

Decomposing the AI Value Chain

By Gill Segal

For the better part of the last decade, "Long Tech" was a singular trade. Whether you were buying semiconductors or cloud infrastructure, the exposure was effectively bet on the Nasdaq 100 (*QQQ*). The correlation structure was clear: if yields fell, tech went up. If growth accelerated, tech went up faster.

However, recent analysis of the sector's sensitivity to interest rates reveals a structural break that has largely gone unnoticed in the broader "AI Bubble" narrative. Since 2020, the "Tech" factor has split into two distinct asset classes with opposing sensitivities to macro-financial shocks.

So what's new? Conventional market wisdom holds that 'Growth = Duration'—when rates rise, all tech stocks should fall together. My latest empirical work shows this rule is no longer universal along the AI value chain. While Software (downstream) has adhered strictly to this textbook definition, Semiconductors (upstream) have structurally broken away from it:

1. **The Hardware Layer (Semiconductors):** More upstream, now behaving as a **Cyclical/Capex** asset, trading on short-term cash flow news.
2. **The Software Layer (SaaS/Cloud):** More downstream, now behaving as a **Long-Duration** asset, trading almost exclusively on discount rate news.

The contribution here is not that tech is rate-sensitive (we knew that), it's that **the sign of the sensitivity diverges across the value chain and becomes stable after a break.**

The Empirical Setup

To isolate this phenomenon, I analyzed the daily returns of two primary ETF proxies: **SMH** (VanEck Semiconductor ETF) for the hardware layer and **IGV** (iShares Expanded Tech-Software Sector ETF) for the software layer.

The goal was to strip out the general "Tech Beta" and isolate the pure sensitivity to the risk-free rate. I utilized a rolling 252-day regression model controlling for the market factor (proxied by *QQQ*):

$$R_{asset,t} = \alpha + \beta_{QQQ} R_{QQQ,t} + \beta_{\Delta 10Y} \Delta 10Y_t + \varepsilon_t$$

Where:

$R_{asset,t}$ is the daily return of the ETF.

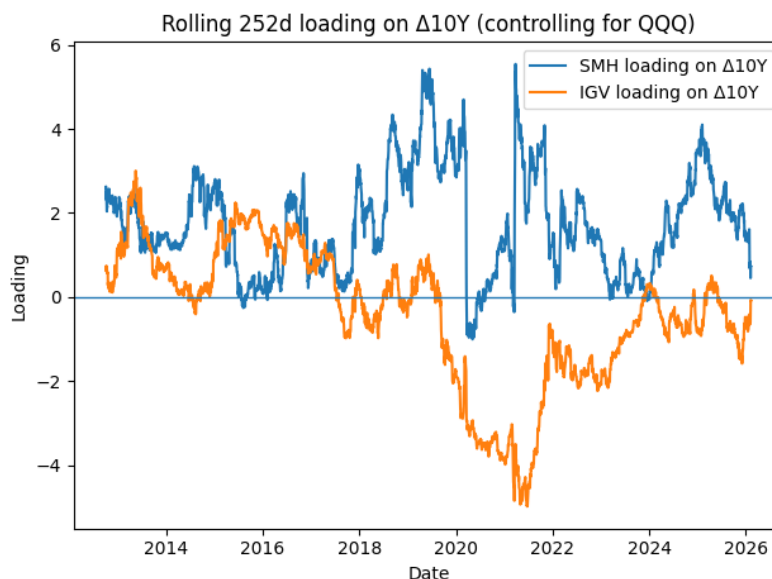
$R_{QQ,t}$ is the daily return of the Nasdaq 100 (controlling for the general "Tech" factor).

$\Delta 10Y_t$ is the daily change in the 10-Year Treasury yield (the rate proxy shock).

A positive $\beta_{\Delta 10Y}$ implies the asset behaves pro-cyclically (rising with yields), suggesting that "Cash Flow News" dominates "Discount Rate News." A negative $\beta_{\Delta 10Y}$ implies the asset behaves like a duration instrument (falling when yields rise), suggesting discount rate sensitivity is the dominant driver.

A Tale of Two Regimes

The results provide stark evidence of a regime shift that began forming around 2020 and has solidified in the post-2022 AI era.

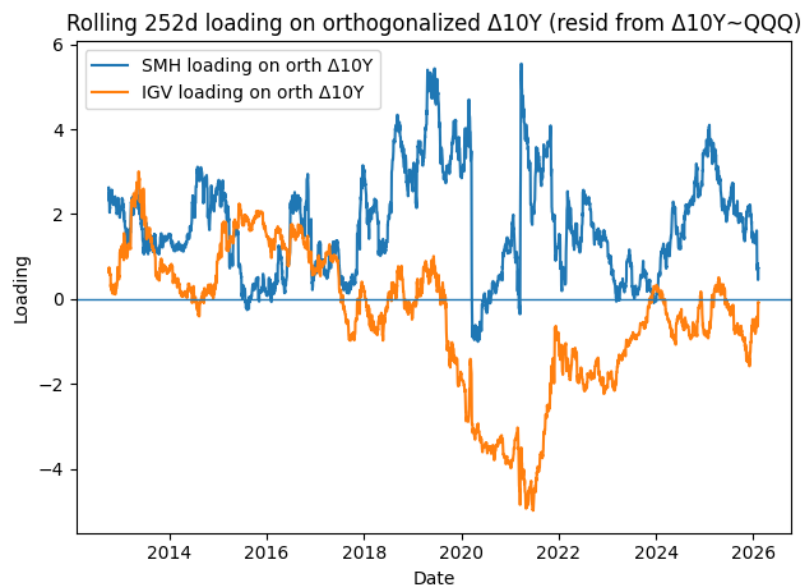


As the plot above illustrates, prior to 2018, both hardware and software exhibited fluctuating but generally aligned sensitivities to interest rates. However, post-2020, a dramatic decoupling occurred:

1. **Software (IGV) flipped deeply negative:** The loading on $\Delta 10Y$ dropped significantly below zero, stabilizing in the -0.5 to -1.0 range. This indicates that even after controlling for the Nasdaq, software stocks are adversely impacted by rising rates.
2. **Semiconductors (SMH) surged positive:** Conversely, the semiconductor loading on $\Delta 10Y$ climbed steadily, piercing $+2.0$ and remaining positive throughout the recent cycle.

This is a non-trivial divergence. It suggests that on days when interest rates rise (typically a signal of strong nominal growth or inflation), semiconductor stocks tend to *outperform* the broader tech index, while software stocks *underperform*.

To ensure this wasn't a statistical artifact of collinearity between rates and the Nasdaq, I ran a robustness check using orthogonalized rate shocks (taking the residuals of $\Delta 10Y$ regressed on QQQ).



The results held firm. The orthogonalized plot shows the exact same divergence, confirming that this is a fundamental property of the assets, not a beta distortion. A formal Quandt-Andrews (Sup F) break test further pinpoints the structural break to approximately mid-2020, coinciding with the onset of the pandemic-induced digital acceleration, and the introduction of GPT 3.

Cash Flow Timing vs. Discount Rate Risk

Why has this split occurred? The answer lies in the decomposition of equity returns into **Cash Flow News** versus **Discount Rate News**.

In the current "AI Construction" phase, the cash flow profiles of these two sub-sectors have moved in opposite directions on the timeline.

1. Hardware is "Cash Now" (Short Duration)

Semiconductors have changed into a classic cyclical industry. The AI boom is, first and foremost, a Capex super-cycle. Downstream hyperscalers (Microsoft, Meta, Google) are spending billions *today* to build out infrastructure.

This front-loads the cash flows for upstream companies like Nvidia and TSMC. In a high-nominal-growth environment (which typically drives yields higher), the "Cash Flow News" for semis is overwhelmingly positive—demand is stripping supply, and pricing power is absolute. This growth shock overwhelms the negative effect of a higher discount rate. Thus, Semis behave like Industrials: they rally on news of a stronger economy, even if that news brings higher rates.

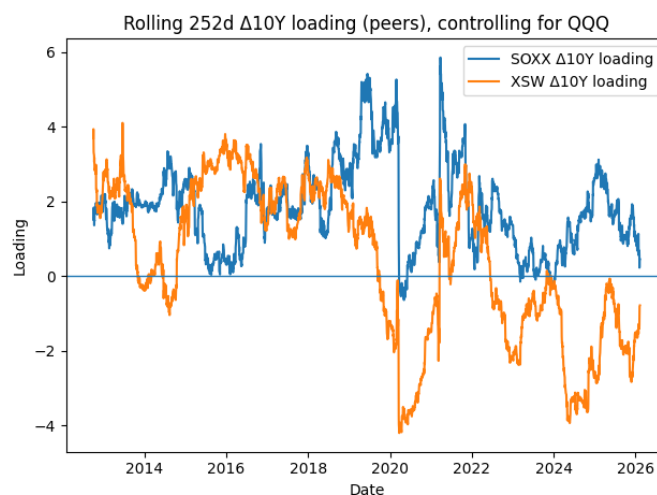
2. Software is "Cash Later" (Long Duration)

Conversely, the downstream software layer has extended its duration. While the "AI narrative" promises massive productivity gains, the monetization of those gains is largely theoretical and years away. Right now, AI is a cost center for software companies (training models, integrating features) rather than a revenue generator.

Consequently, the value of a software company is increasingly derived from its terminal value—cash flows expected 5 to 10 years in the future. Mathematically, (and informally) this makes the stock behave like a long-duration equity claim. When the discount rate rises, the present value of that distant terminal value crashes. There is no immediate "growth surprise" to offset the mathematical drag of higher rates.

Robustness and Peer Confirmation

Critically, this is not an idiosyncratic story about Nvidia or Salesforce. The pattern replicates across the broader peer group.



When we substitute **SOXX** (iShares Semiconductor) for SMH and **XSW** (SPDR S&P Software & Services) for IGV, the exact same divergence appears. This confirms we are observing a sector-wide structural change in business model sensitivity, not an idiosyncratic alpha signal.

Furthermore, this relationship holds across yield regimes. Whether we look at periods of "Low Yields" (<2.36%) or "High Yields" (>2.36%), the sign of the coefficient remains stable: SMH is always positive, and IGV is always negative .

Conclusion: The End of "Long Tech"

The implications for portfolio construction are significant. The "Tech" factor is no longer a sufficient resolution for risk management.

Investors must recognize that they are essentially trading two different macro bets under one sector label:

- **Long Semis** is a bet on **Nominal Growth and Capex**. It is a pro-cyclical trade that can withstand (and even benefit from) a "Higher for Longer" rate environment.
- **Long Software** is a bet on **Disinflation and Rate Cuts**. It is a duration trade that requires the cost of capital to fall for the valuation math to work.

We are currently in the construction phase of the AI revolution, not the utility phase. Until the software layer demonstrates the ability to monetize AI in the *present*, it will remain at the mercy of real-rates. Meanwhile, the hardware layer, acting as the digital industrial base, will continue to dance to the beat of the real economy.