CARLYLE

**RETURNS REINVENTED**
2021 GLOBAL INVESTOR CONFERENCE

# Ascending with Waxed Wings: Inflation & the Tech 'Bubble'

- Inflation dominates the macro discourse, but markets seem almost exclusively focused on tech-enabled productivity growth and the digital businesses that facilitate it. This disconnect makes sense if inflation is "transitory," as seems likely, but it also creates danger, especially for portfolios aggressively adding exposure to those assets that surreptitiously embed the most inflation risk.

- Inflation risk is not restricted to fixed income markets, nor is it an industrial or "old economy" problem. The valuations most exposed to higher interest rates are those of tech-enabled digital assets whose free cash flow arrives furthest into the future and is therefore most heavily discounted.

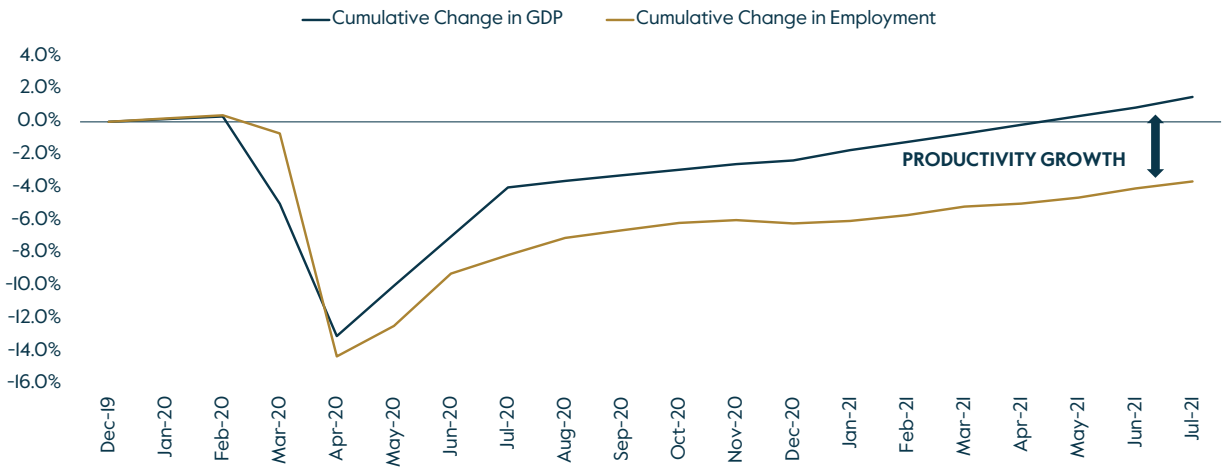
- It is neither the time to fly too low and bet against tech-enabled productivity growth, nor the time to fly too high, hubristically putting all of one's eggs into that basket. Diversified portfolios that treat "technology" as a value-added input rather than an asset class are likely to exhibit the most impressive risk-adjusted performance.

# Disconnect Between Market Discourse & Market Prices

Of the many twists and turns in the macroeconomic data since the start of the pandemic, two stand out: the surge in productivity and spike in inflation. Both phenomena have been especially evident in the United States, and both appear to be the product of a "high-pressure" economy characterized by increasingly digitized processes, speedier execution, and a sense of pervasive shortages (materials, semiconductors, labor, etc.). While the former drives near-term market movements, the latter dominates market conversations.

Since March 2020, labor productivity in the U.S. has grown at a 3.7% annual rate (Figure 1), nearly 4x the annual average of the past decade, and almost 3x the 1.3% annual growth observed between 2014 and 2019.[1] When translated into company financial ratios, these gains are even more impressive: economy-wide revenue-per-worker has increased by more than 12% (Figure 2) and operating margins are up 24% (Figure 3) relative to pre-pandemic levels. These efficiency gains have helped to validate much of the run-up in asset prices in 2020 and fueled added gains this year.

*Figure 1.*
U.S. GDP-Per-Worker Up 6% Since 2019




1 U.S. Bureau of Labor Statistics, August 2021.

Figure 1. Source: Carlyle Analysis; Bureau of Economic Analysis of Portfolio Data; Bureau of Labor Statistics. August 2021. There can be no assurance these market conditions will continue to be achieved.

*Figure 2.*
Revenue-Per-Worker Up 12% Since 2019

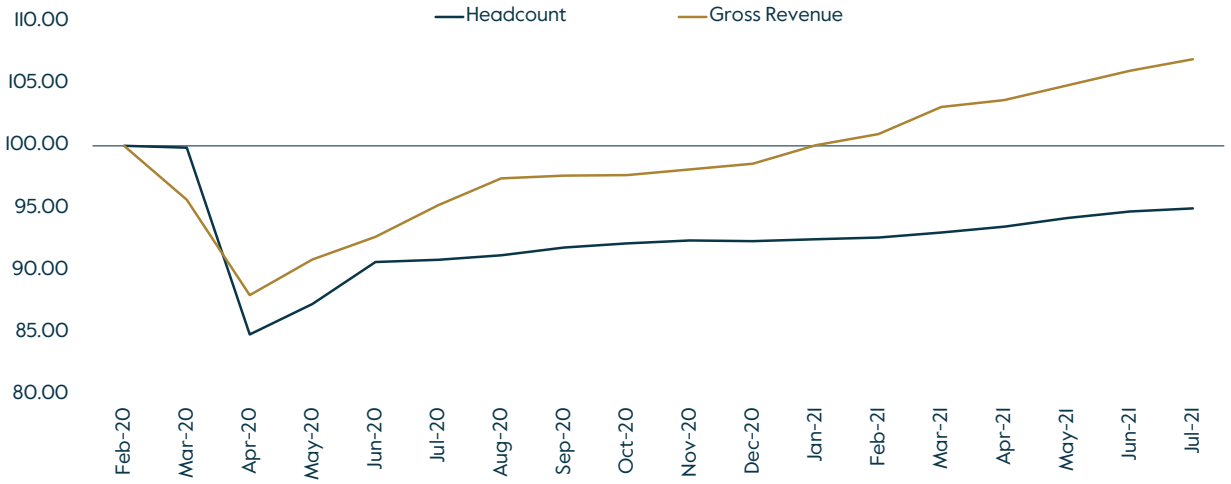



*Figure 3.*
Profit Per Unit of Value-Added up 24%

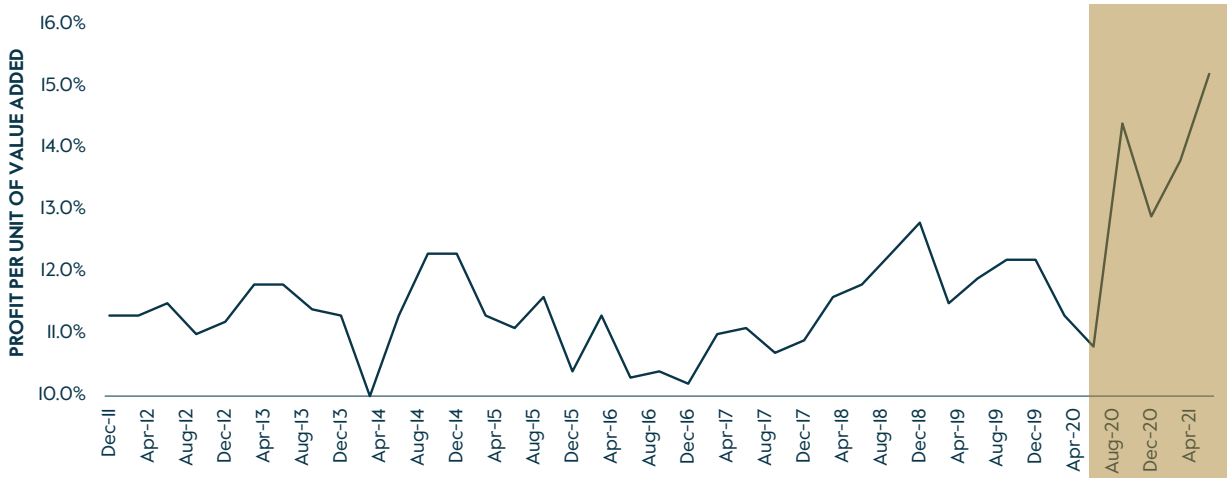



Figure 2. Source: Carlyle Analysis; Bureau of Economic Analysis of Portfolio Data; Bureau of Labor Statistics. August 2021.
There can be no assurance these market conditions will continue to be achieved.
Figure 3. Source: Carlyle Analysis; Bureau of Economic Analysis of Portfolio Data; Bureau of Labor Statistics. August 2021.
There can be no assurance these market conditions will continue to be achieved.

Yet, it seems that all anyone wants to talk about is inflation. Over the past year, inflation has garnered nearly 12x more mentions than productivity in major financial news outlets (left panel of Figure 4). Across all news sources, stories on inflation have grown 70% more numerous while productivity articles run only when quarterly data are released (right panel of Figure 4). Markets have been surprisingly unperturbed by the suffocating attention the topic receives; measures of inflation risk premia[2] extracted from Treasury yields remain near all-time lows (Figure 5).

*Figure 4.*
Inflation Dominates Public Discourse

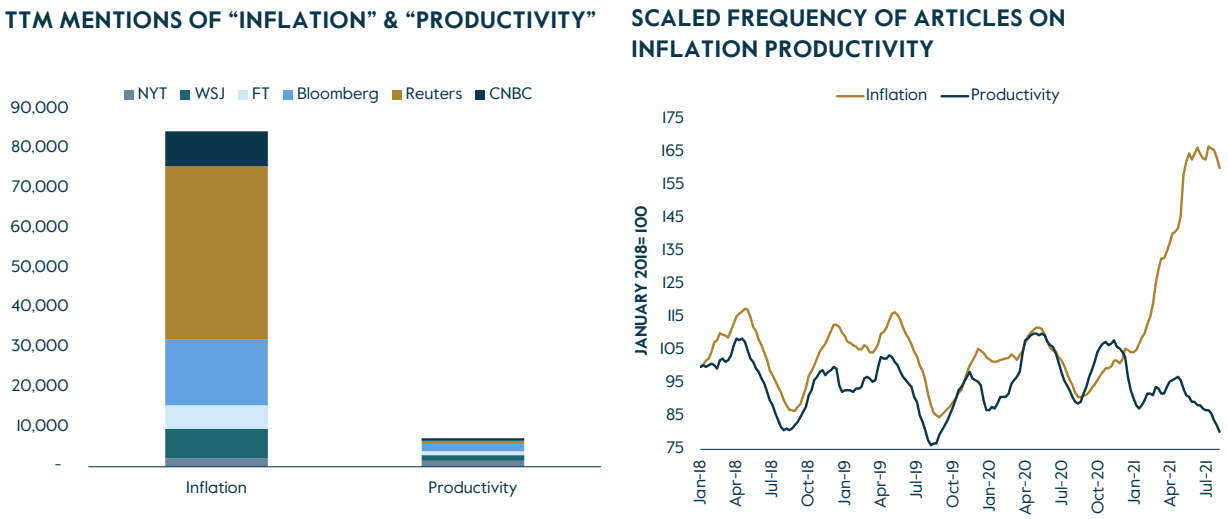
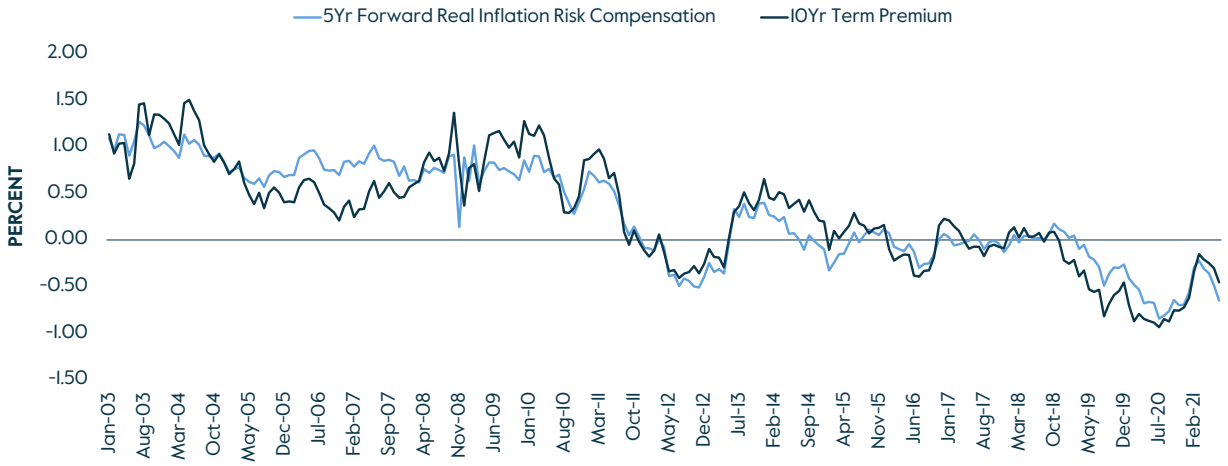



*Figure 5.*
Inflation Risk Premia Near All-Time Lows




2 As opposed to inflation breakevens, the term premia measure the compensation for unexpected inflation over the next 10 years.
Figure 4. Source: Carlyle Analysis of News Website Text; Google News. August 2021. There can be no assurance these market conditions will continue to be achieved.
Figure 5. Source: Carlyle Analysis, FRED Data. August 2021. There can be no assurance these market conditions will continue to be achieved.

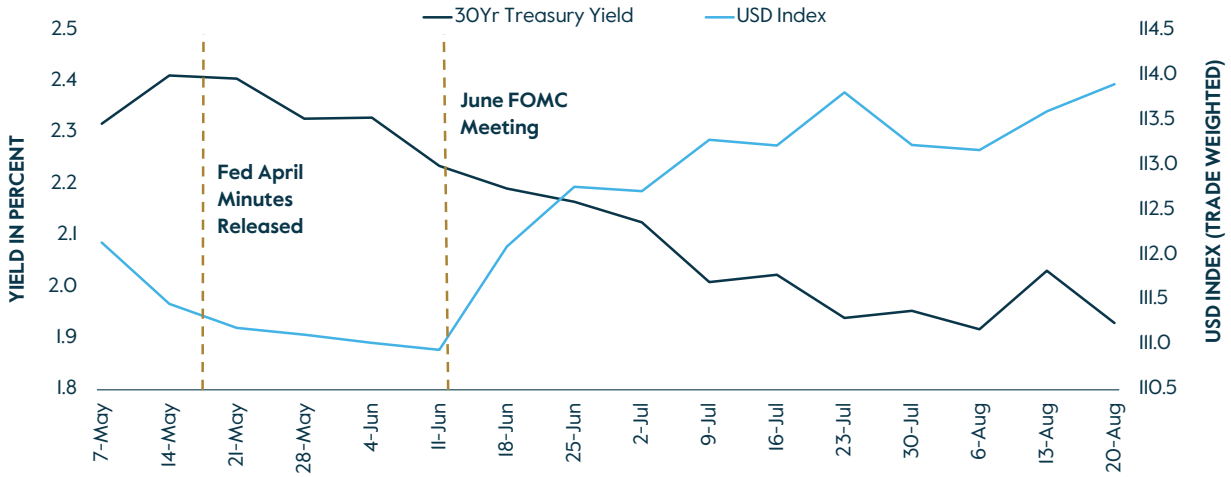
# Inflation's Origin: 'If You Don't Make Stuff, There is No Stuff'[3]

Markets embrace the Fed's mantra that inflation is likely to prove "transitory." Indeed, markets may be more convinced of this than the Fed itself. "Hawkish" June rhetoric from the Fed, motivated by concerns that inflation may prove more persistent than expected, was met with a sharp *drop* in long-term bond yields and an upward adjustment in the foreign exchange value of the dollar (Figure 6). If anything, these price movements are suggestive of a central bank potentially *overreacting* to inflation risk.

There is good reason to suspect that the market has this priced correctly. Today's elevated inflation has its origin in temporary, pandemic-induced supply-demand imbalances that nearly every household has experienced in some form or another over the past 18 months.

Starting in the middle of 2020, cash-rich but locked-down households channeled the savings from sharply reduced spending on travel, leisure, and live events towards durable goods. Sales of new and used cars, boats, pools, pianos, motorcycles, personal water craft, hot tubs, and construction materials all boomed at never-before-seen rates.[4] Overall consumption soon recovered to pre-pandemic levels, but its composition had shifted massively, with durable goods spending running about 30% above prior trends (Figure 7).

*Figure 6.*
Inflation Risk Perceptions Fall in Response to Fed

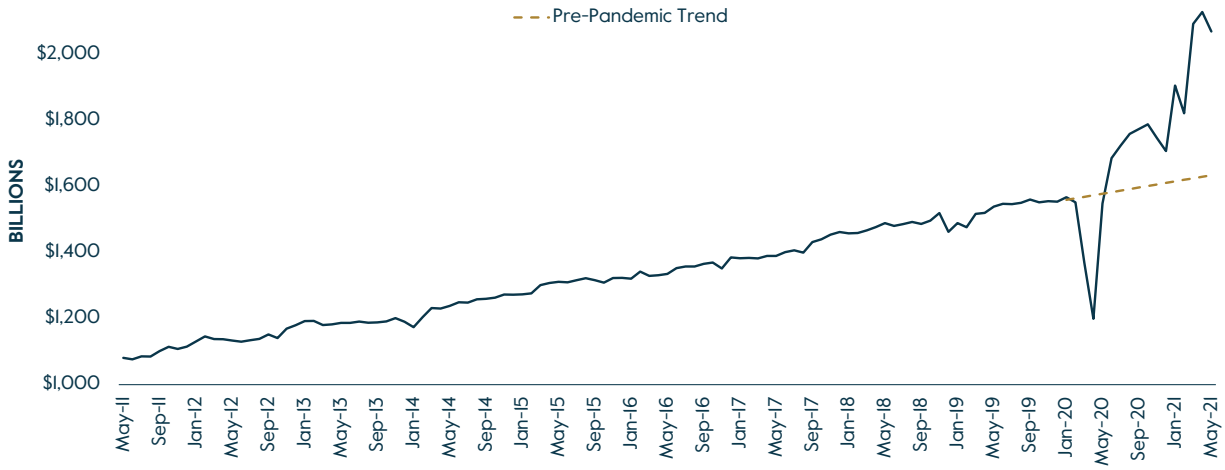



3 Elon Musk on Joe Rogan Experience, May 2020.
4 Carlyle Analysis of Bureau of Economic Analysis Data, August 2021.
Figure 6. Source: Carlyle Analysis, FRED Data. August 2021. There can be no assurance these market conditions will continue to be achieved.

Unfortunately, capacity in most of these product markets only exists to meet unit sales growth of 1% to 3% per year. In other words, there are no factories sitting idle, waiting to be turned on to accommodate a sudden surge in orders. And due to the lockdowns and management conservatism, manufacturing output actually dropped by -6.5% through Q1-2021, leading to a massive supply-demand gap (Figure 8) that not only led to shortages of finished goods, but also the components, parts, semiconductors and other intermediate goods that go into them.

Inflation rates have largely tracked the size of the gap, peaking at a 0.9% monthly rate in Q2-2021 and declining to 0.3% in July as manufacturing output rebounded and consumption rotated back towards services like travel and live events.[5] In total, durable goods prices rose at a 16.8% annual rate in Q2-2021, accounting for virtually all of the excess inflation observed this year (Figure 9).[6]

*Figure 7.*
## Durable Goods Spending Rises 30% Above Prior Forecasts




5 BLS, August 2021. Inflation refers to the monthly percentage change in the core CPI index.
6 Carlyle Analysis; BEA, Q2-2021 GDP Report.
Figure 7. Source: Carlyle Analysis; St. Louis Federal Reserve, July 2021. There can be no assurance these market conditions will continue to be achieved.

*Figure 8.*
Durable Goods Supply-Demand Imbalance

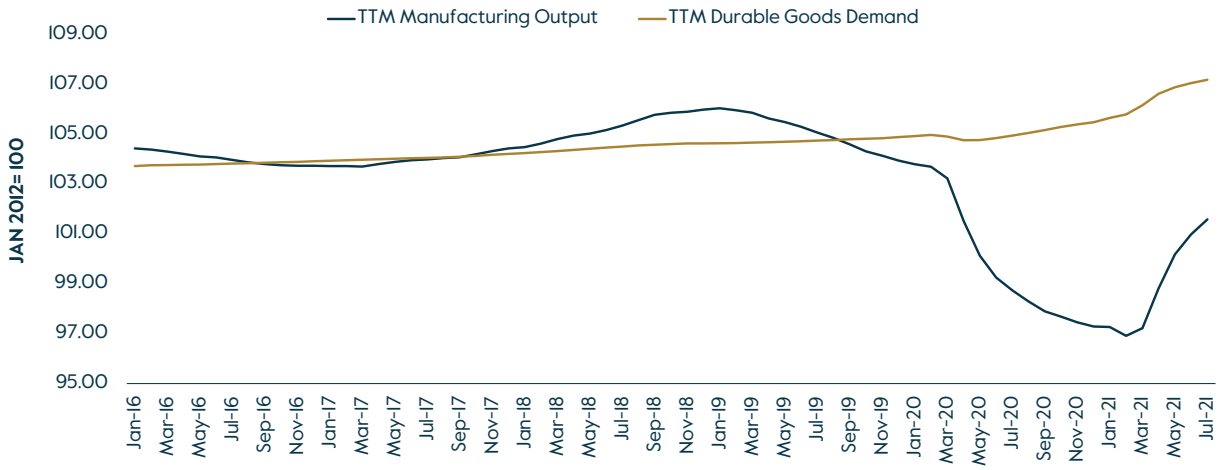



*Figure 9.*
Durable Goods Prices Drive Overall Inflation

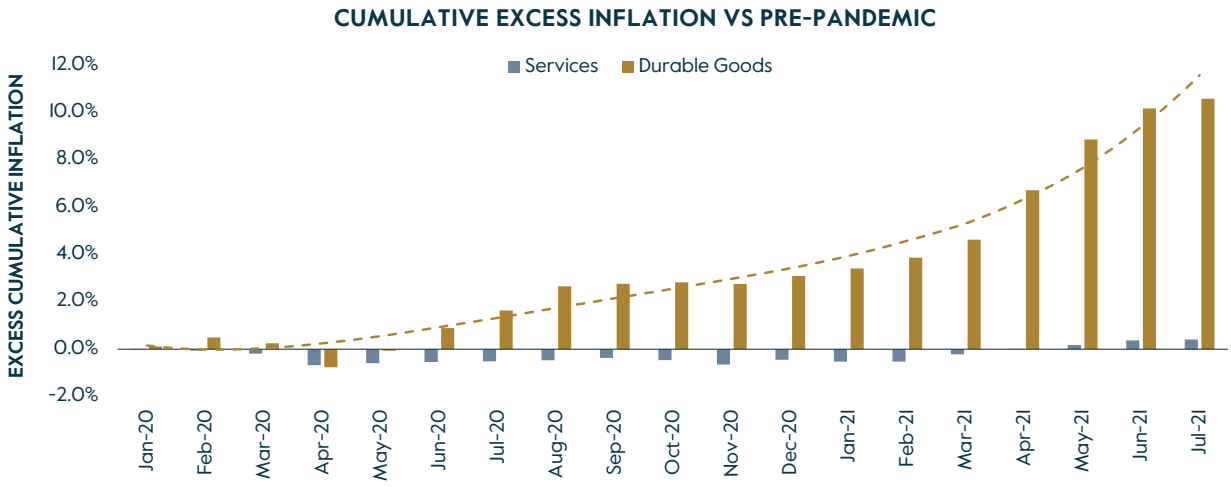



Figure 8. Source: Carlyle Analysis, FRED Data. August 2021. There can be no assurance these market conditions will continue to be achieved.
Figure 9. Source: Carlyle Analysis of BEA Data, August 2021. There can be no assurance these market conditions will continue to be achieved.

# Inflation Atmospherics & Confirmation Bias

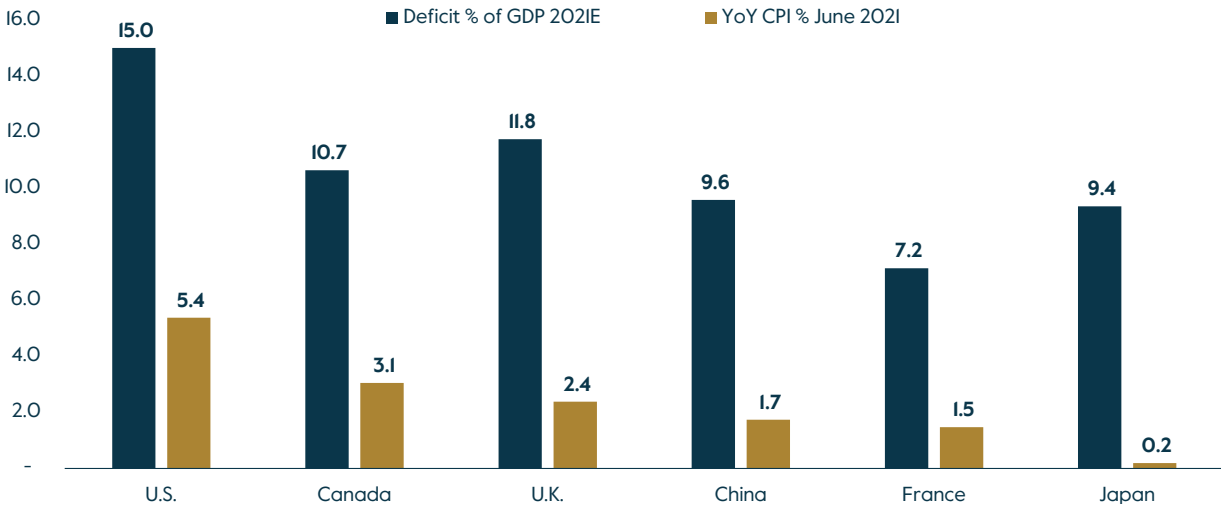
If pinpointing inflation's origin is so straightforward, easy to document, and consistent with virtually everyone's lived experience, both in terms of changed consumption patterns and extended delivery times and backorders, why has the topic commanded so much attention? The inflation debate seems far livelier than merited by the facts surrounding it.

The answer lies in the atmospherics surrounding the issue. To many observers, the pandemic seems to have unlocked changes in attitudes, behaviors, and expectations that all point in the direction of higher prices. Elevated inflation provides empirical validation for this supposition, irrespective of its actual origin.

For example, consider the scale of the attitudinal shift among policymakers. As laid out *explicitly* in the new policy strategies of the Fed[7] and European Central Bank (ECB),[8] and *implicitly* through enacted and proposed deficit spending (especially in the U.S.), imprudence seems to have become the default fiscal and monetary policy setting. If you worried that $6 trillion in new federal spending funded by printed money would inevitably lead to higher inflation, a 5.4% annual increase in the consumer price index would provide powerful confirmation of those fears.

And it's not as though policy has played *no* role stoking inflation. While shortages and concomitant inflationary pressures were likely to manifest themselves given the scale of the shift in spending from "experiences" to "stuff," fiscal transfers boosted purchasing power at precisely the time output was still constrained by the virus and supply-chain disruptions. U.S. inflation is higher largely because its fiscal transfers were larger (Figure 10).

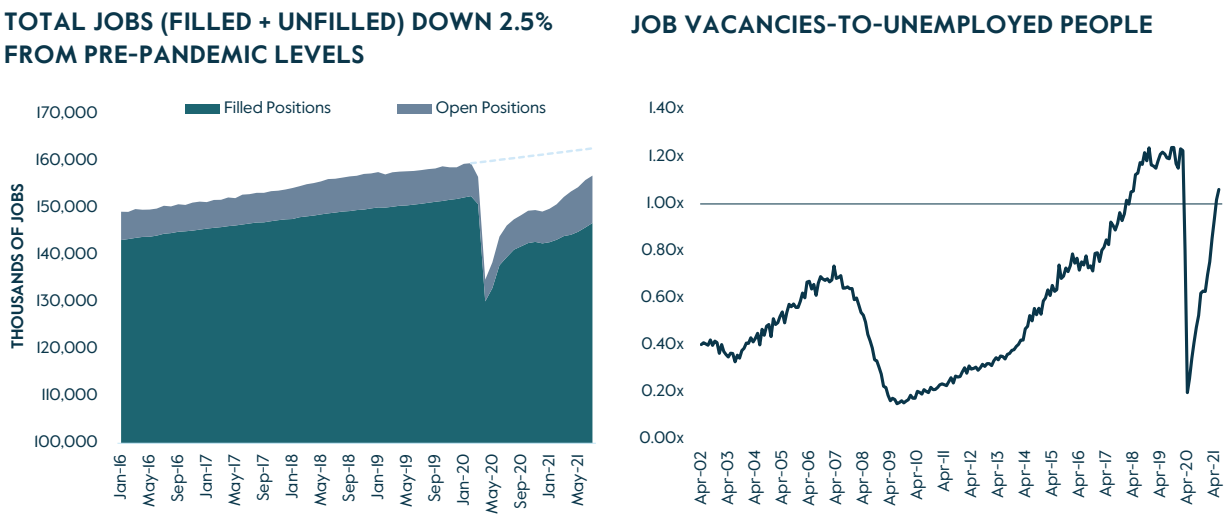
*Figure 10.*
Fiscal Deficits & Inflation Rates




7 FOMC Statement on Longer-Run Goals and Monetary Policy Strategy, August 27, 2020:
8 The ECB's monetary policy strategy statement, July 8, 2021:
Figure 10. Source: IMF WEO Database as of April 2021 and The Federal Reserve St. Louis. There can be no assurance these market conditions will continue to be achieved.

Likewise, elevated inflation is exactly what one would expect if pervasive "worker shortages" were forcing businesses to "pay up" massively to fill positions. Never mind that real wages have actually *declined* this year, or that labor shortages don't look as acute as they're portrayed – job vacancies remain 14% below pre-pandemic levels when measured relative to the pool of people seeking work (Figure 11).[9] Something *has* changed in worker attitudes, likely due to some combination of health risk perceptions, self-discovery, and fiscal transfers, and it has not only left jobs unfilled but also created new vacancies as people leave existing jobs at elevated rates (Figure 12). Academics have dubbed it the "Great Post-Pandemic Resignation Boom," and believe it reflects many workers' unwillingness to return to work-life as it existed in January 2020.[10]

*Figure 11.*
Worker Shortages in Context

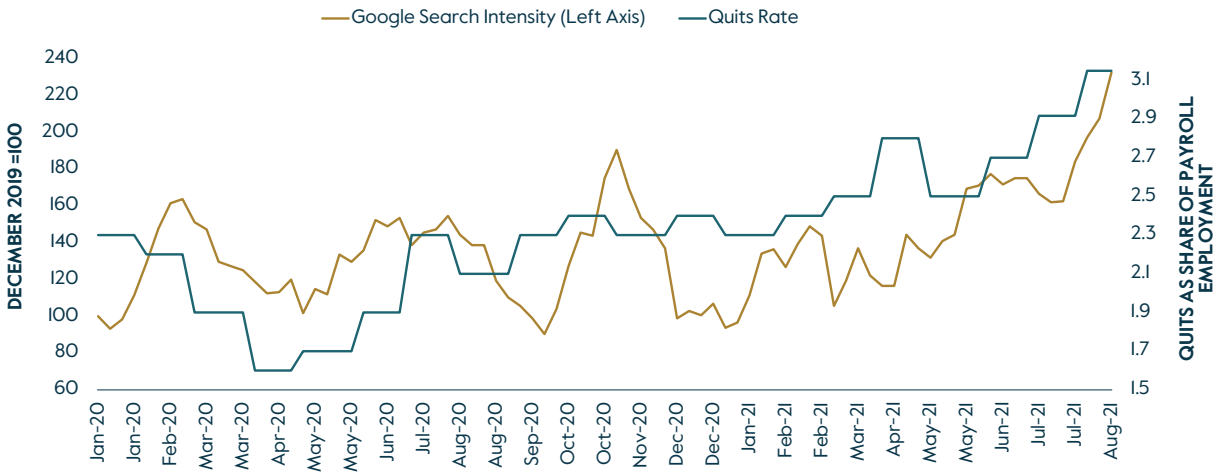



9 BLS, August 2021. U.S. jobs (workers on payrolls plus unfilled positions) sits 2.5% below pre-pandemic levels even as the prime working-age population (25-45) has grown by 175,000 since then. The total work-eligible population is up over 1.8 million since February 2020.

10 "How to Quit Your Job in the Great Post-Pandemic Resignation Boom," Bloomberg.

Figure 11. Source: Carlyle Analysis, FRED Data. July 2021. There can be no assurance these market conditions will continue to be achieved.

*Figure 12.*
## Resignations Rise 34%; Interest in Quitting Doubles




Finally, those who expect that inflation will prove transitory anticipate a return to the *status quo ante*, as global value chains scale up production and household spending rotates back from durable goods towards experiences. But what if that doesn't happen, either because new variants of COVID depress services consumption and labor supply for much longer than supposed, or because governments and multinational corporations decide to scale back cross-border production processes in light of the vulnerabilities exposed by the pandemic?

The longer elevated inflation persists, the more it shapes our expectations. Today, confirmation bias leads analysts to overlook elevated inflation's *concrete* origins in favor of their preferred *abstract* narrative. But should inflation persist, initial conditions will matter much less as convictions harden over time and perceptions become reality.

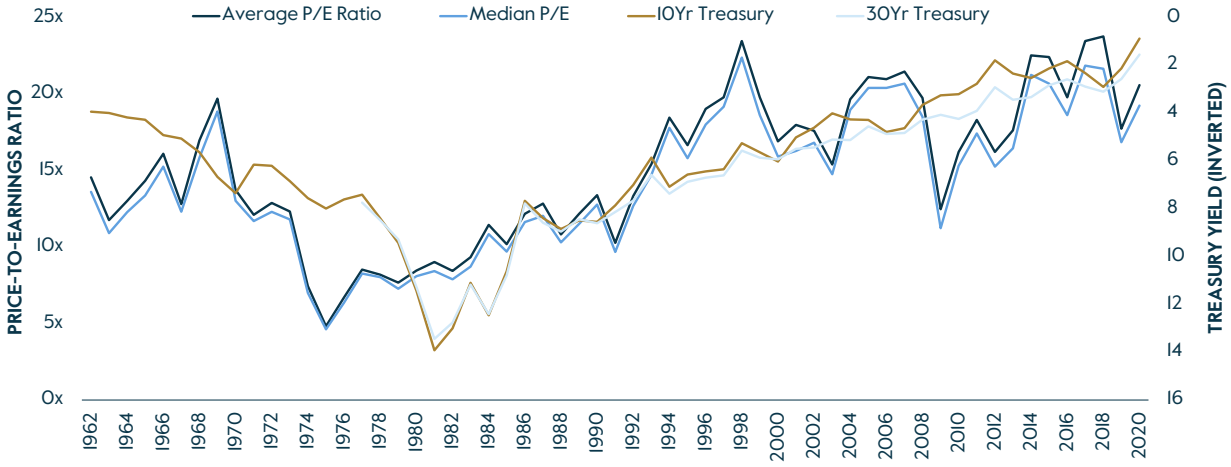
Figure 12. Source: Carlyle Analysis of News Website Text; Google News. August 2021. There can be no assurance these market conditions will continue to be achieved.

# Looking for Inflation Risk in the Right Places

So while inflation has begun to abate, it seems hardly the time to be cavalier about this risk, especially considering the extent to which asset prices embed expectations of low inflation. And that extends well beyond fixed income or industrial businesses exposed to rising input prices. Indeed, more dangerous than the risk of inflation itself may be the failure to perceive where that risk manifests itself. For many portfolios, elevated inflation may prove to be less of a surprise than the specific categories of assets that get clobbered by it.

If high inflation persists, nominal and real interest rates will have to increase, especially at longer maturities where the risk of real capital losses is greatest.[11] Since Treasury yields constitute the base rate used to discount *all* future cash flows, economy-wide valuation ratios fall as interest rates rise (Figure 13). While asset prices depend on a host of other factors, including growth expectations, time-varying risk premia, and liquidity flows, yields on corporate bonds, equity, and real estate all tend to correspond, over time, to long-term interest rates (Figure 14).

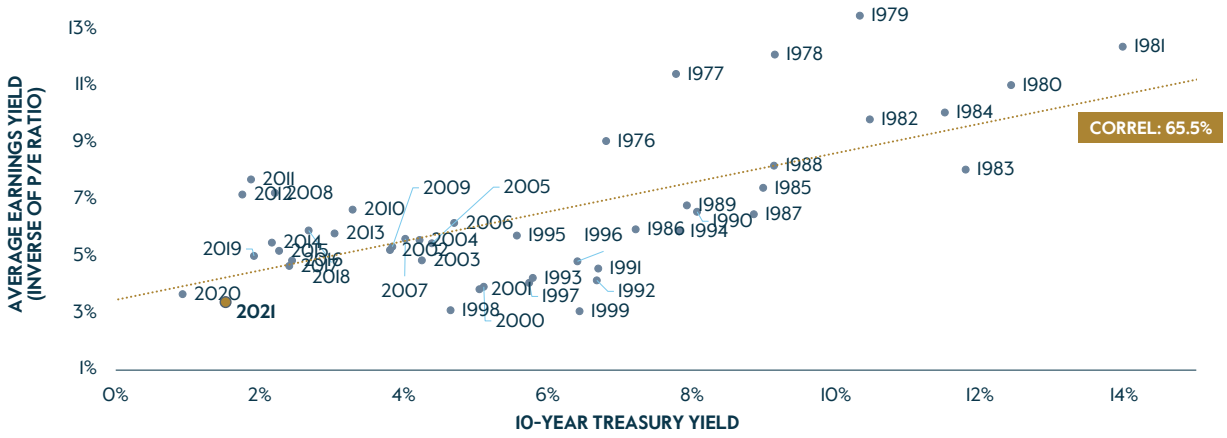
*Figure 13.*
Valuation Ratios Move Inversely with Interest Rates




11 Nominal rates will rise with inflation expectations and real rates will have to increase to bring inflation back down towards target. Longer-term rates will also likely rise further as interest rate risk premia increase to account for the uncertain size of the adjustment in policy.

Figure 13. Source: Carlyle Analysis; CRSP Database, U.S. Treasury. August 2021. There can be no assurance these market conditions will continue to be achieved.

*Figure 14.*
Corporate Earnings Yields & Bond Yields



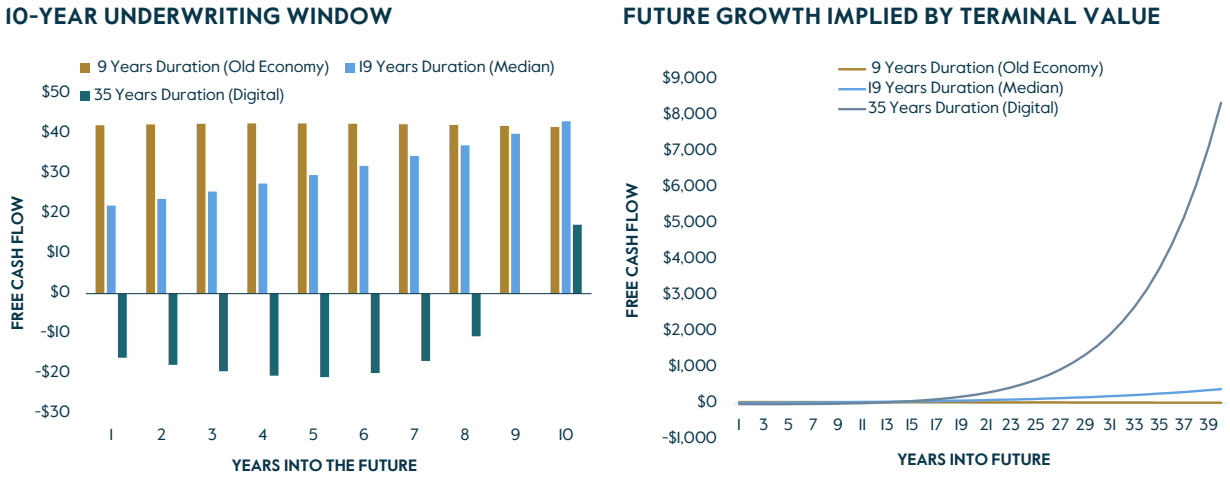

The impact of higher rates will not be uniform across assets, however. As is well known in bond markets, the sensitivity of an asset's price to a change in interest rates depends on the duration of its cash flows. The further into the future cash flows arrive, the more heavily they're discounted and therefore the more sensitive to a change in rates. A $100 payment due in 10 years is worth $82 when rates are 2% but just $60 if rates rise to 5% (-27% lower); the same $100 payment due in 30 years is worth $55 today if rates are 2% but only $21 if rates are 5% (-61% lower). This impact is not limited to bonds; all assets are exposed to the same risk. But rather than calculated based on a schedule of coupons and principal payments, equity duration depends on the timing of a company's free cash flow.

Figure 14. Source: Carlyle Analysis; S&P Capital IQ; Federal Reserve Board of Governors. July 2021. There can be no assurance these market conditions will continue to be achieved.

# Estimating the Duration of Free Cash Flow

While the effective duration of corporate assets cannot be observed directly, because their free cash flow is not fixed like bond coupon payments, it can be approximated using an algorithm calibrated to current valuations, growth rates, and profit margins.[12] No surprise that the assets with the highest implied duration tend to be fast-growing businesses with large near-term operating losses and the highest valuation ratios (enterprise value relative to sales or book value). Effectively, all of the enterprise value of these businesses is embedded in their terminal value, which is the discounted present value of all of the free cash flow expected to be generated outside of the 10-to-15 year underwriting window (see illustrative case, Figure 15). The lower the equivalent duration Treasury yield, the more people are willing to pay for that terminal value.

*Figure 15.*
Illustrative Annual Free Cash Flow by Asset Type




12 The basic idea is that businesses with the high market valuations (relative to current sales) tend to have cash flows weighted more to the future, the precise timing of which can be estimated based on sales growth and current profit margins. This algorithm was first proposed in Dechow, P., R. Sloan, and M. Soliman. (2004), "Implied Equity Duration: A New Measure of Equity Risk," Review of Accounting Studies. C.f. Dechow, P., et al. (2021). "Implied Equity Duration: A Measure of Pandemic Shutdown Risk," Journal of Accounting Research. An industry-specific algorithm was introduced in Fullana, O., J. Nave, and D. Toscano. (2016), "The Implied Equity Duration When Discounting and Forecasting Parameters are Industry Specific," Accounting & Finance. Finally, the higher covariance of growth stocks and discount rates is presented in Lettau, M. and J. Wachter. (2007), "Why is Long-Horizon Equity Less Risky? A Duration-Based Explanation of the Value Premium," The Journal of Finance.

Figure 15. Source: Carlyle Analysis; For illustrative purposes only. August 2021. There can be no assurance these market conditions will continue to be achieved.

Since these businesses' expected free cash flow arrives furthest into the future (a discounted weighted average of 35 years at the 95th percentile), their valuations tend to be far more sensitive to interest rates than those of the median company (18-20 years duration). This is evident if one looks at the time series evolution of market-to-book ratios and bond yields (Figure 16): while the valuation of the median-duration company has doubled over time as rates have declined, the valuations of the longest-duration businesses have risen more than 5x. It also helps to explain why the highest-priced 5% of businesses now sell for 8x the median company, an all-time high in terms of price-to-adjusted earnings (Figure 17).

*Figure 16.*
Long Horizon Equity 5x as Sensitive to Bond Yields

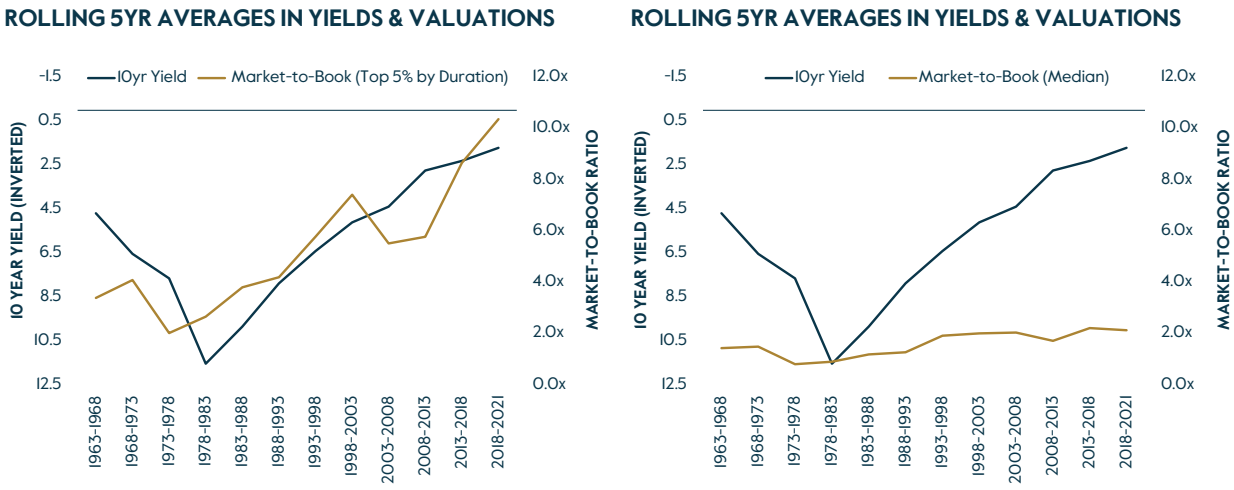



*Figure 17.*
Record Dispersion in Valuations Between Top & Median

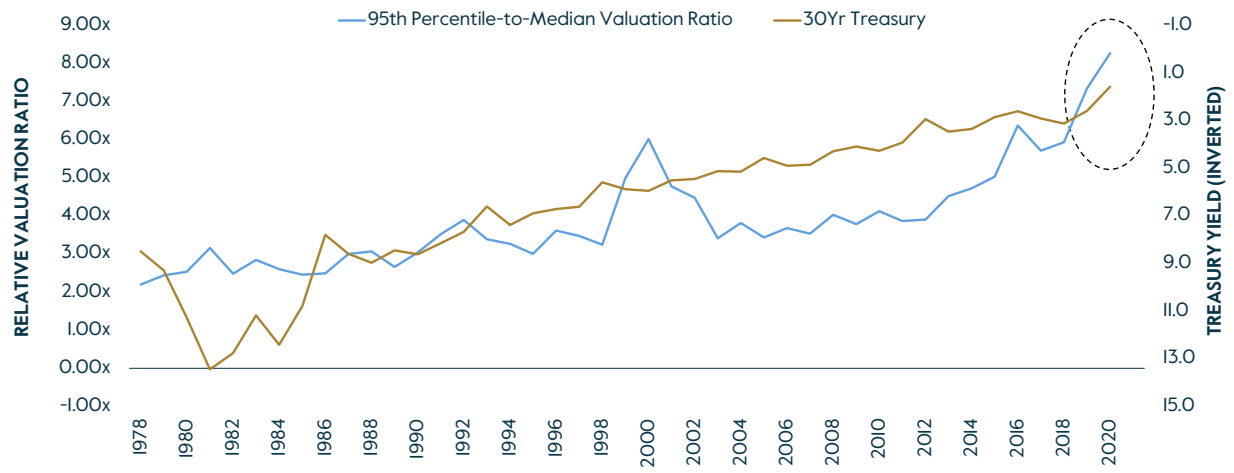



Figure 16. Source: Carlyle Analysis; CRSP Database, U.S. Treasury. August 2021. There can be no assurance these market conditions will continue to be achieved.
Figure 17. Source: Carlyle Analysis; CRSP Database, U.S. Treasury. August 2021. There can be no assurance these market conditions will continue to be achieved.

# 'You Might Not Be Interested in Inflation, But It's Interested in You'

By measuring the duration of free cash flow, one can see how inflation risk may have surreptitiously embedded itself into portfolios of investors that had no idea they were assuming this risk. Fast-growing but loss-making businesses do not "look like a bond," nor do they typically have to worry about the rising costs of copper, trucking, or corn. But persistently high inflation will inevitably lead to higher nominal and real interest rates that are likely to impact these businesses disproportionately. As Trotsky said of the dialectic: you might not be interested in inflation but inflation is interested in you.

Using available data for more than 6,500 stocks from 1963-2011 as a guide, the valuations of the top 5% of businesses by duration have proven to be about 60% more sensitive to movements in the 10-year Treasury yield than the median business, and 2.5x as sensitive to movements in the 30-year yield over time (Figure 18). Part of that may reflect the low correlation between tech sector revenues and consumer price inflation, which means that increases in rates would not likely translate to faster nominal growth rates.[13] And when segmenting data by time periods, one can infer how convexity causes interest rate sensitivity to increase as valuations rise.[14] When controlling for other factors, like market-wide returns, company growth differentials, profitability ratios, and company size, a 100bp increase in the 10-year yield would reduce valuations of the longest-duration businesses by more than 25% today, a magnitude that's increased 3x over time as nominal rates and term premiums have trended towards zero (Figure 19).

13 The idea that higher inflation, realized or expected, will translate into faster revenue growth on anything like a 1:1 basis is wishful thinking. Nominal revenue growth for the IT and software business sector has been only 25% correlated with consumer prices at an annual or quarterly frequency since 1990. For the most "disruptive" businesses with the most idiosyncratic growth trajectories the correlation is likely to be even lower. Note, moreover, that the rate adjustment will not just be expected inflation, but also the real rate (to bring inflation back down to target) and the inflation risk premium, all of which have declined since 2011.

14 If the relationship between interest rates and earnings yields, for example, is linear then the effect on valuations (the reciprocal) is nonlinear. For example, if a 100bp increase in rates causes a 50bp increase in earnings yields, valuations will decline by 14% if the initial earnings yield is 3% but by just 7% of the initial earnings yield in 7%.

*Figure 18.*
Free Cash Flow Duration & Interest Rate Sensitivity

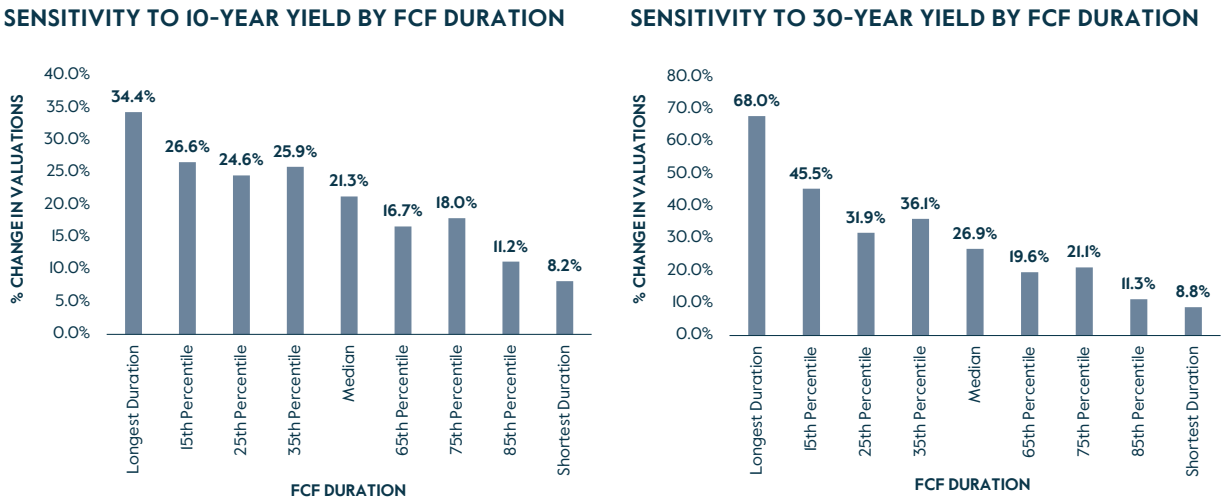



*Figure 19.*
Sensitivity of Valuations to 100bps Increase in 10 Year Yield

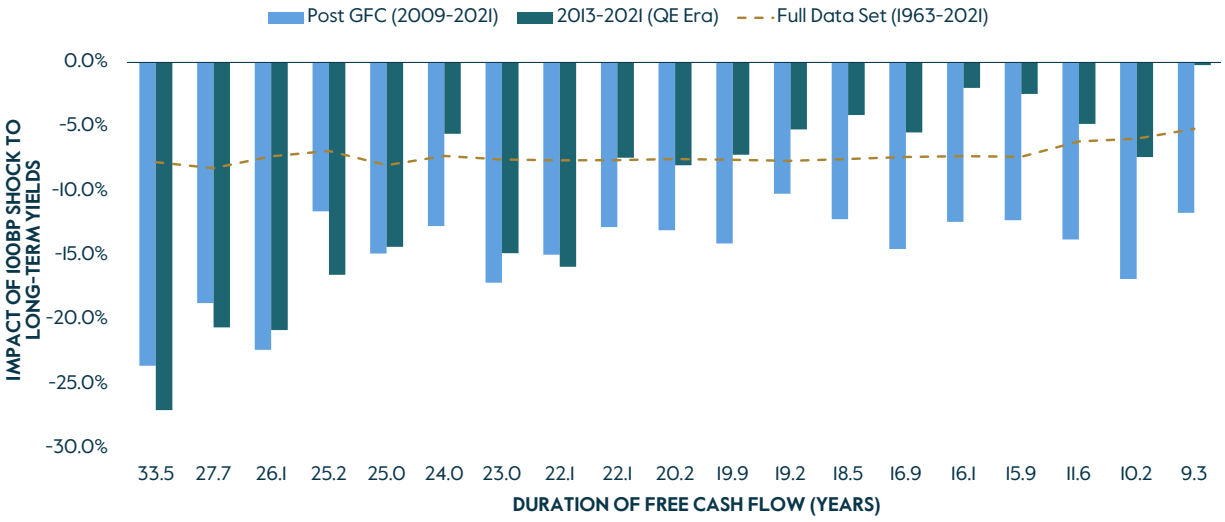



Figure 18. Source: Carlyle Analysis; CRSP Database, U.S. Treasury. August 2021. There can be no assurance these market conditions will continue to be achieved.
Figure 19. Source: Carlyle Analysis; CRSP Database, U.S. Treasury. August 2021. There can be no assurance these market conditions will continue to be achieved.

# Implications for Investors' Portfolios

The point of making this risk more visible is not to encourage investors to run from it, but to contextualize past returns and emphasize the importance of diversification moving forward.

Many technology-focused funds, public and private, have performed so well over the past several years partly because they hold long-duration assets whose terminal values spike when long-term interest rates fall. The average price-to-book ratio of the top 5% of stocks by FCF duration has been more than 80% correlated with the market value of the 50-year Austrian bond issued January 2012 (Figure 20). Before doubling down on such allocations, investors worried about inflation risk should consider how much exposure they'd like to call options written on government bonds maturing in the 2050s and 2060s.

*Figure 20.*
Terminal Values Depend on Long-Term Bond Prices

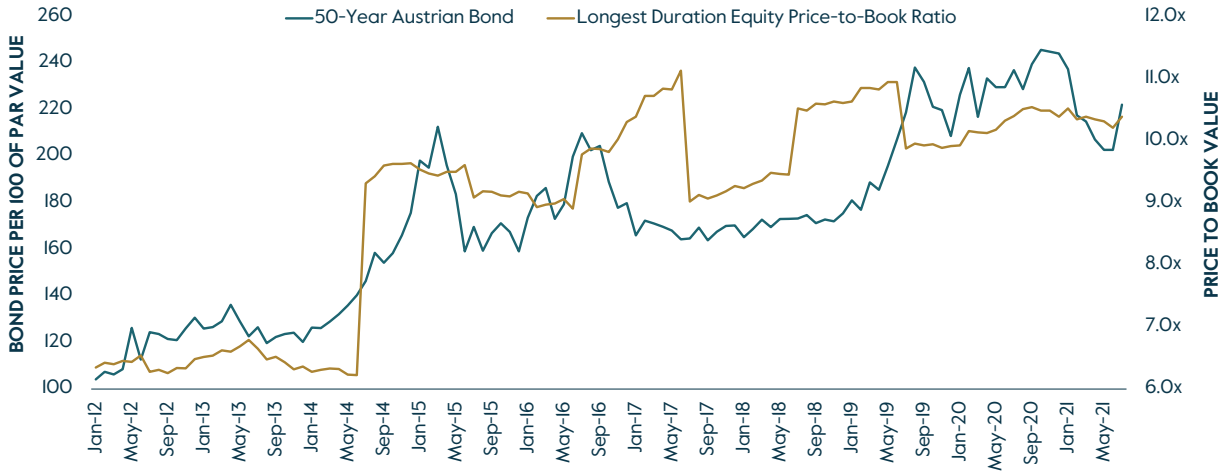



Figure 20. Source: Carlyle Analysis; CRSP Data, August 2021; Bloomberg. There can be no assurance these market conditions will continue to be achieved.

The only zero duration asset is cash, but there are alternative non-zero-yielding inflation hedges, including floating-rate loans, many types of real estate and infrastructure assets, as well as unloved but cash-generative corporate assets whose enterprise value depends disproportionately on near-term FCF. Relatively low valuations and interest rate risk sensitivity make traditional buyouts of such businesses attractive portfolio additions in the current environment.

But investors will have to continue to add exposure to fast-growing, nearly infinitely scalable digital businesses concentrated in the technology and health care sectors because that's where the growth is. If inflation moderates, as expected, and interest rates remain in the current range, today's sky-high valuations could persist. And even if they don't, the faster idiosyncratic growth of these assets will offset some of the loss on terminal value.

Much of the productivity growth observed over the past year reflects the conscious desire of management teams to make better use of available technology to get to the future faster than their competitors.[15] It has never been easier for digital software and automation solutions firms to get in front of prospective customers. "Workers shortages" only increase the attractiveness of such technology.[16] It is neither the time to "bet against" tech-enabled productivity growth nor to put all of one's eggs in that basket.

15 C.f. "When the Future Arrives Early," Carlyle, September 2020.
16 BCG, 5Yr Average of Total Factor Productivity and Cyclical Tightness in Labor Markets.

# Conclusion

The market does not seem to share the market commentariat's obsession with inflation. That makes sense, in that elevated inflation is a temporary phenomenon tied to pandemic-specific supply-demand imbalances that should ease over time. But it also accentuates risk, as valuations provide little compensation for the chance that inflation proves more enduring, especially for the long duration assets most sensitive to an increase in interest rates.

In this environment, investors should heed Daedalus' advice to Icarus. Avoid flying "too high" by hubristically accelerating deployment into early-stage digital assets that have benefitted disproportionately from the fall in rates and surreptitiously embed the most inflation risk. But also avoid flying "too low" by becoming consumed with risk aversion and losing sight of the tech-enabled productivity boom and its potential extension to businesses operating in a broader set of industries and geographies.

*Till swollen with cunning of a self-conceit,*
*His waxen wings did mount above his reach,*
*And melting, heavens conspired his overthrow*

**Chorus of Marlowe's Doctor Faustus**

# Jason Thomas

**HEAD OF GLOBAL RESEARCH**
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Jason Thomas is the Head of Global Research at The Carlyle Group, focusing on economic and statistical analysis of Carlyle portfolio data, asset prices and broader trends in the global economy. He is based in Washington, DC.

Mr. Thomas serves as Economic Adviser to the firm's Global Private Equity and Global Credit Investment Committees. His research helps to identify new investment opportunities, advance strategic initiatives and corporate development, and support Carlyle investors.

Prior to joining Carlyle, Mr. Thomas was Vice President, Research at the Private Equity Council. Prior to that, he served on the White House staff as Special Assistant to the President and Director for Policy Development at the National Economic Council. In this capacity, Mr. Thomas served as primary adviser to the President for public finance.

Mr. Thomas received a BA from Claremont McKenna College and an MS and PhD in finance from George Washington University, where he studied as a Bank of America Foundation, Leo and Lillian Goodwin Foundation, and School of Business Fellow. Mr. Thomas has earned the chartered financial analyst designation and is a Financial Risk Manager certified by the Global Association of Risk Professionals.