# AI-Semiconductor Market Bubble Analysis

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Date: *01/02/2026*

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# 1 Introduction

This decade has marked the emergence of commercially viable generative AI models, driving the rapid adoption of automation tools across almost all sectors of the economy. Beneath platforms such as OpenAI and Google's Gemini lies a substantial acceleration in semiconductor capability, particularly in advanced logic and GPU architectures, which underpin the training and performance of AI systems we increasingly rely on.

Over roughly a decade, cutting-edge semiconductor manufacturing has progressed from 16-nanometre processes to 3-nanometre transistor nodes, enabling transistor densities to increase by a factor of approximately six to seven. In tandem, computational throughput has scaled even more rapidly. Whereas mid-2010s consumer GPUs delivered compute measured in single-digit teraflops, modern data centre accelerators now operate at far higher throughput, representing orders-of-magnitude improvements for machine-learning workloads.

These advances constitute an unprecedented redesign of computational infrastructure rather than slow, marginal improvements. As a result, the rapid growth of semiconductor firms reflects not only speculative enthusiasm but also a genuine technological shock to the global economy. This coexistence of rapid technological progress alongside extraordinary market enthusiasm motivates the central question of this paper: whether the current AI–semiconductor boom constitutes a speculative bubble, or whether recent growth is fundamentally justifiable.

In this context, a speculative bubble is defined as a persistent mismatch between stock prices and underlying fundamentals, typically driven by market hype and overconfidence pushing valuations beyond what earnings and revenues can sustain. Indicators of such a bubble include sustained elevation in price-to-earnings (P/E) and price-to-sales (P/S) ratios, increasing concentration of market valuations, and price appreciation becoming increasingly detached from earnings growth. Additional structural features often associated with speculative bubbles include narrow market leadership and supply-chain fragility, which can amplify fragility even without mispricing.

Media attention surrounding AI and semiconductor firms has intensified markedly in recent years, coinciding with sharp increases in stock prices and reinforcing concerns that the sector may be experiencing speculative excess. Accordingly, the null hypothesis of this paper is that recent growth in the AI–semiconductor sector is fundamentally justified and consistent with the earnings expansion of scaling companies. The alternative hypothesis is that stock prices have become disconnected from underlying fundamentals, indicating the presence of a speculative bubble.

To assess these hypotheses, four diagnostic tests are applied. First, valuation levels are examined using P/E ratios. Second, price-to-sales (P/S) ratios are analysed to capture valuation pressures at the revenue level. Third, market concentration within the S&P 500 is assessed to distinguish between broad participation and narrow leadership. Finally, a decomposition of price movements was used to test whether the price increase was due to improving earnings or investor re-rating.

# 2 Historical Diagnostic Case Studies

## 2.1 Dot-com Bubble

Through the late 90s and peaking in March 2000, internet company valuations rose rapidly as speculative investments flowed into 'cutting edge' startups, known as 'dot-com' companies. Investors flooded to purchase equity in internet companies that sought to capitalise on developing internet technologies; Intel's high performance CPUs made servers relatively cheap and reliable whilst Oracle's application servers enabled companies to claim they could handle huge, scalable traffic. As a result, up to 39% of all venture capital in 1999 went to internet companies on top of huge funding from the general public.

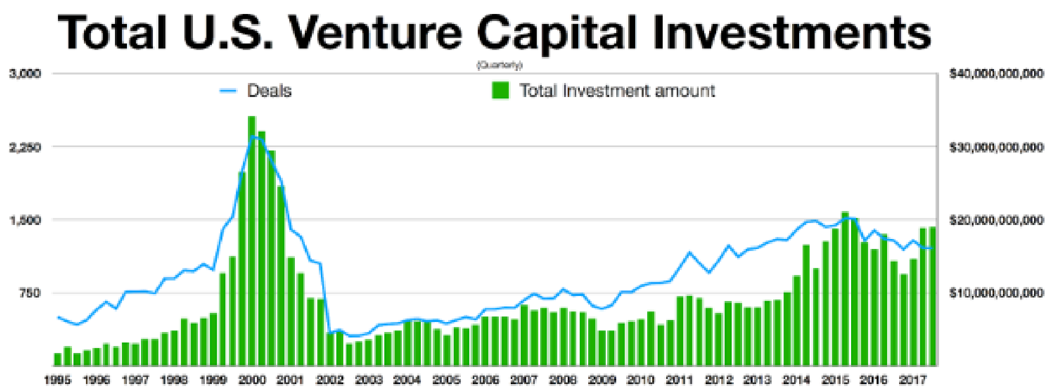


Figure 1: Total US Capital Investments versus time

However, many of these firms lacked viable mechanisms to generate profit from the internet, and hardware bottlenecks severely limited possible traffic. As these limitations became apparent, it was clear that these dot com companies had hugely inflated values without any real profitable architecture being generated. The NASDAQ-100 grew from under 1000 to over 5000 between 1995 and 2001 - marking huge reliance on this economic sector. Once profits were not realised, startups began to collapse, leading to huge sell orders from investment firms and market leaders like Dell alike. The NASDAQ fell by 77% by October 2002 and estimated losses of $5 trillion, the market taking 15 years to recover to its previous high.

Despite investors acknowledging the existence of a bubble to some degree, many still decided to 'hedge' and maintain exposure to startups, hoping that they could identify survivors of the likely incoming crash, like Google ultimately did. In comparison to the AI and Semiconductor market, modern chips have led to a market flooded by startups that either have yet to realise profit or use monthly subscriptions to their services. These companies have been the recipients of huge amounts of venture capital, with 51% of it going to AI companies in 2024.

In its current state, the semiconductor and AI market bears strong similarities to the dot com boom; large numbers of companies capitalising on new technologies receiving huge investment but struggling to realise profit. Another example is OpenAI; they plan to spend at least $1 trillion on infrastructure and development over the next decade yet revenue is only reaching $20 billion annually. To fund this OpenAI relies on a combination of substantial investment and large-scale contracts with other tech giants, notably Amazon, NVIDIA and Oracle. The failure of these would have significant knock-on effects on advancements and supply chain, undermining investor confidence.

However, there are important distinctions between the two booms to be made. Unlike many early internet startups, modern AI firms are built on demonstrable and reliable hardware improvements. Advancements in the semiconductor density and computational architecture are quantifiable, delivering orders-of-magnitude performance improvements. Furthermore, AI systems already generate considerable economic value outside of commercial use, in sectors like advertising, software development, logistic optimisation and scientific research. This is in steep contrast to a large proportion of dot-com companies whose business models were largely revenue-free.

Nevertheless, the similarities are tangible and there is no guarantee that current valuations based on an unknown potential are sustainable. The volume of capital required to scale AI infrastructure, combined with a huge reliance on corporate financial support raise very similar concerns to the dot-com companies. Using this bubble to predict another provides us with several warning indicators, such as excessive capital concentration in a single sector or widespread investment without sustainable profits. Such conditions would distort metrics like P/E and P/S ratios, which raise serious questions as to whether current growth is justifiable.

## 2.2 Japanese Asset Bubble

Following the 1973 oil shock, Japan entered a prolonged economic slowdown, causing the Bank of Japan to maintain exceptionally low interest rates to stimulate economic recovery. At the same time, financial deregulation lowered traditional bank margins, leading banks to expand loaning for revenue, subsequently triggering rising land asset bids. The value of assets and property increased aggressively, with land also becoming a preferred collateral for loans, owing to their reputation as safe and appreciating investments.

The loans also fuelled rampant speculation by both individuals and companies, stimulating rapid growth in the stock market. The Nikkei 225 stock index peaked at approximately 39,000 in 1989, 224% higher than its 1985 level. Commercial land prices rose by over 300% in the same time span, with the Tokyo Imperial Palace famously valued at more than the entire real estate market of California. Over 30 years land valuations grew by 5000% despite consumer prices only doubling in that time. By 1990 the Japanese real estate market was valued at 4 times the value of real estate in the United States, despite being 25x smaller in terms of landmass and having 200 million fewer people.


Figure 2: Value of the Nikkei 225 versus time

Despite this clear hypervaluation being clear now, the bubble to some extent was disguised by consumer prices staying low, giving the appearance of stable inflation. The entire country experienced overconfidence now known as market 'euphoria', encouraging continued purchasing of assets and stock. When the Bank of Japan inevitably hiked interest rates in an attempt to restrain speculation, the confidence collapsed. The Nikkei 225 plummeted to half its peak value within months, erasing over $10 trillion in wealth and causing Japan to enter its 'Lost Decade'.

Corporate and financial companies in Japan were perceived as invulnerable, with valuations fueled by confidence in the market rather than sustainable production or income growth. Mispricing was clear yet policymakers underestimated the risk of systematic market concentration - claiming the economy evidenced by a stable Consumer Price Index. Importantly, the bubble exhibited identifiable warning indicators, notably extreme market concentration and systematic overconfidence.

# 3 Data and Methodology

For the investigation, 5 leading firms were selected, making up a significant portion of the semiconductor market. NVIDIA (NVDA) is a leading developer of GPUs and AI accelerators, dominating the market for machine learning training and data centres. Advanced Micro Devices (AMD) design CPUs and GPUs, offering high performance processing for consumer and data centre markets. Taiwan Semiconductor Manufacturing Company (TSMC) is the world's largest and most advanced semiconductor foundry, making up around 70% of the global semiconductor foundry market. ASML is the sole manufacturer of extreme ultraviolet lithography machines, used for producing advanced semiconductor nodes of 5nm and below, selling mostly to TSMC. Broadcom (AVGO) designs semiconductor and infrastructure software products, used widely to scale data centres. Market leaders in AI, OpenAI were not included due to their status as a private company. The data used was taken from Yahoo Finance through the python finance API.

Historical speculative periods have been characterised by elevated valuation metrics, particularly Price-to-Earnings (P/E) and Price-to-Sales (P/S) ratios, reflecting prices rising faster than income generation. The P/E ratio over time provides an insight into profit-level valuation and the P/S ratio captures revenue-level valuations. Distorted valuation ratios typically imply mispricing, as stock prices are driven by investor confidence rather than income gains. Both metrics were calculated monthly and plotted to observe their changes over time.

Valuation concentration has also previously been indicative of market fragility, even if not a direct measure of mispricing itself. High concentration implies economic dependence on a few firms and subsequent amplified downside risk. A time series of market concentration was conducted, observing the of the top companies. The S&P 500 universe used for modelling involved approximately the top 100 companies in the US market. The semiconductor universe used comprised approximately 40 top firms spanning the US, European, and Asian market leaders. This analysis displays evidence of narrow market leadership rather than broader speculation, indicative of market fragility.

Finally, a price-fundamentals decomposition was conducted, identifying components where share growth was due to earnings increase and components where it was due to multiple driven factors, which reflect shifting investor sentiment rather than improving fundamentals. This was conducted since valuation ratios indicate whether or not assets appear expensive, but do not reveal why prices have risen. Using, $P = E \times (P/E)$ the equation for the decomposition is derived as $\Delta \ln P = \Delta \ln E + \Delta \ln(P/E)$, converting a multiplicative relationship into an additive one and so allows for the attribution of price changes to earnings growth versus multiple expansion.

# 4 Results of Bubble Diagnostics

## 4.1 Diagnostic 1: Broad Valuation Expansion - P/E

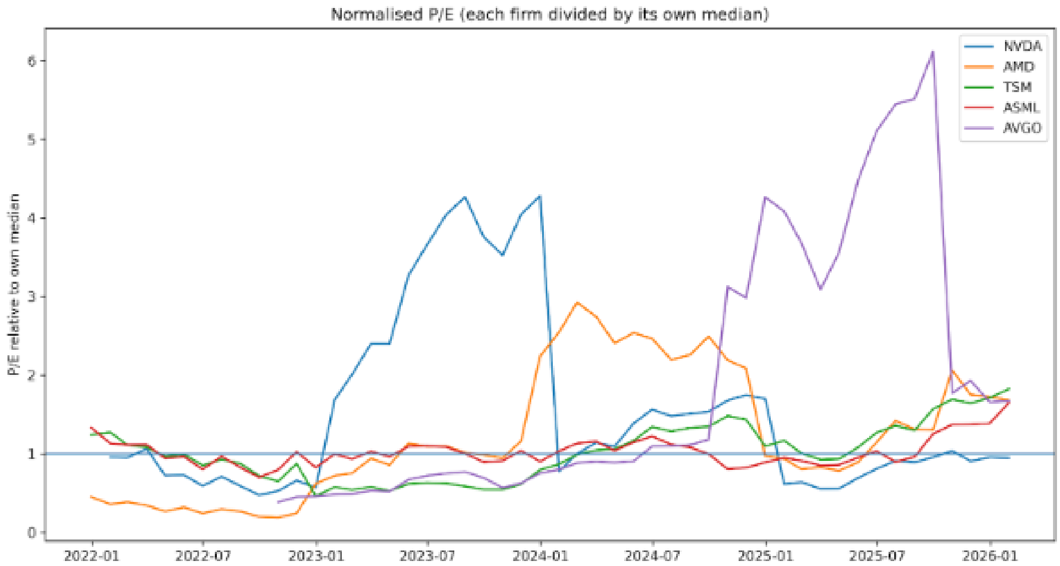


Figure 3: Normalised P/E over time of 5 major semiconductor companies

Figure 3 presents normalised price-to-earnings ratios for NVDA, AMD, TSM, ASML, and AVGO, with each firm's P/E divided by its own historical median to facilitate cross-firm comparison. Across the sample, most firms cluster closely around their median values for extended periods, indicating historically stable valuation regimes.

NVDA exhibits a sharp but temporary spike in 2023, followed by rapid mean reversion as earnings increased substantially in subsequent periods. AVGO displays a later episode of elevated valuation, while AMD, TSM, and ASML remain comparatively anchored around their median values throughout most of the sample. Importantly, valuation peaks occur at different times and with differing magnitudes across firms.

A classic speculative bubble would be expected to demonstrate sustained and synchronised multiple expansion across firms, reflecting broad repricing driven by sentiment rather than fundamentals. No such pattern is observed in Figure 3. Valuation variation appears firm-specific rather than systemic, with no evidence of a sector-wide re-rating regime.

## 4.2 Diagnostic 2: Revenue-level Overpricing - P/S

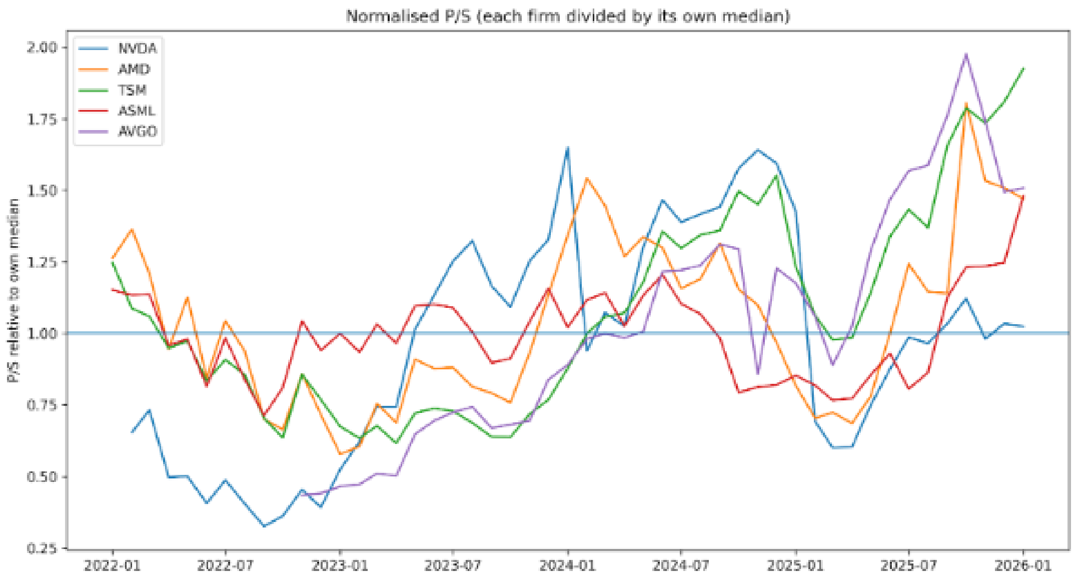


Figure 4: Normalised P/S over time

Figure 4 displays normalised price-to-sales ratios for the same firms. While P/S ratios exhibit more pronounced short-term fluctuations than P/E ratios, most firms remain within approximately 0.5–1.5× of their historical median values. These deviations are orders of magnitude smaller than those observed during the dot-com bubble, where many firms traded at P/S multiples 3 times their historical norms, with some reaching highs of 20-50 times.

P/S ratios are inherently more volatile than P/E ratios, as they reflect expectations about future margins rather than realised profitability. Nevertheless, the observed fluctuations are episodic rather than persistent, with firms generally reverting toward their historical medians following periods of elevated valuation. This gives no evidence of sustained mispricing and, broadly speaking, revenue growth has reverted more extreme P/S swings. This again does not provide sufficient evidence of a speculative bubble.

## 4.3 Diagnostic 3: Market Fragility - Valuation Concentration

Having established that the valuation metrics do not indicate systemic overpricing, market structure is assessed as to whether the regime is characterised by broad participation or narrow leadership, and therefore structural fragility.

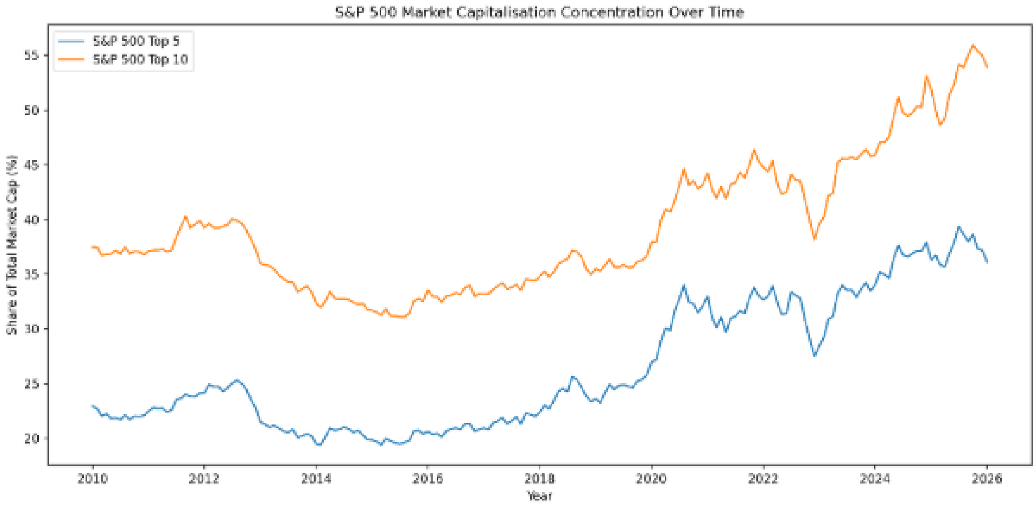


Figure 5: S&P 500 valuation concentration

Figure 5 shows the share of S&P 500 market capital accounted for by the top five and ten companies.

From approximately 2010-2019, the chart demonstrates a relatively stable concentration. After 2020, a sharp rise in both top-5 and top-10 shares is seen, with both rising to historic highs. This is indicative of increasing market dependence on a small number of firms.

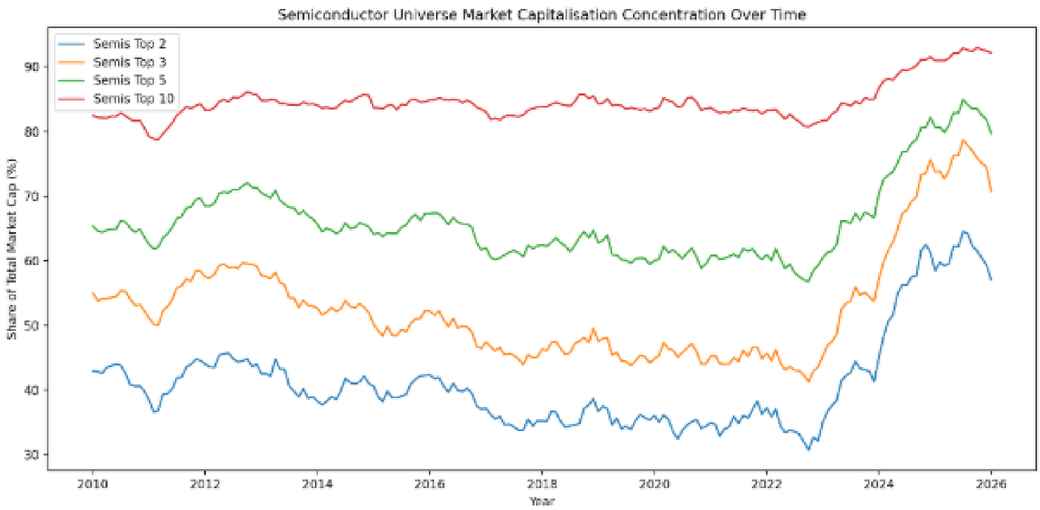


Figure 6: Semiconductor market valuation concentration

Figure 6 presents concentration measures for a semiconductor sector, comprising 35-40 major companies that are publicly trading. The sector follows a similar trend to the S&P 500, of long term relative stability with a marked inflection after 2022, with the market becoming increasingly concentrated towards the top-few companies.

The increasing concentration of market valuation across the S&P 500 and semiconductor sector are both indicative of capital reallocation and narrow participation rather than speculative overvaluation, reflecting market fragility rather than an outright bubble.

### 4.4 Diagnostic 4: Prices Straying from Fundamentals - Decomposition

The decomposition examines whether price appreciation has become decoupled from fundamentals by decomposing price changes into earnings-driven and valuation-driven components. The chart displays the rolling valuation contribution against time, with higher values indicating the market paying more ‘per £’ of earnings than historically - valuation driven growth. Lower values indicate the market is paying less ‘per £’ than historically - earnings driven growth.

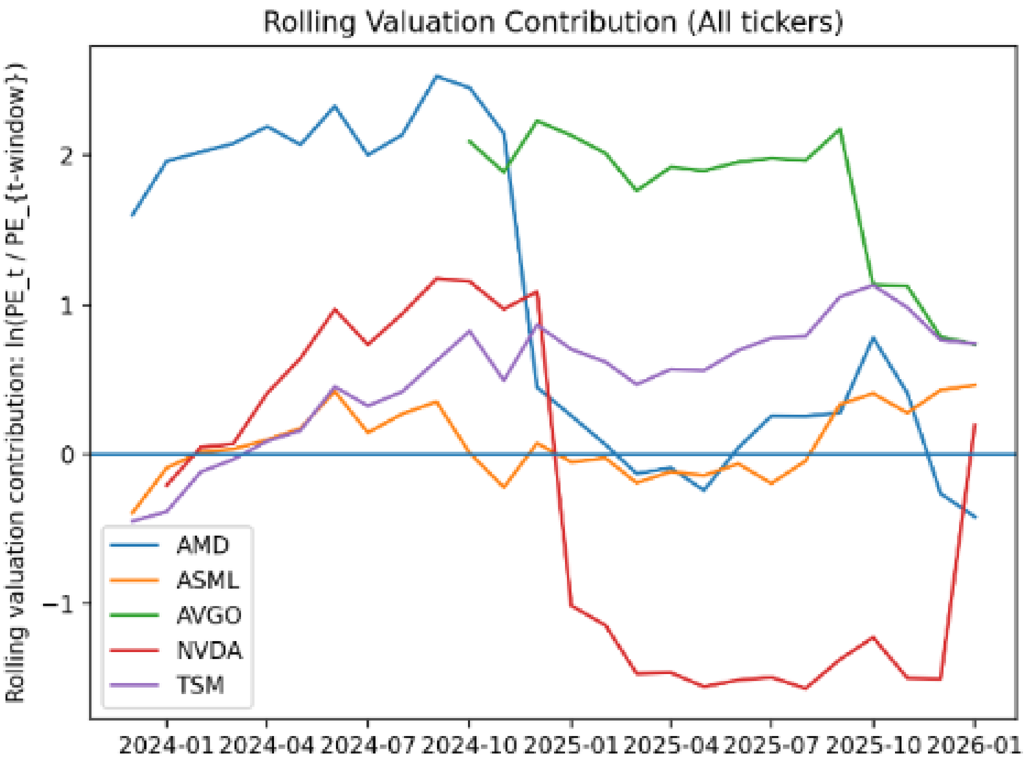


Figure 7: Rolling valuation concentration

Most companies evidently maintain a positive value throughout the past 2 years, mostly staying near zero. NVDA is presented predominantly as an earnings-driven company, staying around zero and moving to -1 in early 2025, staying negative until 2026. TSM, AMD and ASML are intermittently valuation-driven, though the periods are neither sustained nor extreme. AVGO and AMD both experienced periods of being strongly valuation-driven, however both mostly reverted toward zero; a balanced regime like most companies.

This provides very little evidence of systemic, bubble-like overpricing as valuation-driven periods are episodic rather than systemic.

# 5 Discussion

## 5.1 Bubble Narratives

The results have clearly not been indicative of systemic mispricing and there is not sufficient evidence to reject H0 , there is not enough evidence of a speculative bubble. This then lends the question as to why headlines and social media are viewing the AI and Semiconductor market as so unstable, consistently being referred to as a bubble.

The first reason could be the speed and visibility of the sector's gains. AI-linked equities have appreciated extremely quickly; OpenAI's revenue has increased by over 3000 times since 2020. On top of this, the sector's gains have been unusually visible to the general public, NVIDIA's revenue and value has repeatedly made headlines, chatbots have been increasingly relied on and integrated on platforms like Google and X. The market's boom has been seen throughout the last 5 years, often seen as speculative excess. People typically associate speed as unstable and indicating a bubble, even if the growth is earnings-driven.

Secondly, the growth of the sector can be very reminiscent of the dot-com bubble and other cases of new growth collapsing. The technology has been framed by most reports to be life-changing, however has long and uncertain timelines to become monetisable. This allows for easy pattern-matching between the two cases, however it is important to note that narrative similarity does not equate to economic similarity. Despite the story of AI and semiconductors sounding like yet another too-good-to-be-true technological boom, in its current state the growth of the market has been relatively stable.

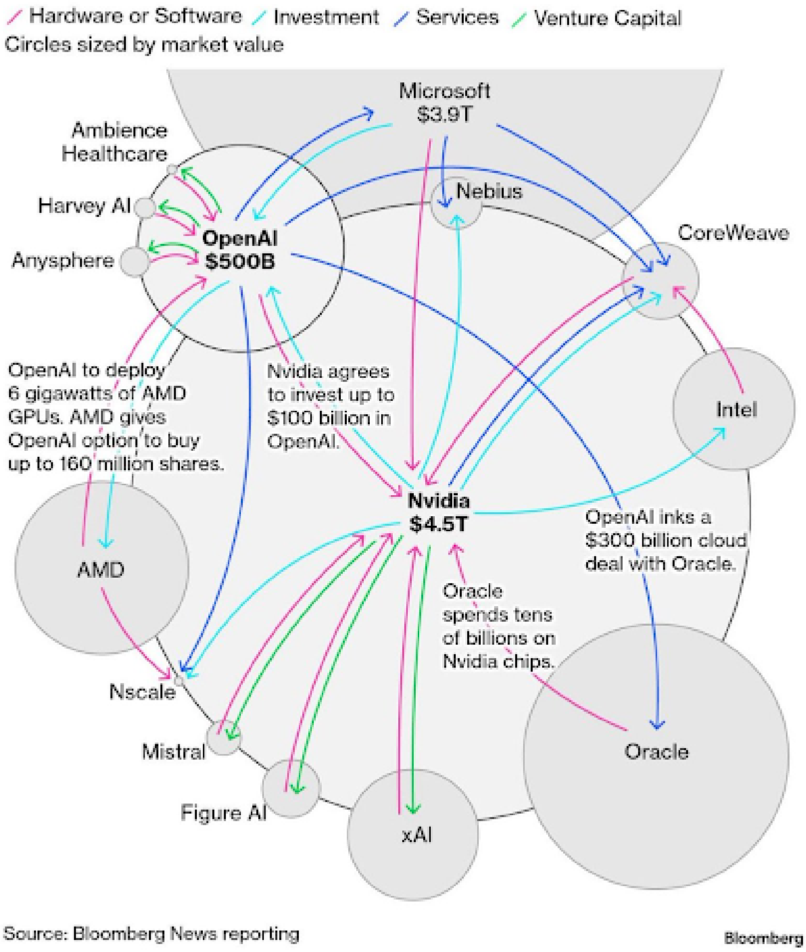


Figure 8: Bloomberg News 'closed loop' money flow diagram

The Bloomberg News image above has been frequently included as evidence in recent commentary, supposedly illustrating a closed loop of spending and self-funded demand. Figure 8 shows investments, spending and revenue flows between hyperscalars, AI labs and semiconductor firms all seemingly investing billions into one another, back and forth with limited end-stage buyers. The diagram illustrates non-independent demand, reflexivity (belief fueling spending which again fuels belief) and highlights the markets extreme concentration. This causes significant concern among investors and increases scepticism.

The concerns are extremely valid, along with the other speculative bubble allegations as they are easy to construe in a way to support pro-bubble arguments. The diagram however displays strategic investments rather than circular funding. For example, NVIDIA designs chips used by AI hyperscalars and labs. Therefore by investing in companies like OpenAI and increasing the population's reliance on AI tools, the demand for chips worldwide will increase and so NVIDIA's revenue and market capitalisation will increase in turn. The vast majority of spendings reported are justifiable in a similar manner, through resource spending, strategic investments and integration of produced tools. These create deceptively problematic money-loops, however the diagram captures concentration and path-dependence, not that prices have detached from fundamentals. The diagram therefore does not support our definition of a speculative bubble, but does cause concern among investors.

### 5.2 Fragility versus Speculative Mispricing

It has become apparent that most narrative surrounding the bubble has been supportive more of a fragile regime rather than the speculative bubble we defined. The bubble is characterised by price gains becoming detached from fundamentals, returns dominated by multiple expansion rather than earnings, and synchronised repricing. Structural fragility however is represented by prices driven by earnings growth, high sensitivity to shock and most importantly narrow market leadership. These regimes can produce similar post-shock price dynamics however arise from different mechanisms.

Reflecting on the results, both the P/E and P/S multiples provided no speculative bubble evidence, and the decomposition of prices displayed fundamental-driven growth for the market leaders. The concentration metrics however clearly demonstrated narrow leadership whilst prices were driven by earnings, suggesting strongly the current regime to be structurally fragile. The AI-semiconductor boom therefore is likely not a typical speculative bubble, however is still somewhat unhealthy, fragile and susceptible to collapse through other mechanisms.

### 5.3 Why Private and Public Markets Diverge

This paper investigated only the largest publicly trading companies, and due to lack of data available largely ignored privately trading ones. The narrative for these private mainly AI companies likely varies to the semiconductor monopoly-like firms studied. The public semiconductor firms trade continuously, publicly repricing every day and report earnings regularly meaning they are judged heavily on realised performance, as assessed here. Private AI companies however raise money privately and episodically, often optimising for growth rather than profit since they are not constantly judged, allowing them to work on long-term expansion. They are therefore structurally different and as a result, private-market valuations are embedded with far more uncertainty and optionality. This makes them feel bubble-like even if public-market pricing remains coupled to fundamentals.

This is evidenced by public interpretation as most media coverage is focused on startups like OpenAI, Anthropic and SaaS firms that often have negative cashflow and uncertain economic stability. Public perception is therefore shaped only by the knowledge of huge spending and investments and leading to assumptions of bubble-like behaviour. Huge investment however is not equal to mass mispricing of equities as the investment is intended to be at a loss, pushing for new technologies and infrastructure, hedging on long term gains and therefore the losses are calculated as acceptable.

An important distinction is that the semiconductor firms sit upstream of the AI companies that are riskier investments. Regardless of whether start-ups fail or earnings do not materialise, they still sell chips, generate earnings and are able to fundamentally justify their stock valuations. This allows public semiconductor firms to exhibit strong fundamentals even in an environment of decoupling downstream where many AI ventures will ultimately fail and venture capital is lost.

The divergence between the private AI markets and public semiconductor ones explain why AI is widely perceived as a bubble, despite the absence of bubble diagnostics in the semiconductor sector. The presence of a true speculative bubble in AI itself cannot be known since most companies are private, however the most likely outcome is that many of the current names will fail and lose their investments. This however will not cause a major economic shock like the dot-com case, instead the ventures are calculated losses, gaining infrastructure, technologies and the companies that remain after collapses; long term gains at a cost rather than outright failure.

# 6 Mechanics of Downside Risk Without a Bubble

Despite the risk of a bubble and subsequent collapse being limited and not evident in the empirical findings assessed here, the risk of a downturn in stock is very real. This is due to several geopolitical and psychological factors and therefore it is important to note these factors are conditional and not structural, guaranteed vulnerabilities.

Firstly, as seen in the results, the semiconductor sector can certainly be considered to have narrow leadership and is therefore relatively fragile to any shocks. When small numbers of firms dominate the market, shocks are much faster to take effect and are somewhat amplified, bringing larger drawdowns and sentiment shifts. High concentration as seen greatly increases market sensitivity, regardless of how justifiable valuations are. This itself is a risk to prices, however more broadly threatens to enlarge the effects of other risks to be discussed.

## 6.1 Supply-Chain Exposure through Taiwan

A core source of fragility in the semiconductor market arises from the geographic concentration of advanced chip manufacturing. Despite the global appearance of semiconductor supply chains, since it spans several countries, production of leading-edge chips is heavily dependent on a small number of firms and facilities. Most notable among these are TSMC's fabrication plants in Taiwan, making up an estimated 90% of production of advanced nodes. This makes a single-point dependency in the production of chips that underpin AI accelerators, data centres and high performance computing. Unlike many other products, advanced semiconductor manufacturing cannot be quickly or easily substituted or relocated due to its capital intensity, complexity and tightly integrated production process.

From a market perspective this concentration introduces a low-probability but still high-impact risk that is difficult to price. Semiconductor fabrication relies on access to stable power, water and digital connectivity meaning that limited disruptions, whether geopolitical or logistical, could have huge downstream effects. Importantly, such risks do not imply mispricing in semiconductor equities, rather display a market characterised by narrow leadership and strong, earnings-driven valuations. The Taiwan-related risk therefore reinforces the paper's general result, the market is fundamentally justified, but structurally fragile and therefore highly sensitive to any shocks.

*Further geopolitical context is provided in Appendix A*

## 6.2 Policy Risk and Export Controls

As mentioned before, the Semiconductor market is extremely monopolistic; ASML making the only EUV equipment, TSMC making the vast majority of advanced nodes, NVIDIA designing the vast majority of high-end GPUs and so on. These companies are virtually irreplaceable and unchallenged, a leading factor in the prohibition of Chinese competition. Before controls, China ranged from 30-40% of the global GPU market, with fabs and cloud firms in the country advancing and expanding rapidly. After US and EU export controls, Chinese AI labs could not continue to develop or train models and cloud companies could not expand to high performance computation meaning the market was dominated by western companies. This has a twofold impact; a lack of competition, and capped demands. At least a third of global demand is structurally capped and reduces long term market size significantly. Depending on the action western governments choose to take, the market could either remain monopolistic and highly fragile, or if China was included, expand even more rapidly. The lack of competition is generally unhealthy for markets as prices are somewhat unregulated and shocks are greatly amplified.

## 6.3 Industrial Policy

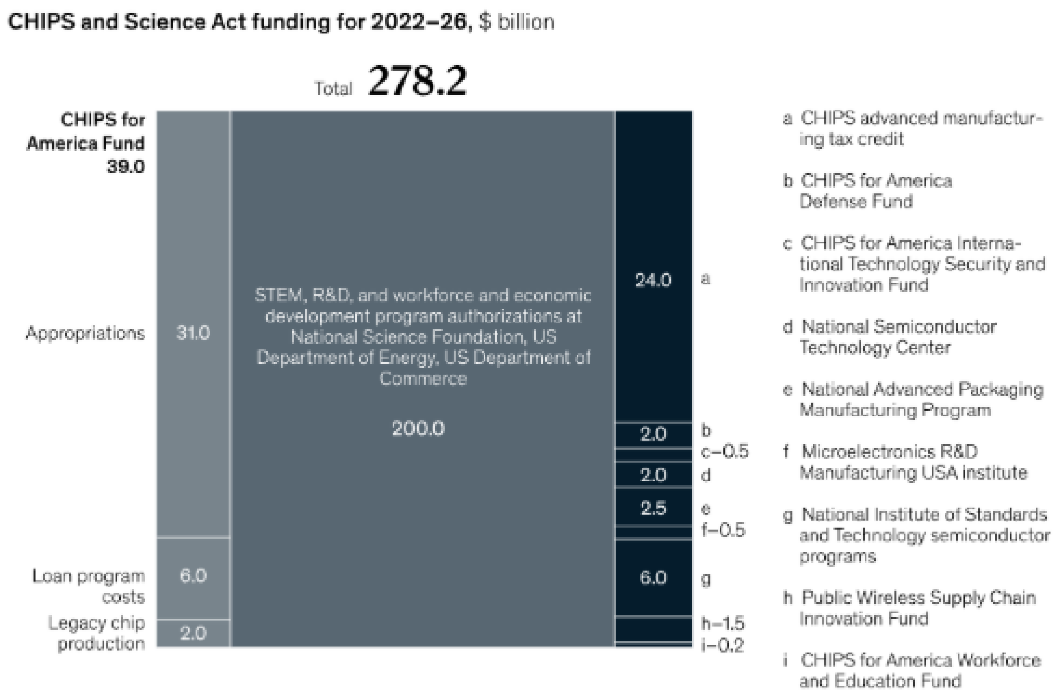


Figure 9: McKinsey & Company CHIPS and Science Act funding allocation diagram

The CHIPS and Science Act passed by the US in 2022 allocated $52.7 Billion in federal subsidies to support chip development and manufacturing, with a total of $280 Billion in 10 years going to scientific R&D. The aim of the project is to improve US competitiveness in the industry and decentralise the market away from the more volatile Taiwan. Subsequently. 70 semiconductor fabrication plants are in construction in Arizona and Texas.

The EU passed their own CHIPS act as well with almost €50 Billion mobilised. The funding has been split into 3 pillars; improving industrial capacity, research and development and crisis response capabilities, creating the European Semiconductor Board to issue warnings for potential market shocks.

Initially, the sector was perpetuated by AI hype, however by flooding money into the market, governments are helping to prove to investors that growth is real. Over time, the funding may act as a 'bubble dampener' by anchoring investments in real infrastructure that will outlive any market falls. It simultaneously decentralises the market, improving stability and reducing the effect of potential shocks. These are therefore not mechanisms of downfall, rather reducing both their likelihood and impact and so are extremely positive for the market.

## 6.4 Narrative-driven Panic and Reflexive Selling

The final potential mechanism is a 'mass sell-out'. Despite evidence provided here, there are still widespread bubble beliefs. Be it through media amplification or psychological disbelief of fast growth, the vast majority of the public and investors do not have faith that the market will not collapse and so will likely seek to get ahead of falls, even aiming to profit. Coordinated selling without fundamentals changing is very possible, triggered by small actions causing larger scares. This could be investment firms diverging stock options, cancellation of contracts or risks to the supply chain. Any following mass sales would trigger a negative feedback loop, themselves causing more selling as market confidence continues to worsen.

Such drawdowns would reflect wholly reflexive market dynamics rather than unwinding of speculative mispricing, in other words it would not be a bubble bursting. Due to this, the market would almost certainly recover and continue to grow as before.

The aforementioned mechanisms demonstrate how a fundamentally justified but structurally fragile market can experience significant volatility or drawdowns without having been a speculative bubble.

# 7 Conclusions

This paper set out to test whether the recent AI-semiconductor boom constitutes a classic speculative bubble, or whether the price appreciation is fundamentally justified despite widespread concerns. Rapid growth in AI-linked equities, whilst media attention has been intense, has led to the drawing of historical analogies and persistent claims that the sector is mispriced. Rather than accepting or rejecting the narrative, the analysis adopted a falsification-based approach, applying a series of empirical tests designed to detect typical indicators of speculative bubbles.

To assess this question, the paper utilised four primary diagnostics, price to earnings and price to sales ratios, valuation concentration measures and a price-to-fundamentals decomposition to distinguish earnings-driven returns from valuation-driven repricing. Together, these diagnostics were chosen to test not only whether valuations were elevated, but whether price dynamics were decoupled from underlying fundamentals, consistent with historical bubbles.

Across both valuation diagnostics, there was little evidence of sustained mispricing or synchronised multiple expansion across the firms examined. When individual firms experience periods of valuation multiple spikes, the movements were individual and typically followed by mean reversion as earnings were materialised. Deviations in P/E and P/S ratios were mild relative to historical benchmarks such as the dot-com bubble, being an order of magnitude lower in many cases. Valuation behaviour in the current AI-semiconductor market does not exhibit the typical systemic mispricing of speculative bubbles.

Analysis of market structure however, revealed a different yet significant source of risk. Market capital has become increasingly concentrated to a small number of firms, both within the semiconductor sector and across the market as a whole. This narrow leadership implies heightened sensitivity to shocks, even without widespread mispricing. The concentration alone however is not indicative of speculative excess, rather a structurally fragile regime in which justified valuations are still exposed to downside risk.

The price-fundamentals decomposition further reinforced this distinction. For the market leader assessed, price appreciation over the study period was largely driven by earnings growth rather than speculation. Periods of valuation-led returns were present but episodic, firm specific and typically returned to the mean multiple values. Taken together, the diagnostics provide no evidence of decoupling between prices and fundamentals, the defining feature of speculative bubbles.

In accordance with these results, the paper finds no support for the hypothesis that the AI–semiconductor boom constitutes a classic speculative bubble. Instead, the current regime is best characterised as experiencing fundamentally justified growth accompanied by elevated structural fragility. This distinction is integral as, while speculative bubbles are defined by widespread mispricing and sentiment-driven repricing, fragility arises from concentration, capital intensity, and sensitivity to shocks, even when valuations are supported by earnings. This distinction carries important implications for interpreting market risk. In a fragile but fundamentally supported market, volatility may arise from narrative shifts, policy changes, or exogenous shocks without implying the unwinding of prior mispricing. As a result, sharp corrections should not necessarily be interpreted as evidence that valuations were unjustified.

Several limitations of the analysis should be acknowledged. The firms utilised in studies were restricted to large publicly traded companies, and the study could not directly assess private-market valuations or early-stage AI ventures, where speculative dynamics may differ substantially. Additionally, geopolitical and policy risks are discussed only qualitatively, as their episodic nature makes them difficult to define by value-based diagnostics. These limitations do not undermine core the findings, but highlight areas where the diagnostics may not fully apply.

In conclusion, this paper demonstrated the value of empirically testing market narratives rather than accepting them as they appear in the media. By separating valuation behaviour, market structure and the drivers of appreciation, the analysis shows that the AI-semiconductor boom does not meet the defined criteria of a speculative bubble. Instead, it reflects an earnings-driven but structurally fragile regime. The risks to the regime are not from mispricing, but rather from concentration and sensitivity to shocks. Continuing to distinguish the empirical findings from the widespread narrative is essential for accurately interpreting markets in periods of rapid change and investing with accurate information.

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### AI statement

AI-based tools were used as a research aid to support code development, figure interpretation, and editorial refinement of written sections. The analytical framework, data selection, modelling choices, and interpretation of results were independently designed and executed by the author. All conclusions reflect the author's own judgment.

## A Appendix

### A - Further Geopolitical Context

The first potential action to be taken is direct military action. Taiwan relies on 6-8 power substations, meaning that roughly 80% of the country would be out of power after limited missile strikes. The entire country also relies on only 14 undersea cables which, if cut, would cripple Taiwanese connectivity and halt fabrication production entirely. The machinery used in fabrication is also extremely sensitive and could take up to 2 weeks to wholly restart production if power or connection was not supplied.

Figure 10: Screenshot of new Chinese barge systems from X

Direct invasion is another, albeit more unlikely, option with US-based intelligence claiming Xi has ordered the People's Liberation Army (PLA) to be capable of invasion by 2027, evidenced by the rampant military build up. This build up is the largest seen worldwide since the second world war, completely overhauling their command structure, boosting missile stocks and strengthening all arms of the military including paramilitary aspects. This has been accompanied by the development of Shuiqiao ships, seen in figure 9, which are able to create floating docks, from which to stage invasion operations, from up to a kilometer to sea. They have also converted civilian ferries and ships to be capable of shipping troops and vehicles, accounting for 1.1 million tonnes of potential transport capabilities, contrasting the entire Chinese navy's fleet capability at 370,000.

Invasion however as stated is unlikely for several reasons. These include notoriously large casualties from amphibious beach attacks, as well as the chance of US, Japanese and Australian involvement. Both of these factors lend the operation to a high risk of failure or stagnation, meaning a more likely option would be the aforementioned 'enforcement tactics'; missile strikes against ports, LNG terminals, military targets or leadership installations. The Centre for Strategic and International Studies also found that 83% of 'Chinese experts' reject the idea of China planning for military action due to domestic instability in food and energy supplies.

The far more likely option would be a 'Quarantine'. This would involve blocking/disabling sea, air and logistical access to Taiwan, wholly prohibiting their exports. This strategy differs from an outright blockade since it would technically be a law-enforcement operation rather than a military one and therefore would not class as military aggression. Since China views Taiwan as a being part of China, law enforcement would be within their rights and so would avoid involvement from other countries. Logistically, the quarantine would be fairly straightforward; Taiwan relies on 4 or 5 ports, with 57% of maritime trade going through the port of Kaohsiung. A quarantine would stop both the fabrication and export of chips and so cripple all semiconductor capabilities/reliances downstream. The stock prices of TSMC and NVIDIA directly would likely plummet with other companies also likely being hit by the shock. The economic cost to the technological industry as a whole would be massive and would take a long time to recover, if it ever did. China would likely take the opportunity to fill the supply gap as they are seeking to make up 40% of chip market share by 2030, investing hundreds of billions to achieve this. Therefore the quarantine would be extremely beneficial for China with limited risk, making it the most likely option.

Figure 11: Chinese military helicopters in the Taiwan Strait, August 2022

Increasingly China has been using 'Salami Slicing' tactics, using incursions into Taiwanese airspace as well as simulated blockades to intimidate and prepare for potential action. In 2024 alone there were over

3000 incursions as well as alleged tapping and cutting of undersea communications cables. This leads to scepticism and risk from investors so the most beneficial method of anticipating downside risk in the market would be assessing when action could take place. This leads to 2 widely regarded options, 2027 and 2035.

2027 is considered the time with maximum asymmetric advantage. It is alleged to be the PLA's modernisation completion goal as well as being within the 'Davidson Window'. This is the window where the US is considered to be at its weakest and China is at its strongest. The US would be in an election cycle, taking its eye off of its foreign policy. It would also not have completed base and missile upgrades in the Indo-Pacific region, while Japan, Australia and Filipino military reforms would also not have taken place. At the same time China would have finished their own reforms and so would be completely capable of action. China would have also likely have reached the capability to produce 5 and 3 nanometre nodes whilst Europe and the USA will be nowhere near, making China the only real producer of chips other than Taiwan and so making action extremely profitable for China. This makes 2027 a very strong window for China to act and so would be a date to watch for investors.

The second time period, 2035, would be the most stable period for China domestically. It is the official given goal for full military modernisation of the PLA however also gives time for China to prepare and stabilise internally. Current youth unemployment is at 20% while food and energy concerns are growing. By waiting and prepping for action, China would be completely ready for any potential conflict, even if it grew beyond Taiwan. EU and US Chips would still not be reaching the 3nm of TSMC whilst China likely will have, still making it economically extremely viable for them.

Anticipating Chinese action, economists and traders will likely be looking for several warning signs. Firstly China would begin unloading western assets and securities to avoid potential sanctions - China has almost $1 trillion in US Treasury bonds as well as many other assets which may be threatened. They would also likely warn their own companies to reduce western reliability, encouraging the movement of staff, infrastructure and servers to the homeland. Stockpiling of oil, LNG, grain and minerals would take place to ensure their own domestic and chip stability. More quantitatively, there would be mass cancellations of PLA leave for the window leading up to and during operations, combined with increasingly frequent cyber attacks and satellite jamming. A large mobilisation of civilian ferries may take place, visible through ship trackers and satellite, however would only occur for the more unlikely invasion option. These indicators would warn of potential action and lead to reasonable shorts of the semiconductor sector and the market as a whole - all major companies would be hit.