2011	11.97	50%	5%
9/19/2011	11.18	50%	4%
9/26/2011	10.81	50%	4%
11/26/2018	84.51	74%	32%
12/3/2018	81.46	74%	31%
12/10/2018	79.60	75%	30%
12/17/2018	68.87	75%	26%
12/24/2018	73.90	75%	28%
6/1/2020	124.15	80%	47%
6/8/2020	127.25	80%	48%
6/15/2020	133.75	80%	50%
6/22/2020	134.64	80%	51%
10/14/2024	188.99	95%	71%
10/21/2024	187.83	95%	71%
10/28/2024	197.93	95%	75%
4/20/2026	263.99	100%	100%
4/27/2026	\$ 265.25	100%	100%

For Illustrative Purposes Only. Past performance is not indicative of future results. Most of the rows in this table have been hidden for ease of viewing, except for those immediately around the notable time and value stops.

User note: Not to ignore the obvious, a stock price is highly variable in the short term even if it will follow a long-term expansion slope. At any of the highlighted time and price stops, temporarily lower prices will be found thereafter. Because this is not, after all, a simulation of a power function. just an observation of one.

Interesting, these tables, huh?

Bitcoin is a Snowball...but then, it was designed that way

This is as simple, in its way, as the Snowball and Amazon exercises, but can be far more intriguing and useful. Carry this exercise forward and it suggests a reasoned expectation of what the price of bitcoin might be at the next obvious time stop, the next halving in 2028—which will be discussed a little more fully later.

This bitcoin table uses daily prices since Jan 2009, so about 6,300 time stops. This time, we'll eliminate all the rows except the handful of now familiar reference points. As was the case with Amazon, these are real-world prices, so they come with interim volatility around the long-term slope. Nevertheless, the results are closer to identical than one could reasonably expect. Particularly given that one is a mass market retailer-slash-IT cloud & AI data-center hyperscaler, while the other is still a point of debate as to whether it's a commodity or security, a true persistent money, or a bubble-as-passion-project by crypto enthusiasts.

MARKET COMMENTARY

2nd Quarter 2026

July 2026

At 50% of the way from inception to the present, bitcoin's price was only 6% of the recent price level; for Amazon it was 5%. At the 75% time mark, bitcoin's price was 47% of the recent level; for Amazon the time and price figures were 80% and 50%. A remarkable consonance.

	Time (days)	Bitcoin Px. Approx.	% Total Time	% Total Mass
1/3/2009	-	\$ 0.00	0.00%	0.00%
1/4/2009	1	\$ 0.00	0.02%	0.00%
1/5/2009	2	\$ 0.00	0.03%	0.00%
5/3/2013	1,581	\$ 102	25%	0.1%
9/1/2017	3,163	\$ 4,881	50%	6%
8/11/2020	4,238	\$ 11,213	67%	15%
1/22/2022	4,767	\$ 35,403	75%	47%
8/4/2024	5,692	\$ 59,136	90%	78%
6/17/2025	6,009	\$104,392	95%	138%
4/29/2026	6,325	\$ 75,655	100%	100%

50% of the total time, but only 6% of total ultimate "mass"/price.
Amazon was 50% and 5%!!

75% of the total time, but only 46% of total ultimate "mass"/price.
Amazon was 80% and 50%!

At 90% of time, final 23% of value remains. In June 2025, at 95%-time mark, the price spiked above the end price.

The end price still tracks the progression curve from prior time mark.

For Illustrative Purposes Only. Past performance is not indicative of future results. Most of the rows in this table have been hidden for ease of viewing, except for those immediately around the notable time and value stops.

From this point forward, Bitcoin and Amazon part company.

First—and this applies to both of them—unlike the water glass or snowball, there isn't a near-term limit to their value progression. They have a future beyond the number of rows in those spreadsheets. And for both bitcoin and Amazon, this geometric progression can be used to suggest what their prices might be in the future. That's only theoretical, though.

In reality, Amazon's capital spending for AI data centers is rising dramatically, it has just about transitioned from free-cash-flow positive to negative, and it's begun to engage in large-scale borrowing. These are changes from its prior business profile and capital allocation practice. Will these changes conspire to degrade the rate of its actual future financial progress or its long-term valuation multiple (from the current-year P/E ratio of 36x)?

In bitcoin's case, that slope of value progression is known and predictable, as defined by its programming: the cost of production is designed to double every four years by halving of the amount of bitcoin reward paid to the miners. Doubling every four years entails a 19% annualized increase in production cost, all else held equal. And the iron law of supply and demand dictates a price at least as high as production cost so long as people (any people, some people, the world) would like to own it or use it. Otherwise, the miners have to close up shop, and no more bitcoin or blockchain.

In another section, as soon as we answer another couple of client questions—about the precious metals royalty companies and the fear around recent new-trading-venue threats to the securities exchanges—we'll test both what the formulaic expectation of the bitcoin price should be in two years at the next halving, and compare that with what the raw mining economics suggest.

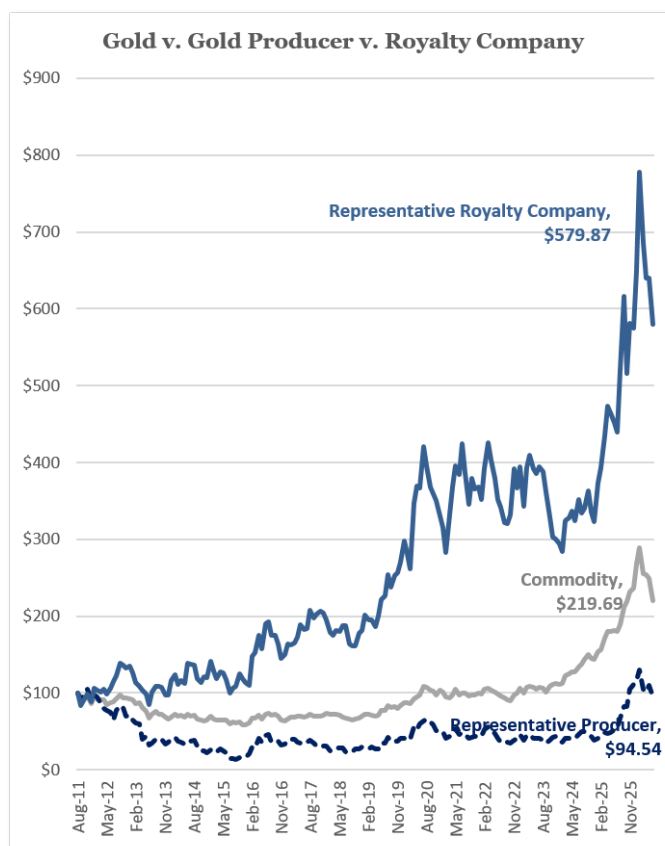
Why Did We Reduce or Sell Precious Metals Royalty Companies?

Many have asked why we have chosen to reduce our positions in the precious metal royalty companies. Perhaps the best way to answer that is to revisit why we purchased them in the first place.

Some Then-and-Now History

In the years following the financial crisis, from year-end 2008 onward, global interest rates were set at effectively zero and many governments were running extreme deficit spending programs—a very accommodative environment for the price of gold. It rose approximately 100% to ~\$1,900/oz at its 2011 peak, only to fall to less than ~\$1,100/oz at the 2015 low.

The low in 2015 is notable, as this gold price was lower than the cash cost of production for a meaningful percentage of the sector. Many mines operated at a loss or were barely profitable, causing segments of the industry to become increasingly strapped for capital. This is not a sustainable dynamic for any commodity, as, obviously, if prices remain below the cost of production for prolonged periods, mines begin to close and new mine supply will contract. Conversely, if demand for a commodity persists or grows, prices will eventually need to increase to a level that allows producers to earn an adequate return on capital, thereby incentivizing investment in new mines.



Source: FactSet, Normalized to a 100 base

This, perhaps counterintuitively, was the absolutely best period for precious metal royalty companies, because they could extract advantageous contractual terms on world-class mines whose owners would otherwise never need to seek royalty financing. The royalty companies were locking in fairly high double-digit financing rates for gold that would be produced over the ensuing 20 years or longer (more details of which below).

Investing in the royalty companies at this point in the gold cycle didn't require a strong opinion about the price of gold. The superior business model inherent to the royalty companies—the advantageous discount rates at which these contracts were signed, the free exploration optionality on a mine's surrounding land package, the insulation from operating expenses and balance sheet risks, the diversified portfolio of newly acquired royalty assets—would allow these companies to potentially generate very attractive returns even if gold prices didn't rise. If gold prices happened to move higher, or if monetary and fiscal policies changed

to become more supportive of gold prices, the potential returns would be that much better. In other words, this was a business valuation selection, not a gold price wager.

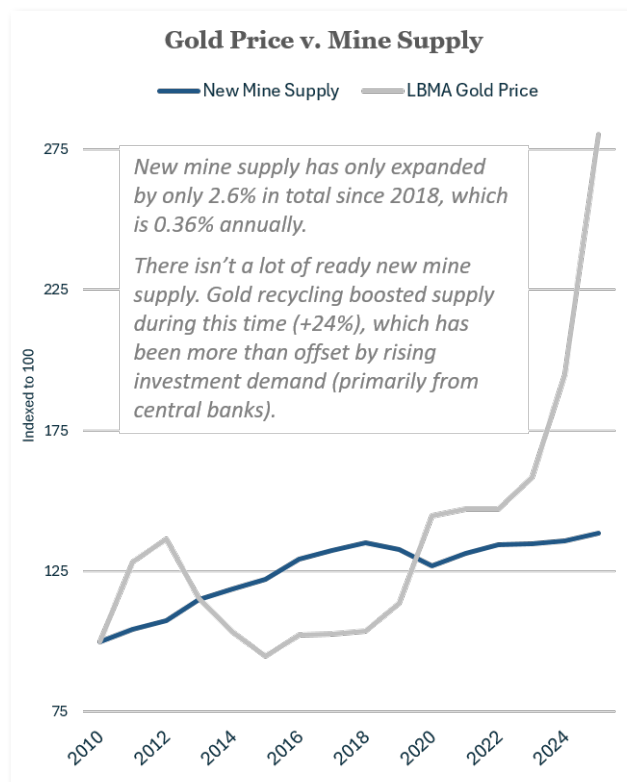
The basic thesis about future gold pricing did eventually prove correct—although, again, it was an unnecessary outcome—with gold rising to a high \$5,400/oz earlier this year before retracing to the current ~\$4,100/oz. However, these higher gold prices are now embedded as premiums in the current valuations of the royalty companies, much as the depressed gold prices a decade earlier were embedded as discounts in the royalty share prices.

All of this simply means the investment backdrop has changed markedly, and the extreme positive optionality that existed in 2015 is no longer present. This doesn't mean that these are not attractive investments today, but they are objectively less attractive than 10 years ago (similar to most other financial assets).

It must ultimately be remembered that, for all the benefits embedded in the royalty business model, there are minor drawbacks. Firstly, while the royalty companies bear no operating or capital costs, they similarly have no discretion over mine operations. Secondly, the royalty companies do not have pricing power with respect to the metal itself. Yes, they have negotiating leverage with a miner when outlining a new royalty or streaming contract, but their revenues are a function of the prevailing gold price. They are price takers for the ounces they earn from their royalty agreements.

Bookending this decade-long period, the gold price is now comfortably above the all-in-sustaining-cost of production for most global mines, not below it. This means that mines can continue to operate and grow even with lower gold prices and perhaps more importantly, these miners have reasonable access to capital, which is less advantageous to royalty financing providers. The royalty companies can no longer secure new royalty contracts that have the same earnings power at existing gold prices or the same degree of gold price optionality that they once did, which is a significant shift.

It should be noted that, while mine supply certainly contributes meaningfully to annual gold supply/ demand balances, new mine supply has only expanded by only 2.6% in total since 2018, which is 0.36% annually. There isn't a lot of ready new mine supply. Gold recycling boosted supply during this time (+24%), which has been more than offset by rising investment demand (primarily from central banks). To the extent that these conditions continue, gold prices should have structural support, and higher gold prices will almost certainly lead to share price gains for the royalty companies. But again, we focus on business analysis and fundamental valuation, not gold price forecasts.



Source: World Gold Council

MARKET COMMENTARY

2nd Quarter 2026

July 2026

Valuations Have Meaning

If that is the *general* valuation risk case, a *specific* valuation and expected return case can also be made. Wheaton Precious Metals and Franco-Nevada are the leading precious metals royalties companies. They have achieved scale economies and an established track record, with key assets that consistently deliver the free optionality upside that royalty investors seek. Because of this, they trade at premium valuations, which gives them the cheapest cost of capital for new deals, thus creating a virtuous cycle. They have the highest returns on equity in the industry.

Likewise, their shares have the highest valuation multiples, roughly 2x NAV, using the consensus estimates of analysts. Understanding how those Net Asset Values are arrived at is instructive, because those NAVs—perhaps vaguely likened to an actively marked-to-market book value for an ordinary operating company—themselves incorporate elevated assumptions.

The assumed price of gold is a primary input into the calculation, which, today, typically starts around current prices and declines modestly over a period of years. The calculation fails to capture the significant value of what is essentially a perpetual option on gold.

Gold production is the other critical input, although the calculation generally only includes currently producing or imminently producing mines such future, non-producing royalties are valued at zero. The calculation fails to capture the exploration optionality on existing royalties or the growth potential from new deals. In this sense, royalty companies should trade at a premium to NAV in almost all environments—the critical question being how large a premium?

These inputs create a set of cash flows, which *analysts* then discount to establish a present value for royalty payments received many years in the future. These discount rates are only in the 3% to 5% range (though the royalty companies themselves certainly negotiate significantly higher discount rates in their own royalty deals). The inverse of those consensus NAV figures would be equivalent to P/E ratios of 20x to 33x. That is not the best analogy.

To illustrate the change in royalty company valuations, an annual income stream of \$100,000 for 20 years—if discounted to a present value at a 15% rate—would amount to about \$625,000. That is the equivalent of buying \$2 million of future payments for about 30¢ on the dollar, and earning 15% annually on that investment. The equity investors for precious metal royalty companies, however, are now choosing to discount these cash flows at a 3% rate, which means the present value of those \$2 million in future payments would be almost \$1.5 million. Not a bargain by any means.

Scene 1			Scene 2		
	Future Value at 15% Growth, 1st 10 Yrs	Present Value @ 4%		Future Value at 15% Growth, 2nd 10 Yrs	Present Value @ 4%
Year 1	100,000	96,154			
Yr 2	115,000	106,324			
Yr 3	132,250	117,570			
Yr 4	152,088	130,005			
Yr 5	174,901	143,756			
Yr 6	201,136	158,960	Year 6	201,136	193,400
Yr 7	231,306	175,774	Yr 7	231,306	213,855
Yr 8	266,002	194,365	Yr 8	266,002	236,475
Yr 9	305,902	214,923	Yr 9	305,902	261,487
Yr 10	351,788	237,655	Yr 10	351,788	289,144
Total	2,030,372	1,575,485	Yr 11	404,556	319,726
			Yr 12	465,239	353,544
			Yr 13	535,025	390,938
			Yr 14	615,279	432,287
			Yr 15	707,571	478,009
			Total	4,083,803	3,168,864
Present Value @ 4% Discount Rate			1,575,485		
Price/NAV Multiple			2.0 x		
Market Value Price			3,150,971		
Annualized Rate of Return			8.6%		
			3,168,864		
			1.5 x		
			4,753,296		

For Illustrative Purposes Only. Past performance is not indicative of future results. Source: Horizon Kinetics Research

With the larger royalty companies now trading at 2x NAV, there is risk of valuation multiple compression. For example, what if, five years from today, these royalty companies were to decline to 1.5x NAV, which is still higher than some smaller but similarly profitable precious metals companies, but continue to earn their normalized returns based on their royalty economics? In other words, yes, the companies are doing everything they're supposed to and are qualitatively wonderful. A valuation contraction within that time frame overwhelms the gradual accumulation of compounded growth.

For instance, say that a royalty company's earnings were to expand, based upon its existing royalty portfolio, at a 15% annual rate and are anticipated to do so for 15 years. However, in five years, the shares, presently priced at 2x NAV, will trade at 1.5x NAV. The annualized return, all else held equal (e.g., excluding real-world complicating factors like the actual price of gold; how much cash or debt might be on the balance sheet; etc.), would be only 8.6%.

For those who like to look at the numbers that comprise that result, this table is a simplified version.

These few minutes of discussion are simply a description of the considerations that go into deciding whether one might or might not want to maintain a large commitment to an excellent business at what appears to be a sub-optimal valuation for a suitable long-term forward return. These companies can still provide very attractive exposure in certain portfolios, but it is not reasonable to assume that the historical returns can be sustained going forward.

The Securities Exchanges: Perpetual Futures, Prediction Markets, “Stunning” Price Declines

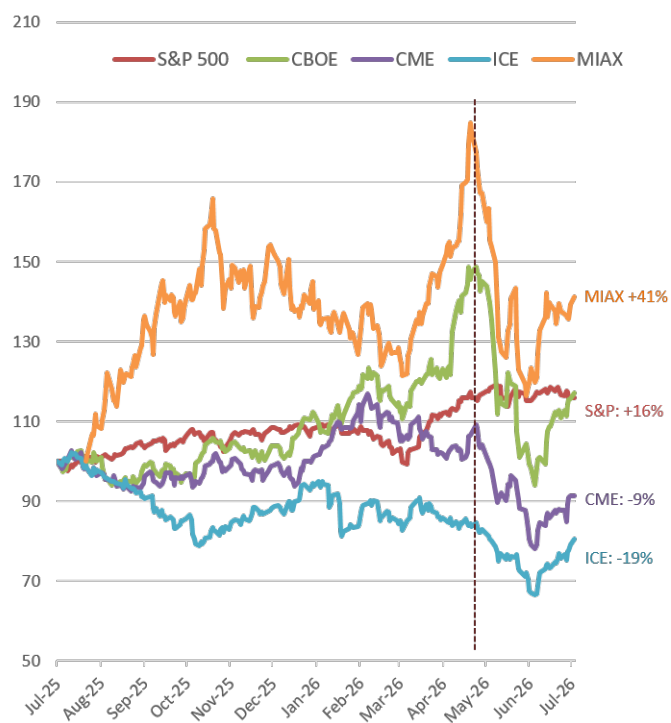
How are the Exchanges Doing?

In the five weeks from May 15 through June 22, the *shares* of the major U.S. regulated securities exchanges behaved almost as one, declining between about 22% and 38%.

In the five weeks since June 22, they recovered on the order of about 20%. Two of them—MIAX and CBOE—are substantially higher than they were 12 months ago and more than the S&P 500. Two of them are substantially lower. As far as price volatility, all looks normal but for the lockstep decline that started on May 15.

The reference to the exchanges' share *prices*, as opposed to the ordinary “the exchanges were down” phrasing is because the exchanges as businesses are doing quite well.

Price Lens



Source: Factset, Price chart July 25, 2025-July 27, 2026.

Intercontinental Exchange's (ICE) first quarter revenues were much higher than in 2025, its operating margin was higher still, and per-share net income even higher. Quarterly earnings are not very indicative, though, since they are so variable.

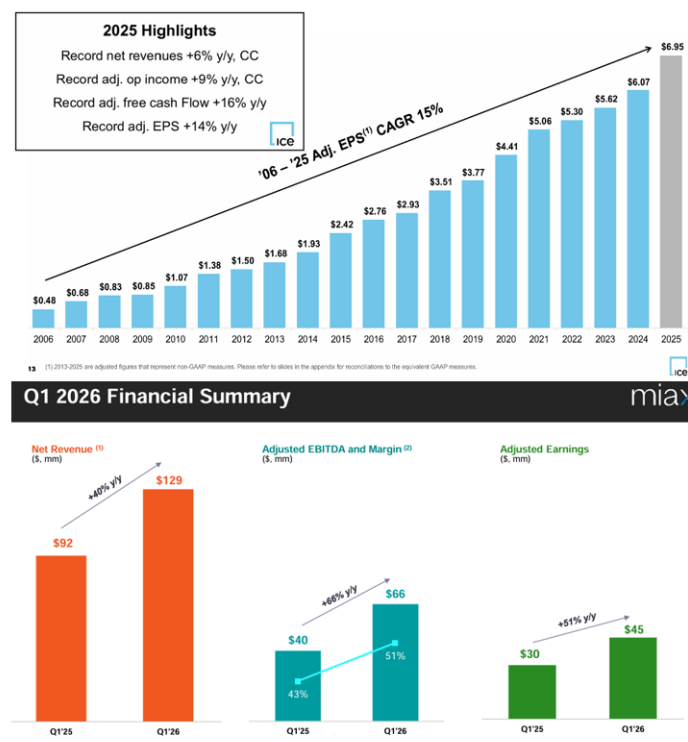
But the same rising revenue and expanding operating margins relationship is apparent in the full-year 2025 results. The revenue expansion for the year is only 6%, but the end result—inclusive of a 33% after-tax net profit margin—is a double-digit per-share earnings growth rate. This reflects the low incremental cost for rising transaction volume and revenues for this type of business.

The year's 14% increase in per-share earnings is essentially equal to the 20-year annualized increase of 15%.

MIAX, which hasn't yet achieved full scale economies, reported 40% higher revenues in its March 2026 quarter, and free cash flow was more than 2x higher.

If these two companies are representative, as far as reported results to date, the exchanges seem to be robust and growing businesses.

Business Lens



The Day the Shares Went Down

The May 15 share price declines commenced on the day of a Bloomberg news story that ICE and CME Group were petitioning the Commodities Futures Trading Commission (CFTC) to require a decentralized exchange called Hyperliquid to register with the CFTC and bring it under U.S. regulation. Without more information, that seems like a big ask. Events leading up to and following that story share a regulatory and political dimension that might partially explain the market behavior around the securities exchange stocks.

Hyperliquid is only three years old. It had recently expanded from cryptocurrencies and began offering blockchain token-based contracts on oil prices. These are a novel type of derivatives contract called perpetual futures, or perpetuals in finance world lingo (and “perps” if you’re in the know). With the end-of-February commencement of the U.S-Iran conflict, oil had one of the largest one-month price increases on record.⁹ Trading in oil tokens on Hyperliquid rose from what was a marginal trading product to notional volumes in the billions of dollars for a single day.

⁹ From Feb. to March 2026, Brent Crude rose from over 75%, from \$71.32 to \$126.69. <https://www.macrotrends.net/2483/brent-crude-oil-price-history>

A natural inference is that perpetuals could be a competitive threat to the regulated U.S. exchanges. This mid-May news about Hyperliquid did not occur in a vacuum. The ICE and CME actions were preceded by and followed by other news about the regulatory framework for commodities futures trading—which is largely what ICE and CME do.

Starting with a later event as the basis for describing some relevant earlier events, in mid-June, the CME filed a suit against the CFTC. It was triggered by the CFTC's May 29 approval of an application by Kalshi, the event or prediction market firm—think YES-NO wagers on sports, economic or political events—to list and trade a bitcoin perpetual in the U.S. as a futures contract.

The CME asserted that the approval contravened various procedural and definitional rules, including that the current Chair of the CFTC is the only member of what is supposed to be a five-person commission, and especially around the definition of swaps. The CME contends that a so-called perpetual future is not an actual futures contract, but a form of swap. Swaps were the kryptonite in the 2008 global financial crisis—which is why these perpetuals could not be traded in the U.S. before that May 29th approval.

By Commodity Exchange Act definition, futures contracts require an expiration date and a delivery date for the underlying asset, whereas perpetuals have neither. This is an exceedingly limited synopsis and is certainly not an analysis or evaluation, since it is in the regulatory realm, which is not ours. The purpose is simply to highlight a political or regulatory risk dimension that might have informed market reaction around the securities exchanges.

Irrespective of the actual regulatory determination in this case, there are very important economic differences between futures and swaps. A trading-product risk dimension question would be whether the perpetuals and prediction markets are a threat to the incumbent regulated exchanges.

As to *event or prediction contracts*, nothing precludes the incumbent regulated exchanges from offering the same products. In fact, ICE owns 17% of Polymarket, which it purchased in late 2025 for \$1 billion. It added another \$600 million to its investment this March. ICE is interested in the crowd-sourced information aspect of prediction markets. Not the sports wagering, but the pricing and volume data around economic indicators and events. Such data, if organized into useful information that can be sold to the professional class of traders, could be lucrative. Information and connectivity services are ICE's second largest revenue source after its core derivatives trading business.

Nor are *token- or blockchain-based products and services* the sole province of the Kalshis and Polymarkets. For the regulated exchanges, blockchain technology can enable all sorts of administrative and back-office efficiencies; same-day/same-moment settlement of trades; which in turn can enable greater collateral reserve efficiencies and transaction velocity for traders; 24-hour/7-day trading; and, via tokenization, the securitization of almost any physical or intangible asset, whether real estate, intellectual property like music or crowdsourced odds on economic events. That's a technological development that can immensely increase the universe of tradable and hedge-worthy assets.

In that respect, the existence of crypto-blockchain-based companies like Kalshi or Polymarket aren't a threat to incumbent exchanges so much as an indicator of extraordinary next-generation, next-decade expansion possibilities for exchanges. Which is why we established the **Blockchain Development ETF**.

There are already tokenization initiatives at almost all the U.S. regulated exchanges.

- The CME has already introduced, earlier this year, 24/7 cryptocurrency futures and options.
 - It is also just launched 24/7 mini Gold futures and plans to launch 24/7 Oil futures by the end of August.
 - And also single-stock futures, which are another means for retail investors to use margin or leverage—using less capital to control a larger position.
 - And prediction markets partnerships with FanDuel and FutureSports
- CBOE submitted a proposal to the SEC to launch near 24/5 U.S. equity trading by the end of the year.
- This March, the SEC approved a Nasdaq proposal to allow certain stocks to trade and settle in token form through the DTCC, the dominant U.S. clearing and settlement entity.
- ICE is working with a crypto exchange in which it has acquired a small stake to launch oil-linked perpetual futures (more of which below) to be marketed to retail traders. Though these will not, by the book, be eligible for trading in the U.S.
- The NYSE division of ICE is exploring a blockchain-based settlement capability that would allow 24/7 trading on the New York Stock Exchange.

A meaningful difference is that these initiatives are coordinated with institutional brokerage firms and regulators on trading, collateral, and settlement protocols. It is important that each tokenized equity has interoperability and the same shareholder rights and governance. One should evaluate this complex interrelated construct of business, legal, regulatory and institutional market participants that is in the process of being developed with what independent unregulated platforms offer.

Perpetuals require some explanation before an informed judgment can be made about their threat to the regulated securities exchanges. To date, their sole allure seems to be with retail investors, whereas 85% to 90% of ICE's business, for instance, is with institutions. The best way to understand why is to compare perpetuals with actual futures contracts, which to a retail investor are prohibitively cumbersome at every step of the process.

First, the primary use and need for a futures contract is to hedge a legitimate business exposure. A made-up-for-instance: a South Korean buyer of a tanker's worth of oil from the U.S., perhaps a distributor who will simply sell the oil to its local customers, could be a temporary owner of 500,000 barrels of oil. The problem is that the transit time can be as long as three weeks. That's \$40 million of oil subject to daily price risk. This distributor needs the price paid in the U.S. to be the same as when it arrives in South Korea, otherwise the intended profit margin of the transaction could easily become a loss. Distributors don't have much of a profit margin anyway. If the departure date for that trip happened to be this past May 31, the buyer's selling price by the end of the trip could have been 20% lower.

That ruinous possibility needs to be hedged, and it is done by selling an equivalent amount of oil at the then-current price for delivery in three weeks. The loss on the purchase would be offset by the gain on the futures contract. This contract can't work without a specific date upon which both parties commit to deliver

and take receipt of that oil. It can't work unless the contract is executed on a regulated exchange that enforces that both parties constantly maintain sufficient collateral to perform.

Amazingly, even though this is done on leverage, and despite all the economic and financial crises there has never been a contract failure on a futures contract in ICE's nearly three-decade history. As a reference point, there have already been over 1.2 billion futures and options contracts traded on ICE this year.

In contrast, a perpetual is just that; it has no expiration date. And there is no delivery of the underlying physical asset. Therefore, it can't be used to hedge a business commitment or exposure and is therefore useless for a commercial customer and, more broadly, for the economy. It's a user-friendly, phone-click wager or trading instrument that is very popular among certain retail traders. It's designed to be. It's referred to as market gamification.

The perpetuals trader doesn't have to take possession of physical barrels of oil or pay for their storage and transportation, or roll those contracts forward as they approach expiration. One attractive feature for retail customers is that perpetuals can have north of 50x leverage in the offshore, unregulated markets, though lower in the now U.S. approved contracts. Kalshi offers almost 6x leverage on bitcoin perpetuals and provides an example of how it works:

Put down \$200 of collateral to control \$1,000 of bitcoin, if 5x leveraged. If bitcoin rises 10% you make a 50% return. If bitcoin falls 20%, your \$200 deposit is lost.¹⁰

Basically, heads, you're up 50%, tails you lose it all. It is known in certain lending and wagering circles that if you offer the customer leverage, or more leverage, they'll probably take it. A commercial customer would be decidedly uninterested in an instrument that is not a direct proportional hedge; they need insurance, not a chance at a trading profit at the cost of compromising their hedge.

Back to Exchanges and What They Do

Predicting political outcomes is a "perpetual" challenge. What if it could be reduced to index datapoints and performance statistics like the S&P 500, along with confidence levels and standard deviations?

A quantitative financial analyst armed with such data might suggest that while the short-term predictability of elections is not much better than a random walk, the long-term trend is a continuation of alternation between parties and administrations. There have been 16 Democratic and 19 Republican presidents, a 46% to 54% differential. Due to the index construction rules, presidents from formerly statistically relevant parties—like the Federalists and Whigs—are

Exchange IPO and Inception Dates	Formation Date	Listing Date
New York Stock Exchange (NYSE)	1792	2006
CME Group Inc.	1898	2002
Nasdaq Inc.	1971	2002
Intercontinental Exchange Inc.	2000	2005
CBOE Global Markets	1973	2010
Miami International Holdings	2000	2025
Japan Exchange Group Inc	2013	2013
Hong Kong Exchanges & Clearing Ltd	1891	2000
London Stock Exchange Group Plc	1801	2007
Deutsche Boerse AG	1992	2001
Philippine Stock Exchange Inc	1927	1992
Singapore Exchange Ltd.	2000	1999
ASX Ltd	1987	1998
Bursa Malaysia Bhd	1964	2004
Euronext Athens	1876	2022
Johannesburg Exchange	1887	2006

¹⁰ <https://news.kalshi.com/p/what-are-perpetual-futures>

excluded. Democratic presidents have served a cumulative 96 years¹¹ and Republican presidents (through July 2026) 97.5 years, a 49.6% to 50.4% differential. The numbers would probably suggest that the U.S. political cycle will remain a fairly short one. The standard disclaimer, of course, is that past performance is not indicative of future results.

Viewed in the same manner, securities exchanges have demonstrated the opposite: statistically unusual staying power and resilience, with very little disruption.

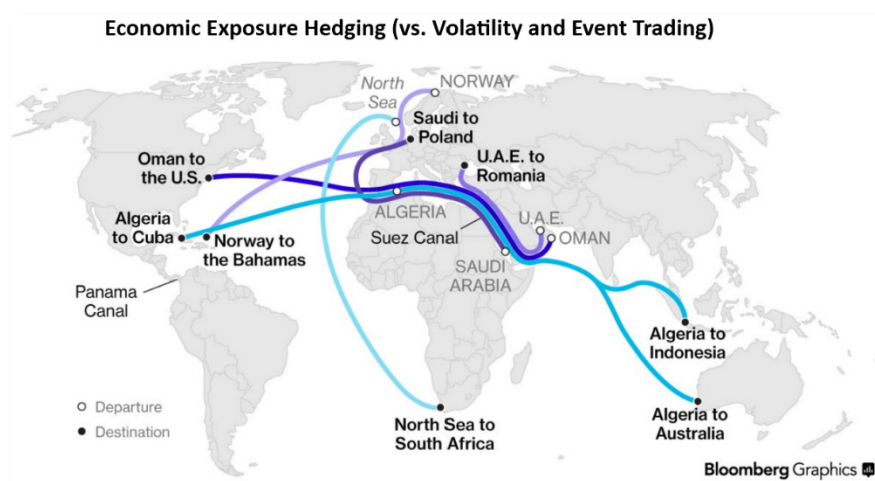
The NYSE predates the first U.S. manufactured four-wheel gasoline-powered automobile in 1893, and the CME started only several years later. The transformative power of that technology was publicly demonstrated when it won the first U.S. auto race in which any of the entrants finished, with a winning average speed over the 54-mile course of 7.5 miles/hour.

Clearly, these exchanges adapted to and eventually benefitted from every subsequent technological, financial and political development or crisis since then. The latter business feature—benefitting from an economic or financial crisis—is an unusual one.

Let's use a current crisis as an example. Polymarket has enabled retail investors to speculate intensively on Strait of Hormuz related events and oil prices. They haven't facilitated any real-economy needs or exposure mitigation. On the other hand, oil producers across the middle east—from Syria and Iraq to Saudi Arabia and the U.A.E.—are now building or planning alternate routes for oil and oil product exports. One such pipeline that is being expanded was in the 1980s when Iran threatened shipping during the Iran-Iraq war. These new export routes will require new futures contracts for hedging purposes.

Why? Because the petrochemicals from each such route will have different delivery schedules. Brent oil futures is not one contract; it's hundreds. This is not only to accommodate different journey times to the U.S., Europe or Asia, but also for one contract's trading or hedging spreads versus other Brent contracts and even other energy commodities, such as heating oil or gasoline. The current geopolitical disruption will result in more petrochemicals being transported over more trade routes, which will require additional hedging demand.

At that point, when institutional customers of CME and ICE identify an economic exposure that can't be hedged with an existing futures contract, the exchanges will compete to launch one. In that way, more resilience is added to the global energy supply chain.



¹¹ Including Andrew Johnson. <https://www.statista.com/statistics/1124563/us-presidents-party-affiliation/>

MARKET COMMENTARY

2nd Quarter 2026

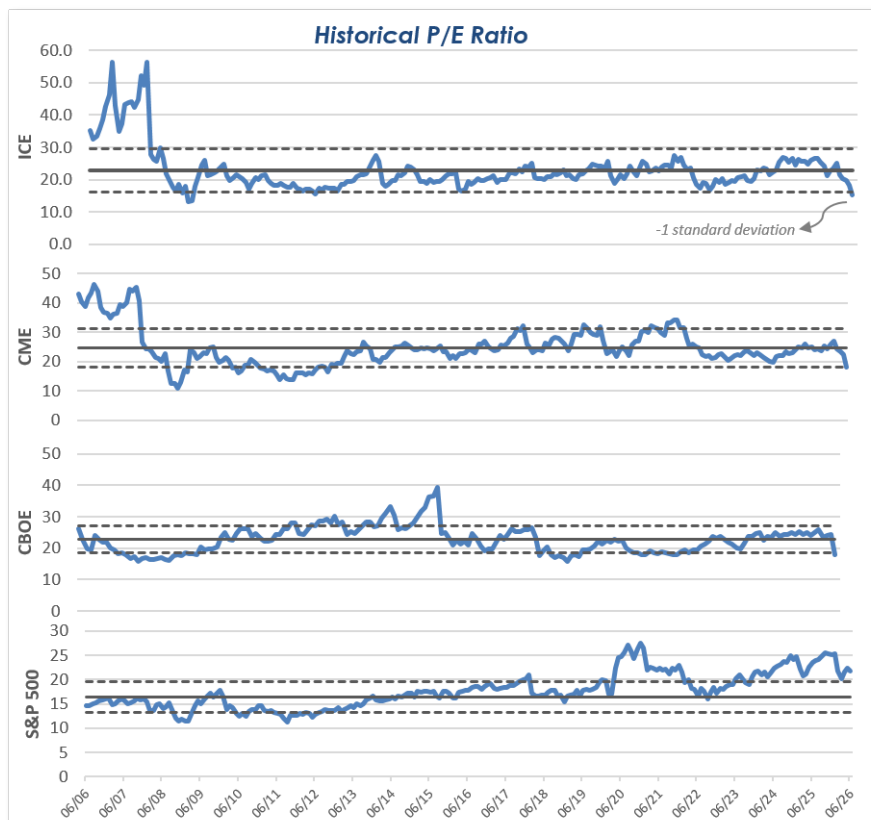
July 2026

Crisis and innovation during the past century-plus have been business opportunities, not displacement threats, for the exchanges.

Meanwhile, one outcome of their share price declines is that the valuations of Intercontinental Exchange and CME Group haven't been this low in the 17 years since the Great Financial Crisis. They are objectively—in terms of profit margins and long-term per-share earnings growth—far superior to the stock market, yet demonstrably cheaper—the S&P 500 now trades at 26x consensus earnings estimates for 2026—and cheaper than their typical valuations. CBOE hasn't been this inexpensive in three to five years.

P/E (FY1)	Valuation vs. Market	
	vs. SP500	vs. N100
CBOE	-25%	-43%
CME	-27%	-44%
ICE	-34%	-49%

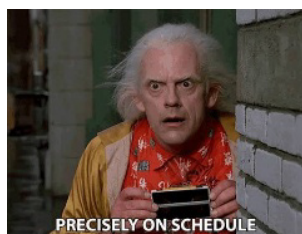
Source: Factset



Source: Bloomberg

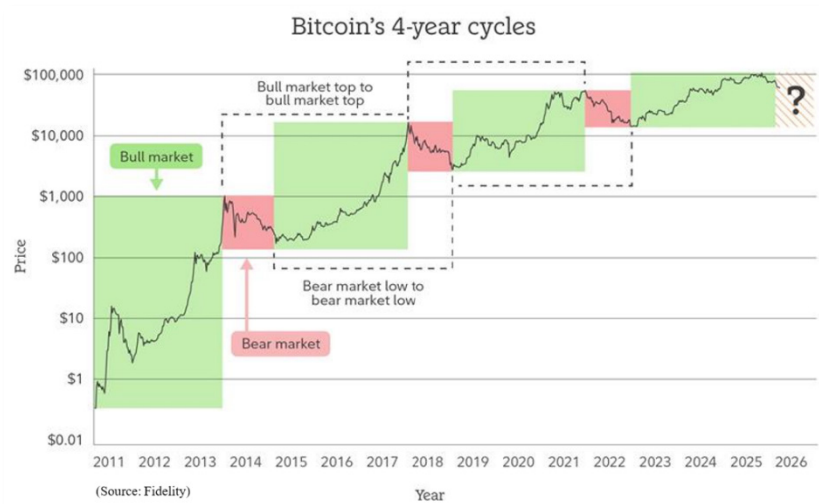
What's With the Price of Bitcoin?

The short answer, is that it's doing pretty much what is expected. Or, as Murray Stahl answered someone's "Why is bitcoin down?" question earlier this year, "It's right on schedule."



That's plain to see in this chart from Fidelity, which was the first mainstream financial firm to allow clients to buy and hold bitcoin in their accounts.

Take note that the price axis is on a log scale where each step increases by a multiple of 10x: the distance from \$0.01 per bitcoin to \$1, is the same as from \$10,000 to \$100,000. It would look like a rocket-ship trajectory if it were an ordinary stock price scale.



One couldn't expect that periodic result without having a sense of the programming behind it, because bitcoin is—however you want to classify it—a programmed money, asset, or commodity. It has a distinct economic *supply* and cost-of-supply component, and a distinct economic *demand* component, and these can be measured.

Without a modicum of knowledge, all you have are the pattern-association explanations: It's a risk-off environment; it was overbought and is finding consolidation at the current resistance level; there's competition from 10,000-plus other cryptocurrencies; oil prices or interest rates are the culprit; heightened geopolitical risk is making gold the favored hedge asset; and so on.

If anyone's patience for the coming explanation is already exhausted, here's the conclusion, right up front, and you can be done with it. By tax-payment day in April 2028, the basic math and real-world economics of the supply side of the bitcoin system (the cost of production) say that bitcoin should be trading between about \$150,000 and \$250,000; and the basic math of the bitcoin system based on the power law relationship described shortly suggests that bitcoin should be trading at \$270,438...and 5 cents.

For anyone who wants to hang around a bit, one part of the explanation—the Snowball Fight exercises—has already been covered: namely that time and value progression aren't one-to-one relationships in long-term compounding. Knowing that can save you from disappointed expectations and badly timed investment decisions.

Reviewing a couple of essentials before moving on, because they are the reason—in the wake of the flood of government money and debt issuance in and after the 2008 global financial crisis—that someone(s) created the bitcoin protocol as a hedge against or haven from debasement of the national currencies:

Bitcoin was the first digital currency to solve two challenges associated with digital money: simultaneously controlling its creation and avoiding its duplication or counterfeiting.

If viewed as a safe MONEY that can't be devalued, bitcoin—alongside energy as perhaps the keystone needs in any economy—really could be the “greatest thing since sliced bread.” Without historical exception, any currency that became widely adopted succumbed to the inflationary consequences of its controller issuing ever more of it over time, ultimately to the point of collapse.

Bitcoin is that first exception. About 96% of the total fixed supply has already been released, so the experienced supply inflation over the next 114 years, by which time the remainder will have released, will average less than 0.04%/yr. The U.S. M2 money supply expanded 5.5% in the past 12 months, while real GDP growth was about 2.7%.

The Supply Side of Bitcoin's Value

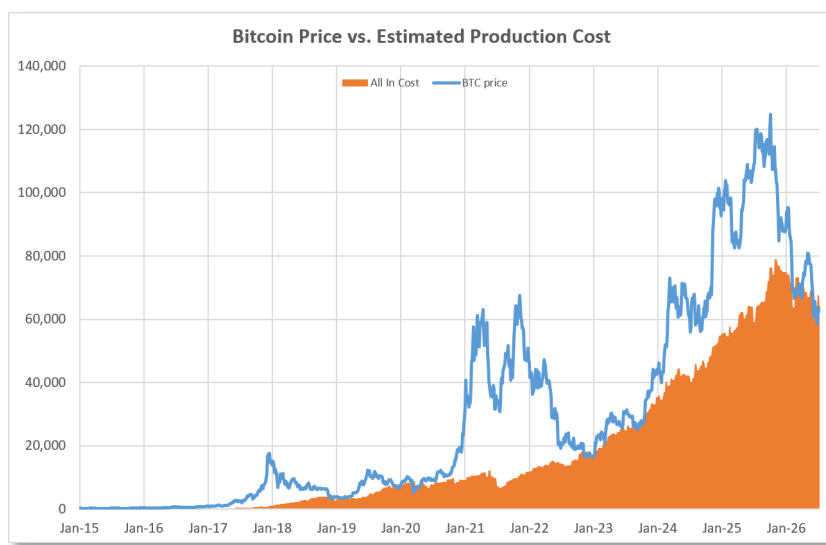
Bitcoin's current decline is the fourth in a series that's repeated with remarkable regularity every four years. That's partly related to the cost of production, which doubles every four years upon the "halving." This is when the amount of bitcoin awarded to the miners, whose activity sustains the bitcoin blockchain ownership record, is reduced by half. In other words, their revenue gets halved, but their operating costs don't.

Many approaches have been taken to try identifying a factor that will match or explain bitcoin's price behavior. On the supply side, which is the most intuitively obvious to investors, if one could know the global cost of production, one could know the minimum bitcoin price, because the miners in their entirety can't, generally speaking, continue production at a loss. The system is much more dynamic than this, but it serves for this discussion.

We've made our own direct estimation of bitcoin's historical production cost as a demonstration of the way it works. The primary cost of mining bitcoin is electricity. Electric power, embodied in hosting costs at a data center, plus ancillary operating expenses, is roughly 60% of the total; the rest is ancillary operating expenses and equipment, which depreciates rapidly enough that it becomes a pretty normalized expense. With some additional information, it's possible to develop an estimate of the production cost per coin.

Our analyst constructed his own estimated historical electricity consumption schedule of the global bitcoin network, although others, like the University of Cambridge Judge Business School, also maintain such indexes. The total computational power of the network is also a known figure, and dividing the two is a way of estimating the average efficiency of the global fleet of bitcoin miners, in terms of electricity used per computation per second. It's known how many coins are issued per day, so one has an estimate of the production cost per coin for an average miner.

On a backward-looking basis, there is a historical series for total network electricity usage, for network hashing power, and plenty of information about the power consumption efficiencies of prior generations of equipment relative to their hashing power. The following chart was modeled using an electricity cost of \$0.05/kWh. The all-in-cost estimate over time is the orange solid-fill area chart, and the bitcoin price is the blue line. Being a model, we can adjust the inputs, say \$0.04 or \$0.06/kWh electricity cost, or a 55% electricity cost (as a proportion of total costs) as opposed to 60%, but the figures we used are pretty close to our real-world observations.



For Illustrative Purposes Only. Past performance is not indicative of future result.

The periodic bitcoin price spikes generally occur at the four-year halvings, because the cost of production spikes. The periodic declines in the bitcoin price appear to touch and climb with the production cost curve until the next price spike.

From this point forward, one can estimate what the production cost per coin will be upon the halving on or about April 15, 2028. If using the current average miner efficiency, multiply by two, from the current all-in estimated cost of \$65,000, which would be \$130,000. For a variety of reasons, the price tends to rise above that. Natural reasons, like bitcoin miners who enjoy being—or need to be—compensated for the time and risk they expend. They could do something else for a living. Taking the average post-halving peaks above production cost, if the price will rise 75% above the production cost, bitcoin might be valued at \$225,000.

A final note on these production-side estimate of bitcoin's value range. The chart above used the convenience of an estimated system-wide efficiency of an average mining rig. But recent more-efficient models are now available. If one of the most recent models were used, the current all-in production cost with an allowance for some miner return on investment might be about \$117,000; if another of the latest models is the one, the figure would be roughly \$149,000. To be clear, these figures assume a 25% annual return on invested capital for the miners (i.e., the midpoint between breakeven and a 50% rate of return).

Though this is a familiar approach, it is not the only one. The more interesting approaches, particularly because they so closely match these figures, but with an entirely different methodology—think Snowball Fight exercise—come from the demand side of bitcoin's value progression.

The Demand Side of Bitcoin's Value

It's not all about production costs. There are explicit demand functions, too. Putting aside the indeterminate (albeit gargantuan) ultimate demand value for bitcoin as a globally accepted parallel currency, if that's how the future unfolds, there is, for instance, its network value. This is a well-known and calculable number developed by Robert Metcalfe for the Ethernet, a local area network for data transfer. Metcalfe's Law, which is well-known in the computer sciences—though not frequently used in economics—has been evident in the initial valuations of companies like Facebook (now Meta) and Tencent, as well as Internet usage in general. It states that the value of a network grows proportionally to the square of its number of users, and this provides a framework for understanding bitcoin's rise over the past 16 years.

The basic idea is that a network gets more valuable when more participants can interact with each other. For bitcoin, each additional user can make the system more useful for payments, savings, transfers, and liquidity, which can increase demand for bitcoin.

Even though people don't transact with every other participant, a larger network generally means more people willing to accept bitcoin as payment; more liquidity in exchanges; more developers building software; more businesses offering services; greater confidence that others will also value and use it. Each of these effects can reinforce the others.

Bitcoin's adoption follows a predictable societal trajectory. Individuals disappointed by inflation and financial 'repression' were the early adopters. They were first joined by entrepreneurial and technically knowledgeable institutions like MicroStrategy and Tesla, which recognized bitcoin's potential as a hedge against fiat currency debasement. Now, nation-states like El Salvador and Bhutan are leading the way, adopting bitcoin as a strategic reserve currency to safeguard their economies from fiat inflation.

MARKET COMMENTARY

2nd Quarter 2026

July 2026

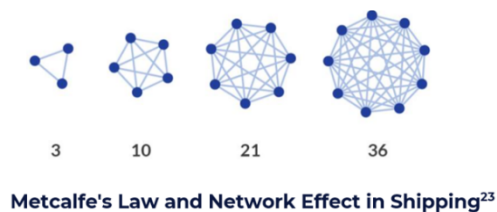
As the network expands, bitcoin's security and utility improve considerably. For example, bitcoin's total hashrate or computational power—a measure of its security—has increased tenfold in the past five years. The decentralized nature of the bitcoin network ensures that no central authority can manipulate its supply or undermine its value. The hashrate, as a demand-side measure, also describes bitcoin's price behavior remarkably closely.

Accompanying is both a log-based chart comparing the system's historical hashrate with the bitcoin price, and a normal linear-scale price chart—the rocket ship trajectory version. Question: is the bitcoin price following the system hashrate, or is it the other way 'round?



Therefore, Metcalfe's Law can be applied to bitcoin by treating it as a network rather than just a digital currency: as more people, wallets, merchants, and nodes join and use it, the network's usefulness and value can grow roughly with the square of its users. In that context, bitcoin's price is driven less by isolated speculation and more by the size and activity of its network.¹²

A visual example would show a three-node network, say for a phone network: there are three possible user-to-user connections that can be made. For a five-person network, there are 10 possible connections. By the time you've got a nine-node network, one begins to lose the ability to visually identify all 36 connections. For 100 users, it's almost 5,000 connections; for 1,000 users, just under 500,000 connections, and for 1 million users, *500 billion connections*. Applications based on Metcalfe's Law are in use commercially, such as by shipping logistics companies,¹³ from which the below graphic pictures of small networks come.



Extending the exercise for possible number of 2-user connections:

With 100 users: ~4,950 possible connections
1,000 users: 499,500 connections
1 million users: 500 billion connections

¹² <https://papers.ssrn.com/sol3/>

¹³ From SeaRates, a cargo logistics and shipping company.

MARKET COMMENTARY

2nd Quarter 2026

July 2026

Using two formulas that are familiar to people in the cryptocurrency realm, and which we covered already here, one can project forward the theoretical price or value an asset like bitcoin. Importantly, these are for specific fundamental reasons, one being the value of a network, using a t^2 power function over time, based on Metcalfe's Law. The other is for the expanding size of a network, approximated by t^3 , a cube function, which was used for the Snowball rolling downhill. One can think of a gas expanding to fill a sphere, which is why natural gas is priced in cubic feet. In the snowball example, while the radius increased linearly with each rotation, the volume or mass of the snowball increased by a cubic function. Combining the two network value and size functions together, one gets a power function for bitcoin's value expansion that is a touch less than t^6 .

For Bitcoin Value Expanding at the Theoretical Power Function of $\sim t^6$			Actual Price & Values of Bitcoin At Same Dates		
Dates by Which Theoretical Value Increases 10x	Years Required For 10x Increase	Theoretical Future Cumulative Value (Starting Index Value of 1.00)	Price	Value Change Period-to-Period (x)	Cumulative Multiple (x)
4/7/2011		1	\$ 0.75		
5/10/2012	1.1	10	4.85	6.5	6.5
12/23/2013	1.6	100	651	134.2	868
5/20/2016	2.4	998	442	0.7	589
12/16/2019	3.6	9,986	6,877	15.6	9,169
4/5/2025	5.3	99,878	\$ 83,045	12.1	110,726
4/15/2028	next halving	270,438			??
2/17/2033	7.9	998,842			??

For illustrative purposes only. Past performance is not indicative of future result.

The extraordinarily surprising part of this demand-based function is that it has projected bitcoin prices over time that are so close to the actual result, that one might swear there was some cheating, or at least peeking, going on. There are two things to pay attention to, an obvious one and a more subtle but important one.

Obvious Thing:

- The theoretical value of \$1 invested in bitcoin in 2011, as projected eight years into the future was, on December 16, 2019, \$9,986, or a cumulative multiple of **9,986 times**. The actual bitcoin cumulative multiple (the actual starting price was \$0.75) on that date was **9,169 times** (\$0.75 to \$6,877).
- As of 4/5/2025, 14 years into the model, the theoretical value of bitcoin was \$99,878, or a cumulative multiple of **99,878 times**. The actual cumulative multiple of bitcoin was **110,726 times**.

Less-Obvious but Important Thing:

- The dates used in this table were based on how long it would take for the projected bitcoin value to increase 10x.
- Each such 10-fold increase takes longer. The first took 1.1 years, the second took 1.6 years, and the third was 2.4 years. From the last such date, April of last year, it will take almost 8 years for the next 10x increase. With power laws, the incremental time required for the same relative increase...increases.

- It's important to know this to avoid unnecessary disappointment because of our arithmetic-anchored pattern spotting brains: the 90% annualized returns from the 2016 “era” will be more like 33% annualized.
- Important, because between the four-year halving-related price declines and the slowing rate of change of the network value as it expands, it's easy to be fooled—without an understanding of the TIME function of compounding—into making investment decisions for the wrong reasons.

It's why we here at Horizon Kinetics Central are not perturbed by the periodic price declines in bitcoin.



Appendix

A telling, by our analyst, of the train of thought that led him from an observed frustration with a seeming lack of bitcoin value progress to...the preceding TIME and compounding exercises.

As I was listening to a recent conversation, I started thinking about Bitcoin and its relationship to time, Amazon's share price history, and, ultimately, cartoon snowballs rolling down hills—and whether some of these seemingly different things might really be the same, at least in some general sense. And if they were the same, well, wouldn't that be surprising, even hilarious!

I often tell my kids to be on the lookout for irony—it comes in multiple forms—and it's often the thing that'll get you, especially if you lose your sense of humor.

There's humor to be found in the outcomes described in the attached. They surprise us. But the outcomes are surprising mostly because of our ignorance, which is harmless most of the time, like a child laughing at Wile E. Coyote, from the old *Looney Tunes* cartoons, as he repeatedly fails to catch the roadrunner. Or when an adult diligently watches and, yet, still manages to burn that piece of toast as the process accelerates at the very end (for me it's always the sesame seeds and pine nuts!). No harm done in either case.

But when crossing the street or making a consequential investment decision, such ignorance can be disastrous. And just like the frustrated coyote, the negative outcome is often self-inflicted and avoidable, *if only we would acknowledge certain basic laws*—the force of gravity for the coyote and the Arrhenius relationship for the toast enthusiast (who knew?!); and perhaps a power law for the tech or Bitcoin investor.

If you want to be good at chasing roadrunners, perhaps consider learning about gravity (and avoid ACME products!). If you want to make toast successfully—even if you know nothing of Arrhenius—be aware that the process tends to accelerate at the very end, so make sure your focus is oriented towards and heightened at *the very end*.

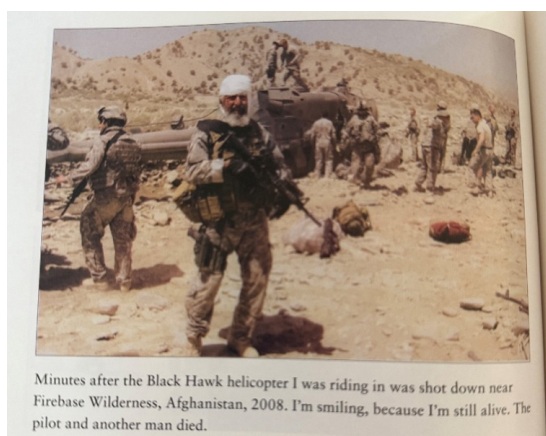
If you want to be good at holding bitcoins and the like, perhaps consider learning some of the characteristics associated with such processes (hint from the attached: similar to toast, but for different reasons, it's also very much about what happens *at the very end*).

Perhaps what you'll find in the attached spreadsheets is all obvious. I did it to answer some basic questions I had and to find some interesting parallels and maybe have a little fun (and then my notes turned into this!). But I thought I'd share it in the event you might find it useful. There's humor in the attached—it makes the ideas easier to hold onto.

It helps to have a sense of humor. Recently, I have been reading about the Iranian sense of humor and the Persian language (and, unrelatedly, about Chuck Jones, creator of Wile E. Coyote—great story!). The detour into Iranian comedy wasn't the plan! I was actually retracing my steps through the Diamond District—where Murray and I first went on walks a long time ago (it's the secret to coming up with good ideas, you know)—and ultimately found myself at the New York Public Library. I renewed my library card, thought about old newspapers and wondered what he might be reading right now, and then saw something about humor in Iran.

The classic novel is called *My Uncle Napoleon*. They have some interesting expressions. "*Ba namak*" is one—literally meaning "with salt" and used to describe someone with a charming, witty, captivating personality—someone with *flavor*, a person whose presence elevates everything else. I thought that fit Murray nicely—perfectly, in fact. I think that's why I stumbled onto Iranian comedy—to find that phrase.

It's perfect. I hope he would like it.



The military history of Iran is interesting. Iranian military history and Iranian comedy—a natural combination, right? If you knew Murray, absolutely! The person below is an American-Iranian and *the* longest-serving member of the United States Special Forces. The attached image is from his *autobiography*. I look at it and the caption frequently, "*I'm smiling, because I'm still alive,*" with a downed Blackhawk helicopter in the background. Just incredible.

While perhaps not finding it hilarious to be in such a predicament, I imagine the author at least finding humor in the situational, or maybe it's cosmic irony—a Blackhawk helicopter crash landing, you say?!—"*dâstân dêrim!*," or, "*we have a story ahead of us!*," as they would say in Persian. Like a more optimistic version of the English speaker's, "*oh man, here we go again!*" Irony and humor being mobilized to steel one's resolve, to turn the otherwise unpleasant situation into an adventure; not the end of something but a chance to accumulate another great story. And perhaps ultimately an acknowledgement of the insignificance of human machinations when confronted by a higher power—the cosmic, r^x, etc.—sometimes you just have to go with the flow. Irony and humor.

Peter said Murray would want us to laugh. This exercise made me laugh. It can be a little analytical in spots, sure, and there's value in being analytical. But everyone's analytical these days, just like the coyote! The coyote would rather be a technician, immersed in the tangible details of his most recent contraption, while at the same time completely ignoring gravity until it's too late. Gravity, a potential ally, instead becomes his antagonist, with the roadrunner's simple "*beep, beep*" being all that is needed to catalyze the series of events that sends him over the edge.

Gravity, time, irony, humor...These expansive ideas can be quite powerful if you know how to use them. Most people just can't bring themselves to focus on time, for example, only on price running up and down the

chart—"beep, beep." Not everyone has a sense of humor. Not everyone appreciates time the way a historian might. Murray sure did. A combination of Ben Graham and Fernand Braudel, but also Mel Brooks. Isaiah Berlin's hedgehog and his fox. Murray made sense of things analytically, but he was also open to the surprising and the unexpected—"cheap optionality," he would say. Understand things like capital structure risk, of course—but, he might add, *"did you ever read the Mel Brooks autobiography, the part where he first understands risk?"* It's so good, it's worth including here, and, of course, it all goes back to Brooklyn:

Brooklyn

It is 1931, I am five years old, and my older brother Bernie takes me to see a movie called Frankenstein at the Republic Movie Theatre. Big mistake! That evening, even though it was a hot summer night, I closed the window next to my little bed. My mother hears it being closed and immediately comes into the bedroom and quickly opens it.

"Mel," she says, "we're on the top floor and it's a hundred degrees in here. It's very hot. We have to keep the window open."

I counter with, "No, we must keep it closed! Because if we keep it open Frankenstein will come up the fire escape and grab me by the throat and kill me and eat me!"

(Even though it was the doctor who was named Frankenstein, all the kids called the monster Frankenstein because that was the title of the picture.)

My mother, realizing that she could never win by demanding that the window stay open, decides to reason with her five-year-old baby boy. "Mel," she

says, "let's say you are right. That Frankenstein wants to come here and kill you and eat you. But let's look at all the trouble he's going to have to get to Brooklyn.

First of all, he lives in Transylvania. That's somewhere in Romania. That's in Europe. And that's a long, long ways away. So even if he decides to come here, he has to get a bus or a train or hitchhike to somewhere he can get a boat to go to America. Believe me, nobody is going to pick him up. So let's say he's lucky enough to find a boat that would take him here. Okay, so he is here in New York City, but he really doesn't know how the subways work. When he asks people they just run away!

Finally, let's say he figures out it's not the IRT, it's the BMT and he gets to Brooklyn. Then he's got to figure out how to get to 365 South Third Street. Okay, it's going to be a long walk. So let's say he finally gets to Williamsburg and he finally finds our tenement. But remember, all the windows at 365 are going to be wide open and he's had a long journey, so he must be very hungry. So if he has to kill and eat somebody, he probably would go through the first-floor window and eat all the Rothsteins who are living in apartment 1A. And once he's full, there is no reason for him to go all the way up to the fifth floor and eat you."

The story made good sense to me. "Okay," I said, "open the window. I'll take a chance." And that's how my patient, loving mother solved only one of the many problems I would hand her each day.

Murray had a way of telling stories that made good sense to me too. I'm grateful that I got the chance to know him.

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