

# Angeles



## *Luminiferous*

**T**o the four known elements—fire, air, water and earth—Plato added a fifth, literally the quintessence, the element that made up the celestial world. Aristotle, his disciple, called this celestial element, aether.<sup>1</sup>

Two millennia later, the great Dutch physicist Christaan Huygens, experimenting with light, concluded that light was a wave, and like other waves, such as sound or water, required a medium to travel through. Plato's aether was that medium. Huygens' contemporary, Isaac Newton, had a different idea, that light consisted of particles, not waves. But Newton's particle theory could not explain the refraction or diffraction<sup>2</sup> of light, so Newton postulated that vibrations of the aether caused light to bend or spread. Both Huygens and Newton agreed that light required an aether through which to travel.

Experiments in the early 19<sup>th</sup> century<sup>3</sup> "proved" that light was a wave, and Newton's particle description was abandoned. Later in the century, the equations of James Clerk Maxwell required that light travel at a fixed speed in a vacuum, and concluded that the aether had to be immobile so as not to affect the speed of light. Heinrich Hertz later showed that electromagnetic waves were identical to light waves, proving that there was only one aether rather than multiple ones. Maxwell wrote<sup>4</sup> that "the only aether which has survived is that which was invented by Huygens to explain the propagation of light."

<sup>1</sup> Or Ether; αἰθήρ.

<sup>2</sup> The redirection of a wave or the spreading out of a wave as it passes over an object.

<sup>3</sup> By Thomas Young and Augustin-Jean Fresnel. Thomas Young was called "the last man to know everything," and among his many accomplishments, was instrumental in deciphering the Rosetta Stone.

<sup>4</sup> In the Encyclopedia Britannica.

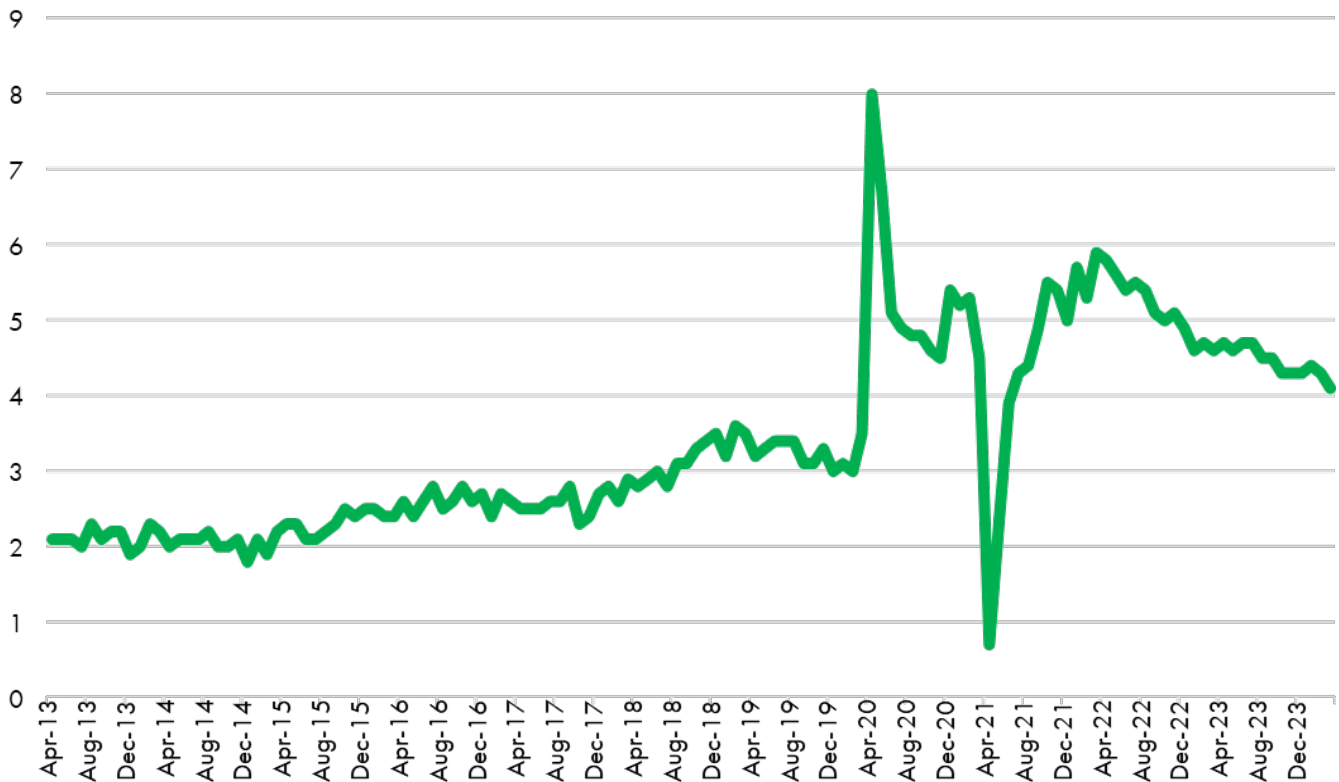
As the studies of light and electromagnetism advanced, the properties of the aether were becoming complicated and difficult to balance. It had to be without mass so as not to affect the orbit of planets, but still had to provide a medium through which light waves could travel.

It was a young American physicist who would devise the experiment that would reconcile these contradictions. Unfortunately, the experiment was an utter disaster, but surprisingly, this failure secured his fame. His failed experiment, perhaps the most famous failed experiment in history, holds valuable lessons for us today.

A year ago, there was a rare consensus among economists of an imminent recession, “one of the most anticipated recessions of all time,” the media reported.<sup>5</sup> Tightening monetary policy, the longest yield curve inversion in history<sup>6</sup> (a sure recessionary signal), a constriction in credit and fiscal tightening would combine to push the economy into a recession. Likewise, most investors expected continued losses in the value of their stocks and bonds. What went wrong? (or right?).

The short answer is the strength of the private sector. Wages have risen sharply (Chart 1), and turned pos-

**Chart 1** Average Hourly Earnings, All Employees, YoY%, 2013-2023



Source: Bureau of Labor Statistics

<sup>5</sup> <https://www.bloomberg.com/graphics/2023-investment-outlooks/>

<sup>6</sup> Beginning in July 2022 and continuing, surpassing the previous record of 634 days beginning in August 1978.

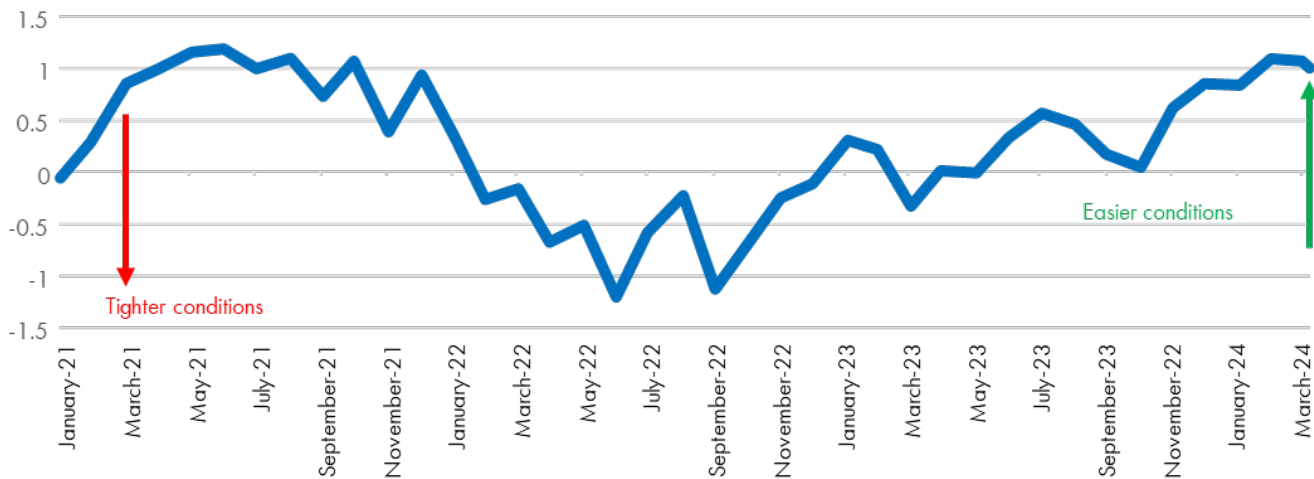
itive (2.2%) in real (inflation-adjusted) terms in 2023. Households and businesses have delevered, and debt service as a percentage of income is near record lows. Despite the rise in interest rates and contraction in bank lending, overall financial conditions<sup>7</sup> have eased over the past year (Chart 2).

Rising wages, strong profits and a lower debt burden have blunted the impact of both the higher cost of

debt and its restricted availability as banks have tightened lending standards. But even as banks have retreated from their traditional role of providing capital, nonbank lenders have stepped in. Private credit has become a growing source of capital globally, but especially in the United States (Chart 3).

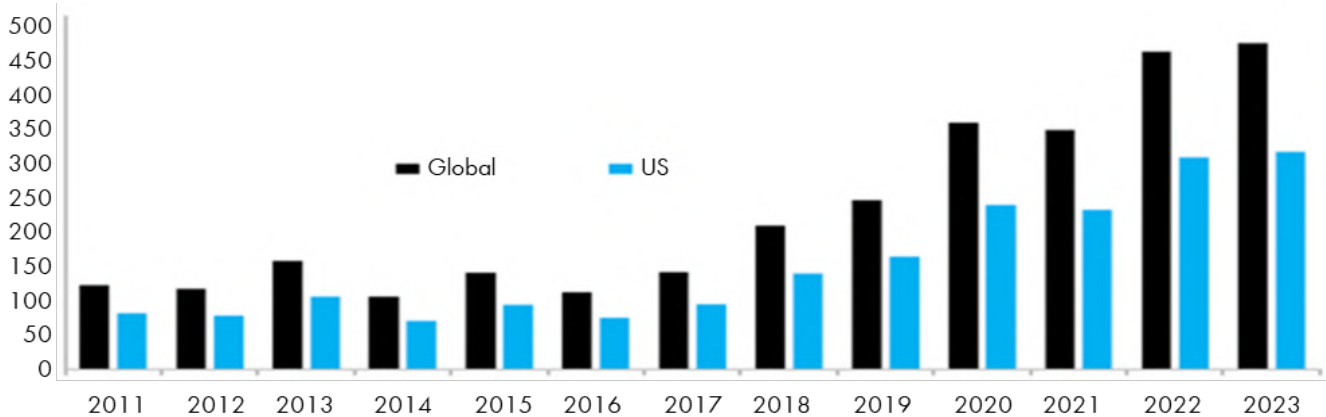
Not just private credit. The United States is the least dependent economy on bank lending for supplying

**Chart 2 US Financial Conditions Index, 2021-2023**



Source: Bloomberg

**Chart 3 Private Credit Dealmaking Values, Global and US, \$bil., 2011-2023**



Source: Deutsche Bank, Preqin

<sup>7</sup> The Bloomberg U.S. Financial Conditions Index tracks the overall level of financial stress in the U.S. money, bond, and equity markets to help assess the availability and cost of credit. A positive value indicates accommodative financial conditions, while a negative value indicates tighter financial conditions relative to pre-crisis norms.

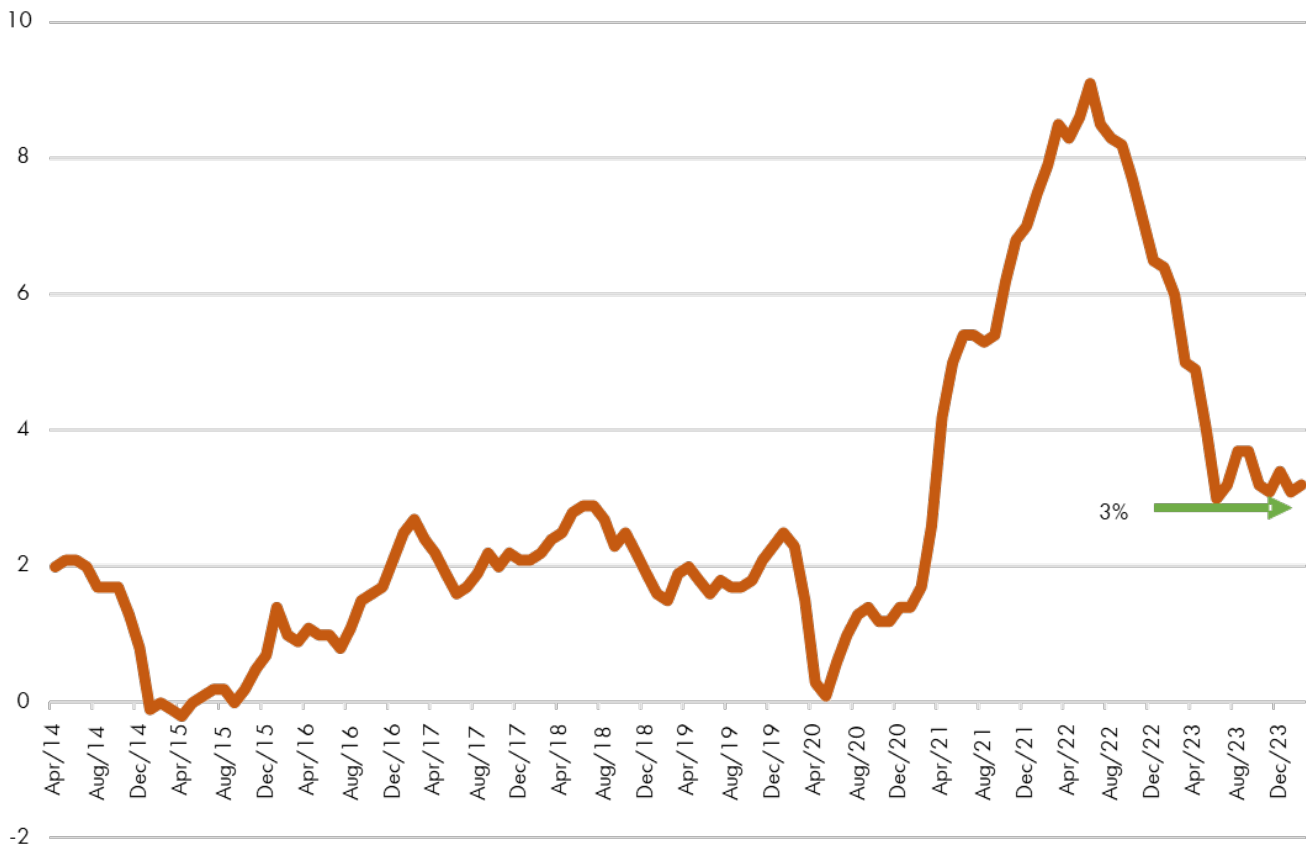
capital. Our capital markets are, by far, the largest, most liquid, most robust in the world, providing capital to everyone from homeowners to start-up businesses to global multinationals. The depth and breadth of our capital markets is an enormous competitive advantage for the United States in supporting economic growth.

**T**wo economic concerns are paramount. The first is inflation. Inflation has been brought down from 9% two years ago to around 3%

today. But the inflation rate has stalled at just above 3% for the past year (Chart 4).

Consumers, used to inflation averaging less than 2% for the previous decade, are not happy with +3% inflation. Two broad reasons explain consumer dissatisfaction with inflation. One is psychological. Even though wages have kept pace with inflation over the past few years, there is strong evidence<sup>8</sup> that employees see wage increases as rewarding individual

**Chart 4 US Consumer Price Index, YoY, 2014-2024**



Source: Bureau of Labor Statistics

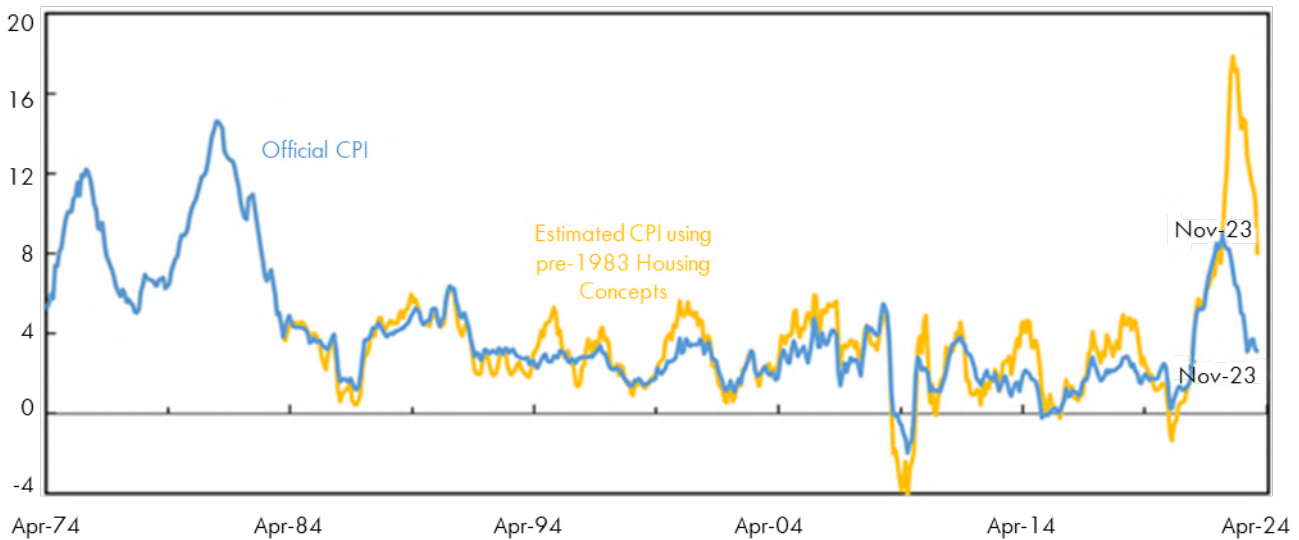
<sup>8</sup> Stantcheva, Stefanie, *Why Do We Dislike Inflation?*, NBER Working Paper 32300, April 2024.

work, whereas rising costs are seen as a loss of purchasing power. Despite the evidence that wages have kept pace with inflation, and have even accelerated faster over the past year, consumers do not perceive it as such.

The second explanation for unhappiness with inflation is methodological, but nonetheless very real: the Consumer Price Index understates the actual cost of living. When inflation spiked in the 1970s, government economists created a new category of “core” inflation that excluded the prices of food and energy, both of which, coincidentally, had soared substantial-

ly (“Pay no attention to the man behind the curtain.”).<sup>9</sup> When that trick didn’t assuage people, in 1983 mortgage costs were excluded from the CPI calculation, and in 1998 car payments were likewise removed. Had they remained, inflation would have peaked at 18% in 2022, rather than the reported 9%, and would today be tracking more than 8%, not the 3% the government tells us (Chart 5).<sup>10</sup> Consumers do not believe that inflation is really running at 3%, and they may be right.

**Chart 5 Official and Estimated CPI using pre-1983 housing methods, 1974-2023**  
Year-over-Year Change in Price Index



Note: 1983 is excluded during the transition, see text for imputation procedure.

Source: Bureau of Labor Statistics; Authors' Calculations.

<sup>9</sup> A Wizard of Oz reference.

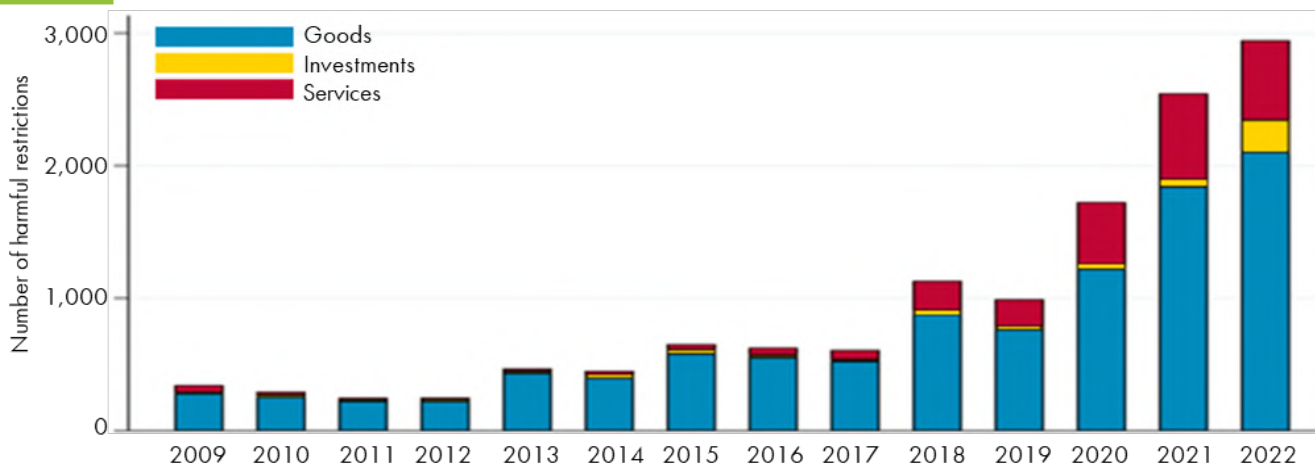
<sup>10</sup> The Cost of Money is Part of the Cost of Living: New Evidence on the Consumer Sentiment Anomaly, Marijn A. Bolhuis, Judd N. L. Cramer, Karl Oskar Schulz, and Lawrence H. Summers NBER Working Paper No. 32163 February 2024.

The second economic concern is protectionism. There has been a steady and material rise over the past decade in restrictions on trade and investment according to the IMF (Chart 6).

Restrictions on trade mean lower growth, less wealth and higher inflation. Politicians would do well to consult David Ricardo's writings of 200 years ago to understand why this is so.<sup>11</sup> Economists estimate that every 1% imposition of a tariff results in a loss of 0.1% in GDP, and likewise, a 0.1% rise in inflation.<sup>12</sup>

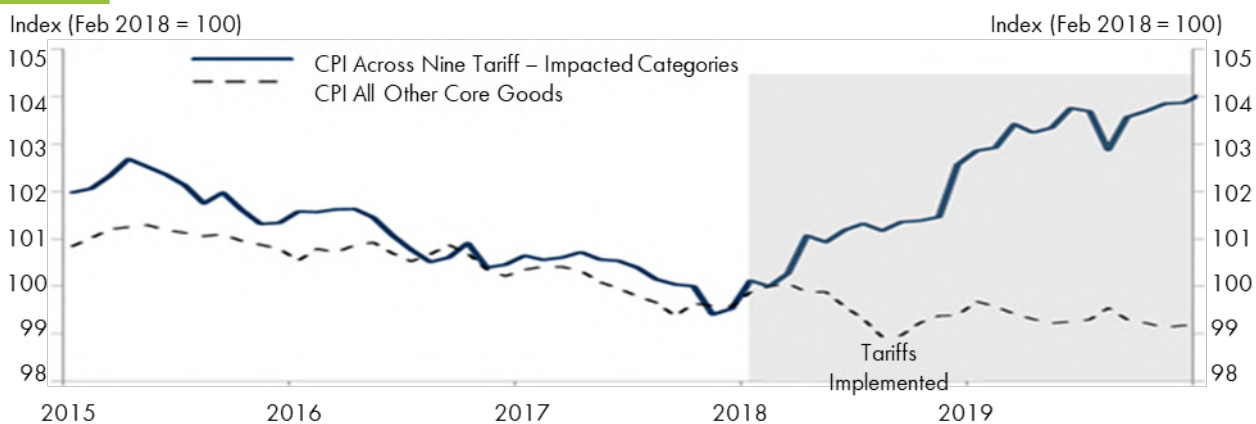
The results of the 2018 tariffs are instructive. Tariffs were imposed on the imports of washing machines (20-50%), solar panels (30%), steel (25%) and aluminum (10%). In the subsequent two years, domestic prices on those goods rose 5% while prices on all other goods not covered by tariffs fell 1% (Chart 7). Domestic producers hid behind these tariffs to raise their prices, perhaps improving their profitability, but at the expense of American consumers.

**Chart 6 Harmful Restrictions on Trade and Investment, 2009-2022**



Source: *Changing Global Linkages: A New Cold War?*, Gita Gopinath, Pierre-Olivier Gourinchas, Andrea F. Presbitero, and Petia Topalova, IMF, April 2024.

**Chart 7 CPI for Tariff and Non-Tariff Goods, 2015-2020**



Source: Goldman Sachs

<sup>11</sup> A Ricardo, David, *On the Principles of Political Economy and Taxation*, 1817.

<sup>12</sup> Goldman Sachs, *The Effect of Tariffs on Government Revenue, Growth and Inflation: Lessons From the Last Trade War*, 6 April 2024

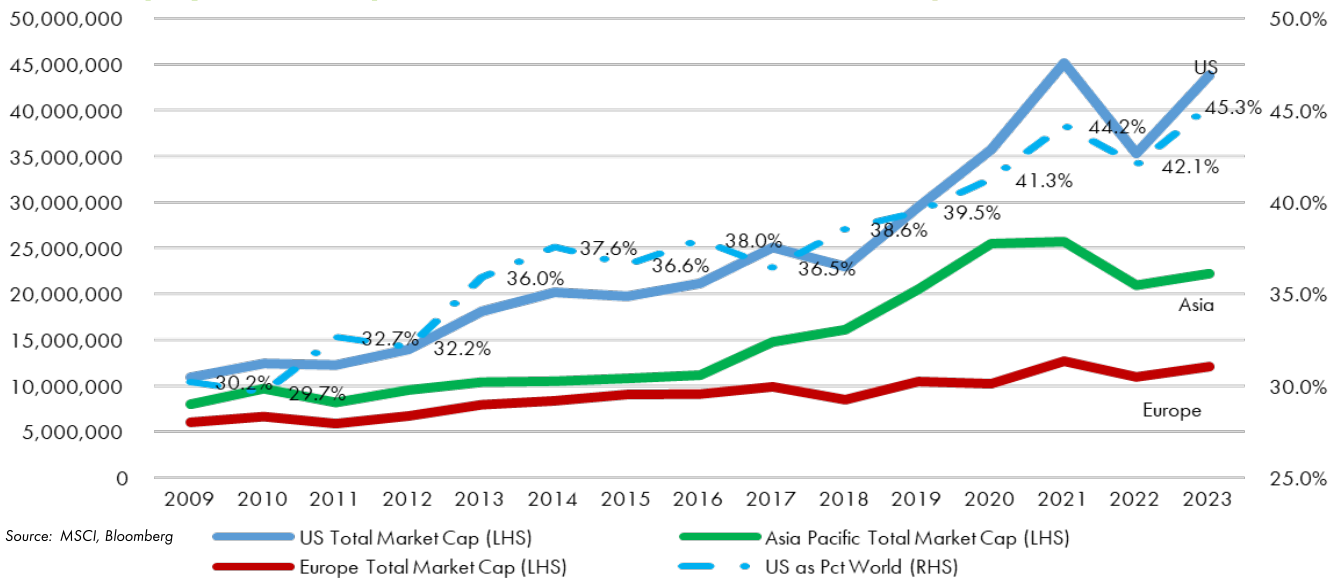
Unfortunately, it appears that the only political consensus in this country is for further restrictions on trade. That is a very short-sighted<sup>13</sup> policy.

Since the Global Financial Crisis of 2009, US equities have massively outperformed the rest of the world. With a capitalization of more than \$40 trillion, the US stock market valuation has risen

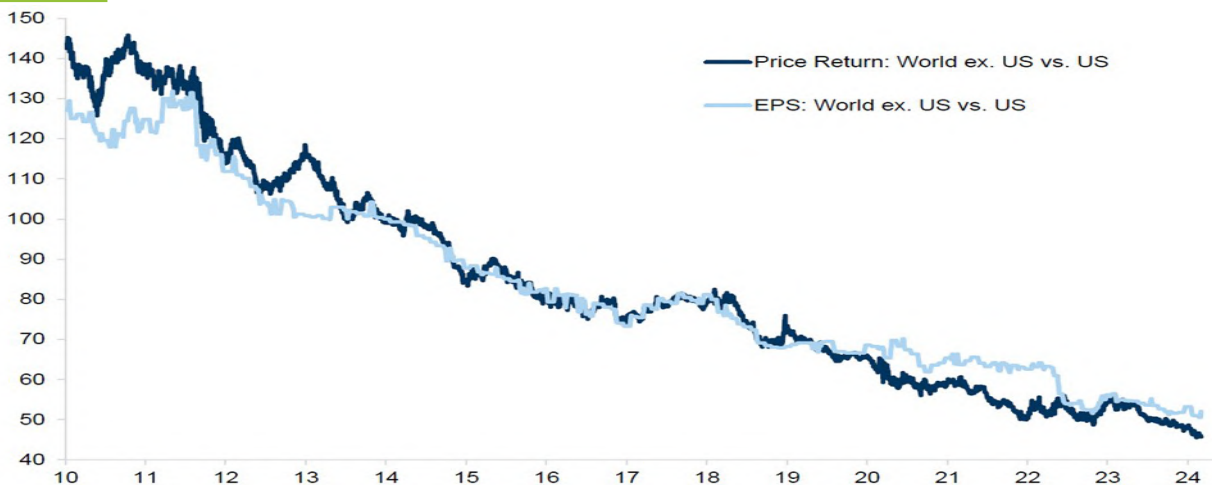
from 30% of the world market capitalization to nearly 50% in the past 15 years (Chart 8).

Follow the profits has been our mantra and the underperformance of the rest of the world reflects (almost perfectly) the relative decline in its profits versus the US (Chart 9).

**Chart 8 Equity Market Capitalizations of US, Asia Pacific & Europe, 2009-2023**



**Chart 9 Price Return and NTM EPS in Local Currency, World vs. US, 2010-2023**



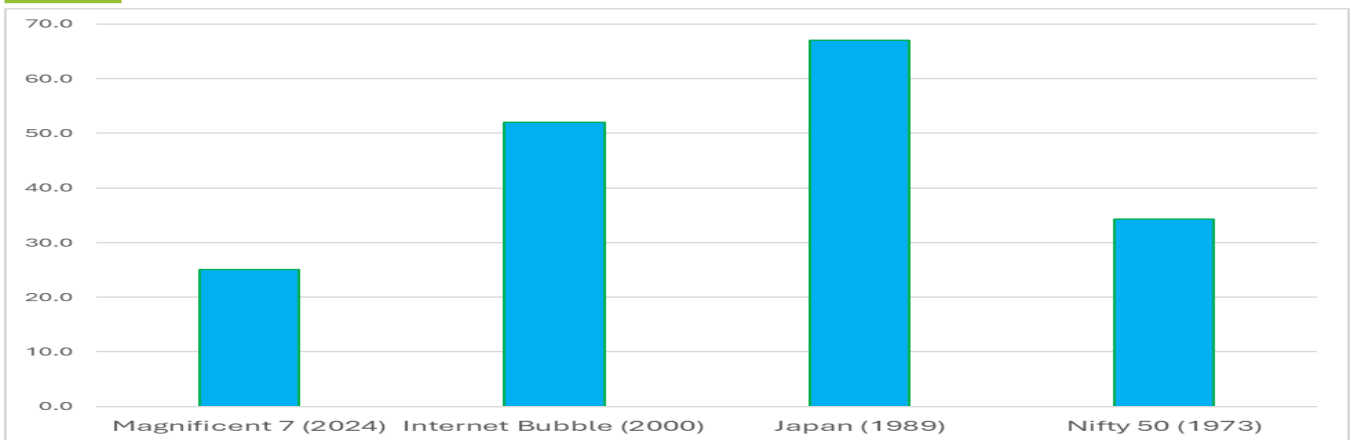
<sup>13</sup> I mean, stupid.

Part (but only part) of the explanation for the divergence in profitability is the composition of the US market, with its large weighting in technology companies relative to the rest of the world,<sup>15</sup> as technology has been the biggest driver of profit growth over the past decade. The dominance of the megacap technology stocks has generated worries of a bubble forming, but we have noted previously<sup>16</sup> that these valuations reflect the superior earnings growth of these companies. Furthermore, the valuations of these

leaders today are well below the levels of past bubbles (Chart 10).

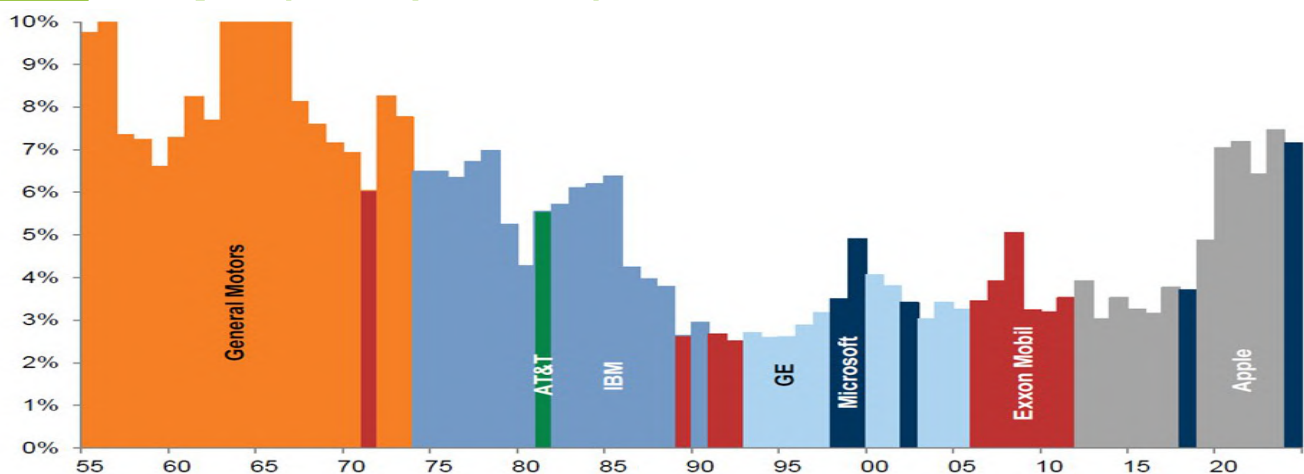
The market leaders of today are great companies, their prominence justified by their high profitability. But it's worth remembering that no company maintains that dominance indefinitely. The largest companies can stay at the top for a decade or more, but inevitably fall as other sectors and companies rise in their stead (Chart 11). Only 52 companies in the

**Chart 10 P/E Ratios, 2024, 2000, 1989, 1973**



Courtesy: Goldman Sachs

**Chart 11 Leading Companies by Market Cap, S&P 500 Index, 1955-2023**



Courtesy: Goldman Sachs

<sup>15</sup> The information Technology sector comprises approximately 30% of the S&P 500 Index versus 15% in MSCI Europe and MSCI Japan.

<sup>16</sup> <https://www.angelesinvestments.com/insights/investment-insights/4th-quarter-2023-storms>.



Fortune 500 in 1955 remain, meaning 90% have dropped out, either acquired or bankrupt. Of the largest 50 companies today, only half were in the top 50 a decade ago and many did not even exist 30 years ago, such as NVIDIA (1993), Netflix (1997), Alphabet (1998), Salesforce (1999), Tesla (2003) and Meta (2004).

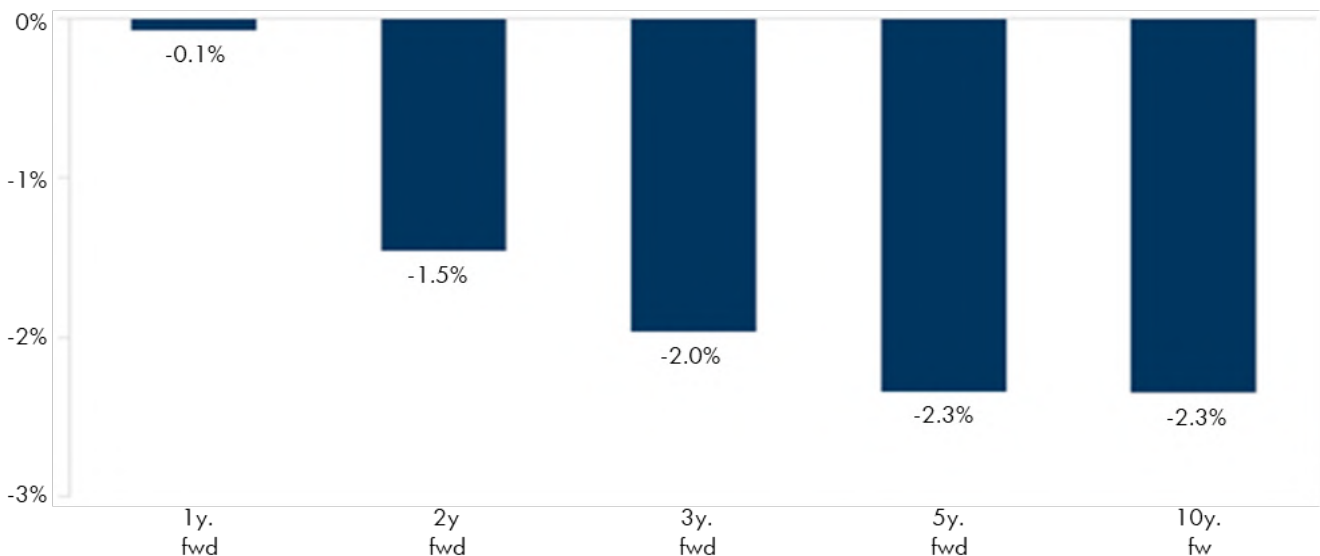
Over time, leadership in the market will change. The largest companies today may continue to generate strong returns in the future, but it is likely that they will, collectively, underperform in the years ahead as new leadership arises (Chart 12).

Herbert Stein, chairman of the Council of Economic Advisors under Presidents Nixon and Ford, quipped that “if something cannot go on forever, it will stop.”<sup>17</sup> Investors must follow the facts, not their expectations or the prognoses of so-called experts. A plausible

outcome is not an inevitable one. The sources of wealth today will almost certainly not be the leaders of tomorrow.

Samuel Michelson and his wife Rozalia left Posen, then in Prussia, today a part of Poland, in 1855 with their two-year old son Albert and dreams of a better life in America. They arrived in New York and made their way to the mining camps in California and Nevada where Samuel eked out a living as a peddler. Albert soon exhibited an unusual intelligence and despite the odds, secured an appointment from President Ulysses S. Grant to the U.S. Naval Academy, where the first Jewish midshipman had just graduated.<sup>18</sup> Albert would be the second.<sup>19</sup> Following his tour, Albert returned to the Naval Academy as an instructor in physics, and in 1883 took a similar position at the Case School in Cleveland.<sup>20</sup>

**Chart 12** Average Forward Relative Returns for Top 10 Companies vs. S&P 500 Index since 1980



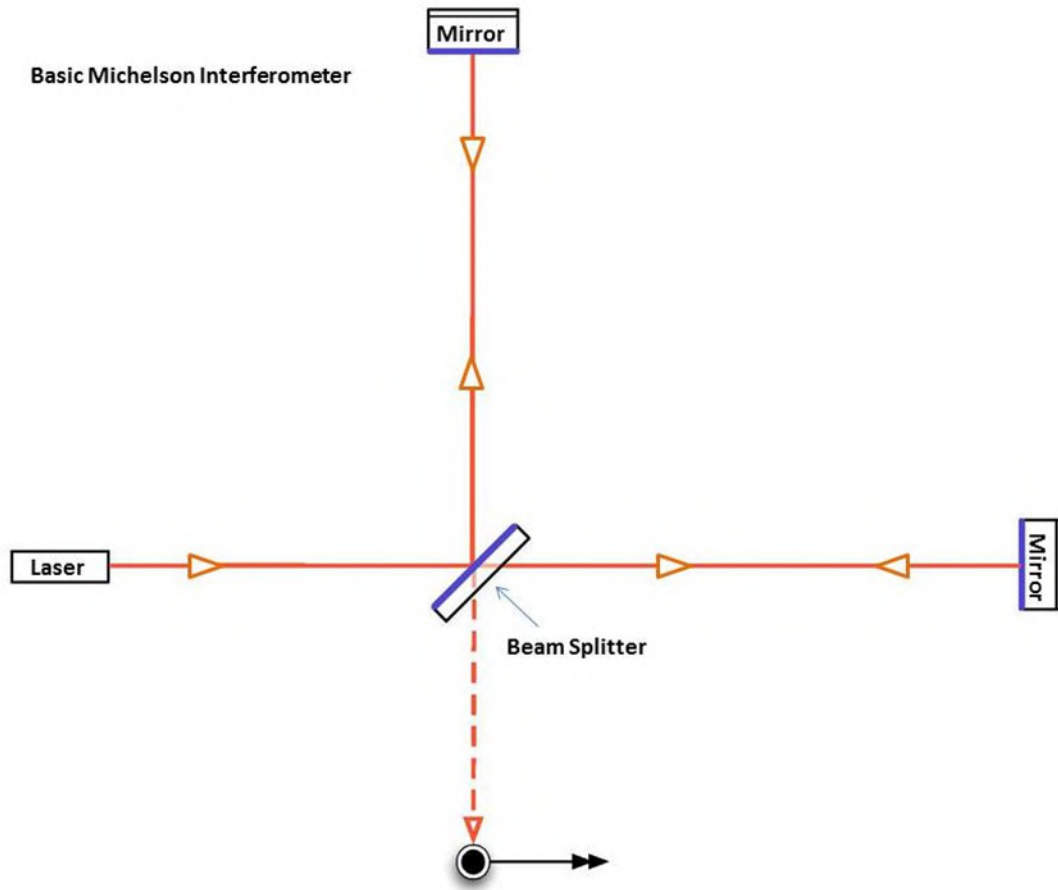
Courtesy: Goldman Sachs

<sup>17</sup> He dubbed this Stein’s Law.

<sup>18</sup> Adolph Marx, he rose to the rank of vice admiral.

<sup>19</sup> Season 3, episode 26 of the television series, Bonanza in 1962 dramatized how Ben Cartwright, the show’s hero, helped Albert secure an appointment from President Grant.

<sup>20</sup> Now Case Western Reserve University.



While at the Naval Academy, and then at Case, Michelson invented an accurate interferometer (see diagram) to measure how two light waves interact, or *interfere*, with each other and thereby measure their relative speed. The idea was to send a light ray to a mirror that would split the light into two beams traveling at right angles to each other. Those two beams would travel out to two other mirrors which then reflected the beams back to the middle where they recombined. If the Earth was traveling through the aether, one of the beams would return slightly faster than the other, generating a pattern, much in the way two waves meet on a lake and interfere with each other. Based on this pattern of interference, Michelson could then calculate the effect of the aether on light waves.

With his colleague Professor E.W. Morley at Case, Michelson assembled his most sensitive interferometer yet, 11 meters long, and installed it in the basement of a heavy stone dormitory on top of a large block of sandstone that floated in a trough of mercury, all designed to eliminate any vibrations or thermal effects. Michelson had calculated that the Earth's motion through the aether would cause a shift of 0.4 fringes (fringes are alternating light and dark bands that form from wave interference), and his equipment was sensitive to much smaller shifts, so Michelson was confident he would be able to detect the aether.



Michelson and Morley published their results in the *American Journal of Science* in 1887. They wrote: "The Experiments on the relative motion of the earth and ether have been completed and the result decidedly negative." Nothing. No shift, no interference, the two beams returned at the same time. Michelson not only failed to calculate the properties of aether, he seemed to prove that aether did not exist at all, overturning 200, or even 2,000 years of scientific assumption.

It was only in 1905 that a theory was developed to explain how the speed of light was a constant, that it did not require a medium, the aether, to propagate. That theory was called special relativity by its creator, Albert Einstein.

Despite the failure of his experiment, Michelson went on to great prominence. He moved to Clark University shortly after the experiment and then became the first head of

the physics department at the newly established University of Chicago in 1892. He left Chicago for the Mount Wilson Observatory, and completed the first accurate measurement of a star. His interferometer became so accurate that the International Committee of Weights and Measures asked him to define the official length of the meter by measuring the wavelength of cadmium light.

His awards and accolades piled up. Michelson won the Copley Medal, the Henry Draper Medal, the Gold Medal of the Royal Astronomical Society and in 1907, Michelson became the first American<sup>21</sup> to be awarded the Nobel Prize in science "for his optical precision instruments and the spectroscopic and metrological investigations carried out with their aid." There are Michelson Halls at Case Western, at the US Naval Academy and at the University of Chicago.

<sup>21</sup> Theodore Roosevelt was the first American Laureate, winning the Peace Prize in 1906 for his role in the Russo-Japanese War

The luminiferous (“light-bearing”) aether may not exist, but not getting the expected results is not a failure. The experiment shone a light on another direction to explore, and pushed Einstein to formulate a new concept, special relativity, that brought closure to the centuries-old debate on the nature of light. Michelson continued to improve the accuracy of his measurements, to the great benefit of science and astronomy. Albert Michelson was truly one of the greatest experimental scientists in history.

Opportunities may be right in front of us, as expected, but eventually, will more likely come from somewhere out in the aether. Our light must shine in all directions if we hope to see the future.



AI-generated art.



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April 2024

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