Global Factor Data Analysis

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Factors and data

Monthly value-weighted US returns from Jensen, Kelly & Pedersen (2023).

Code	Factor	Type	Source
`gp_at`	Gross profitability	Profitability	Novy-Marx (2013)
`tax_gr1a`	Tax surprise	Earnings qual.	Thomas & Zhang (2011)
`at_gr1`	Asset growth	Investment	Cooper et al. (2008)

Returns are already signed in the data set; we use `ret` without further transformation.

(b) Economic interpretation

Gross profits-to-assets (`gp_at`). Novy-Marx (2013) shows that gross profitability—revenue minus COGS, scaled by assets—is the cleanest measure of operating productivity; long productive firms earn higher returns when the market underprices durable efficiency.

Tax expense surprise (`tax_gr1a`). Thomas & Zhang (2011) document that year-on-year changes in tax expense predict returns: taxes are hard to manage, so the tax line signals taxable income that investors under-react to.

Asset growth (`at_gr1`). Cooper et al. (2008) find that firms expanding assets aggressively subsequently under-perform (q-theory / over-investment); the portfolio is long low-growth firms.

The three characteristics fit one theme: profitable, conservative firms earn premia opposite to aggressive growers. Correlations and spanning regressions below; we benchmark each factor against the closest Fama–French five-factor leg (Fama & French, 2015).

(c) Performance metrics

Log returns $r_t = \ln(1 + R_t)$. For each factor and each rolling window of $T = 36$ months we compute

$$\bar{r} = \frac{1}{T}\sum_{t=1}^{T} r_t, \qquad \hat{\sigma}_r = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(r_t - \bar{r})^2}, \qquad \text{Sharpe} = \frac{\bar{r}}{\hat{\sigma}_r}.$$

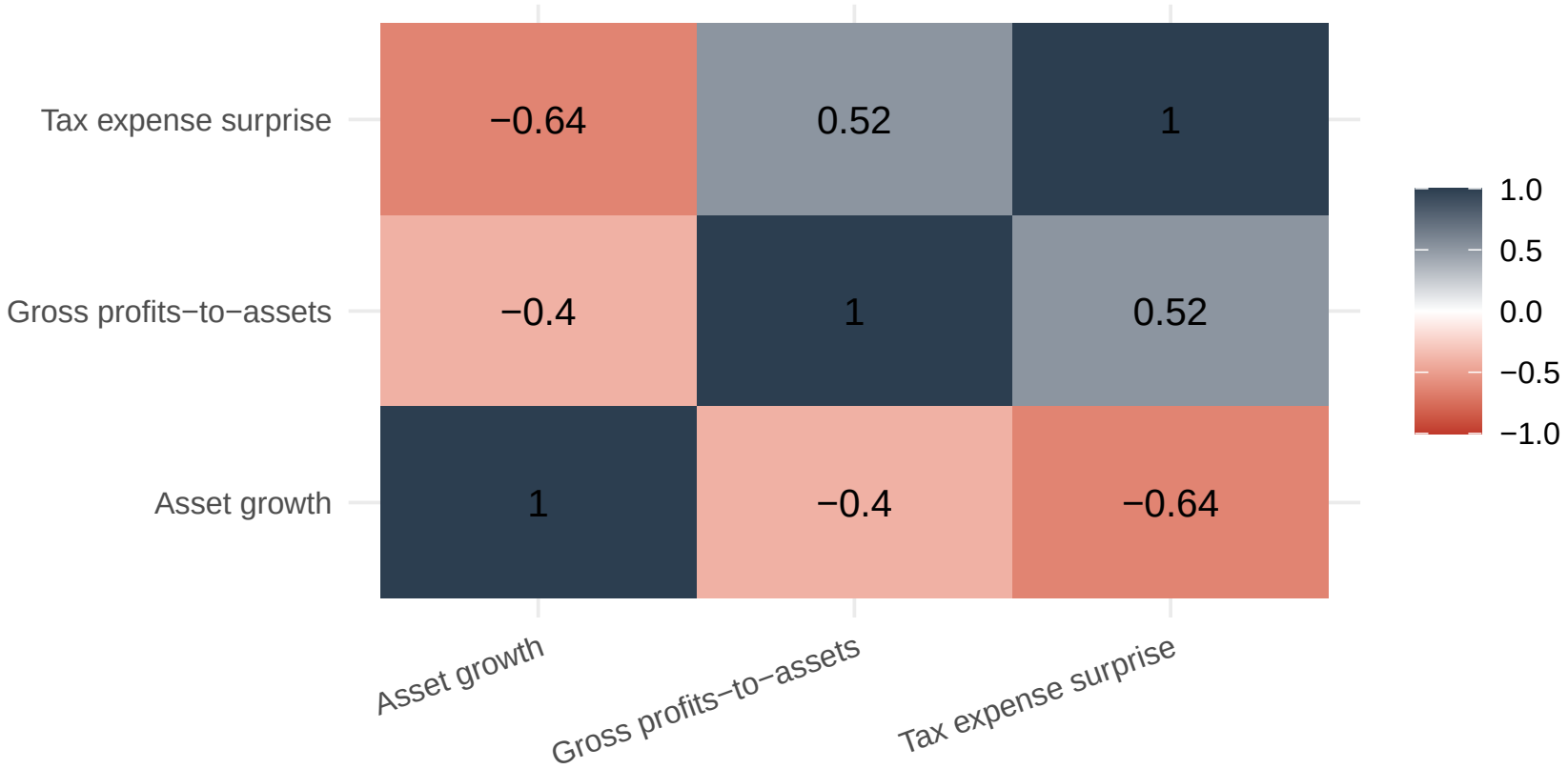
Annualised figures in the tables use $\bar{r} \times 12$ and $\hat{\sigma}_r \times \sqrt{12}$.

Full-sample risk and return

Factor	N	Mean	Vol.	Sharpe	Max DD
Gross profits-to-assets	902	3.5%	7.9%	0.44	-33.6%
Asset growth	890	2.7%	9.2%	0.29	-34.3%
Tax expense surprise	890	1.7%	6.3%	0.26	-28.3%

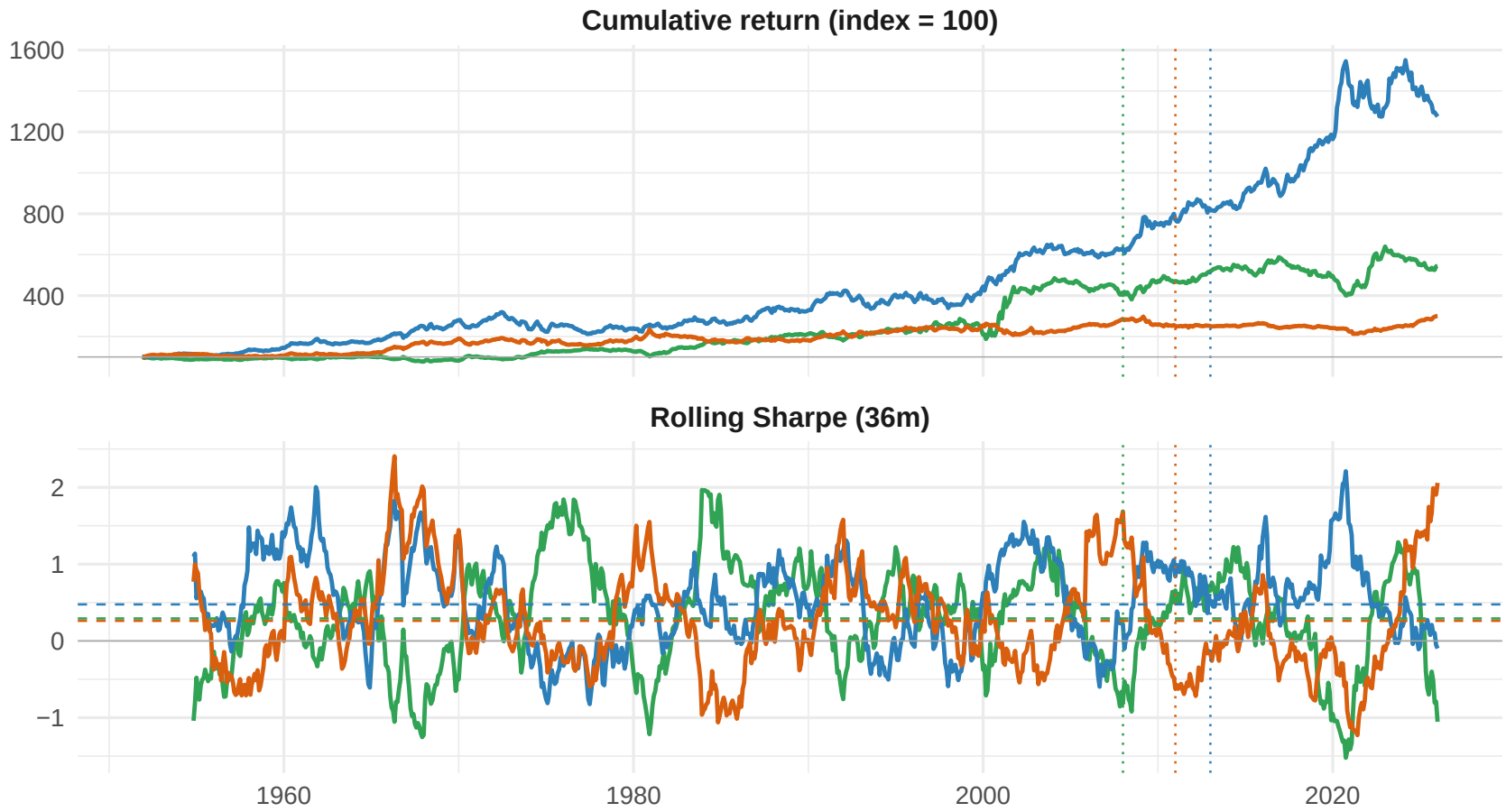
All three factors carry positive mean returns at low volatility. Gross profitability has the highest Sharpe ratio and the smallest drawdown.

Correlation structure



Quality factors correlate positively ($\rho \approx 0.52$); both correlate negatively with asset growth ($\rho \approx -0.40$, -0.64). The data confirm that quality and conservative investment line up on one side of the return spectrum, opposite to aggressive asset growth.

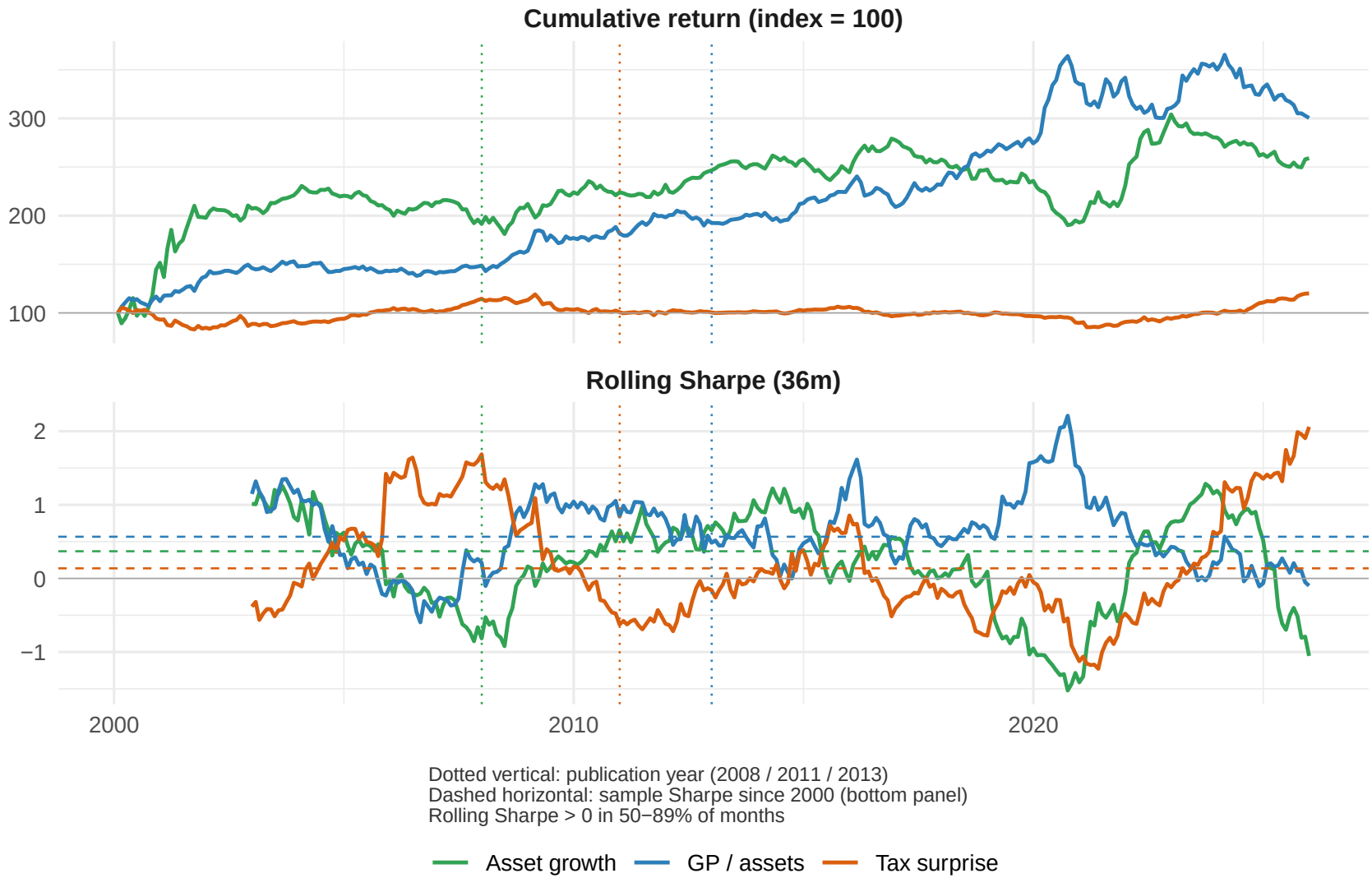
Return paths over time



Dotted vertical: publication year (2008 / 2011 / 2013)
Dashed horizontal: full−sample Sharpe (bottom panel)
Rolling Sharpe > 0 in 61−82% of months

Asset growth GP / assets Tax surprise

Return paths over time (2000–present)



Pre- and post-publication

We split each series at the publication year of its source paper and test whether the mean return changes:

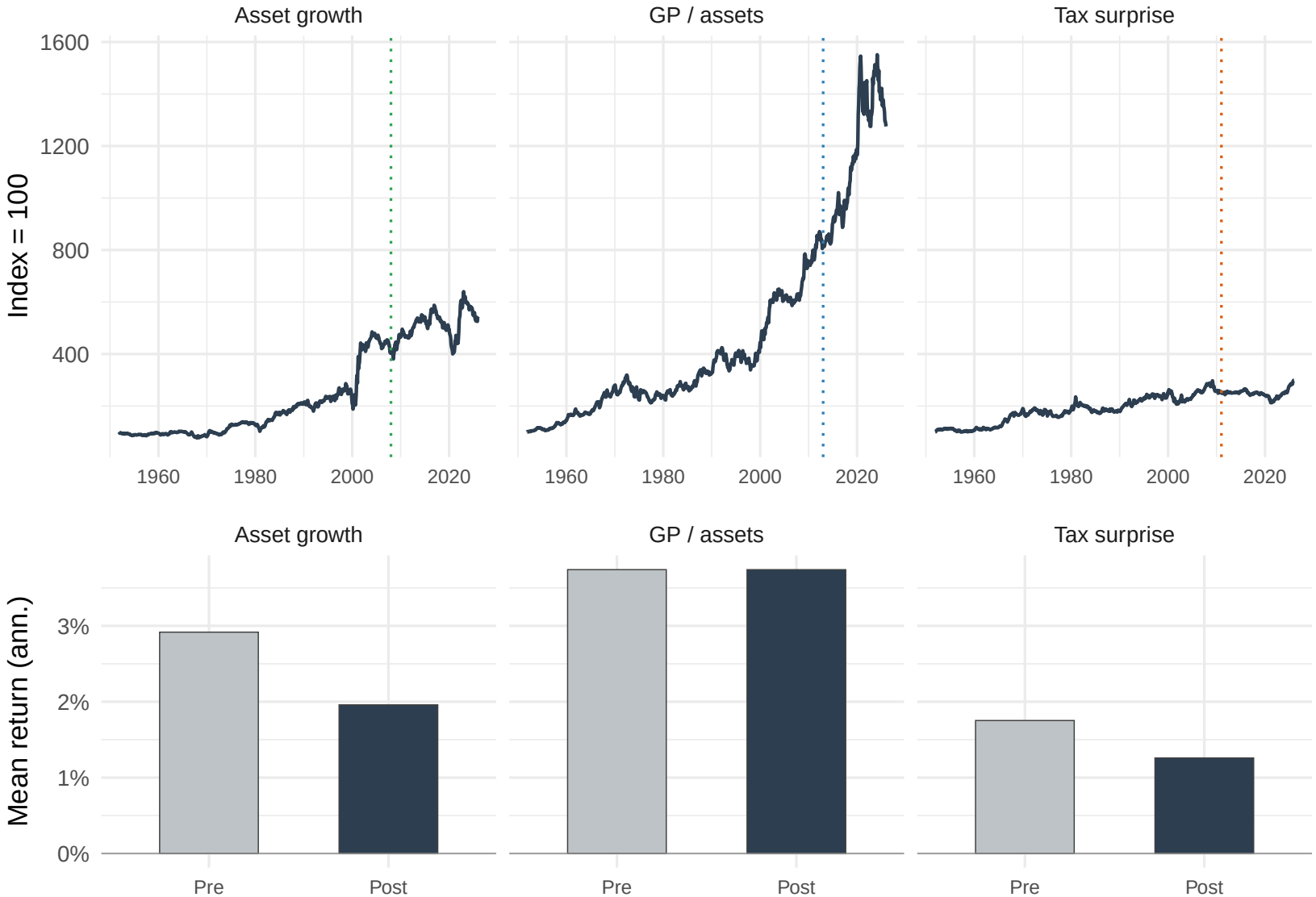
$$r_t = \alpha + \delta\, \mathbf{1}\{t \geq t_{\text{pub}}\} + \varepsilon_t$$

(Newey–West, 6 lags). If arbitrage erodes a mispricing, δ should be negative; a risk premium should largely survive.

factor	Factor	Change (ann.)	t-stat	p-value
at_gr1	Asset growth	-0.96%	-0.37	0.714
gp_at	Gross profits-to-assets	0.00%	0.00	1.000
tax_gr1a	Tax expense surprise	-0.49%	-0.32	0.747

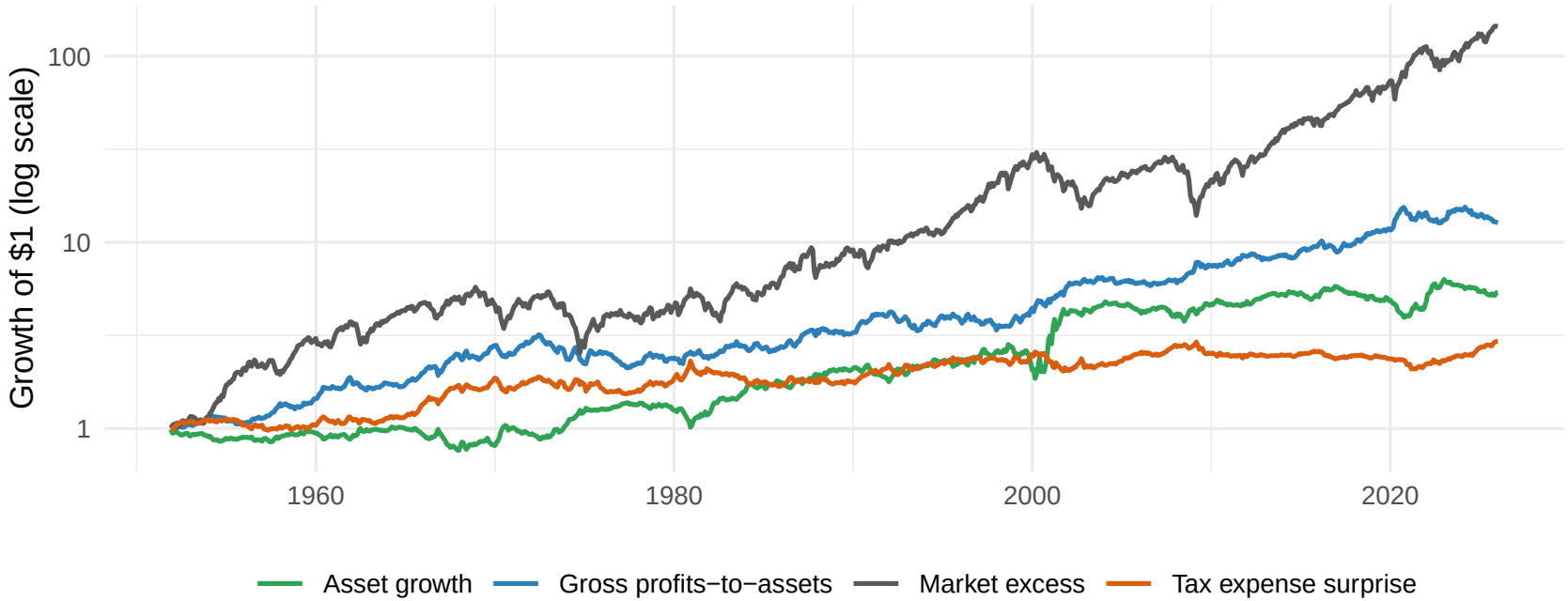
Post-publication changes in mean return are small and insignificant ($p > 0.7$).

Pre- and post-publication paths



Dotted vertical lines: publication years (2008, 2011, 2013). Paths do not break at t_{pub}; bars show no collapse after publication.

Comparison with market excess return

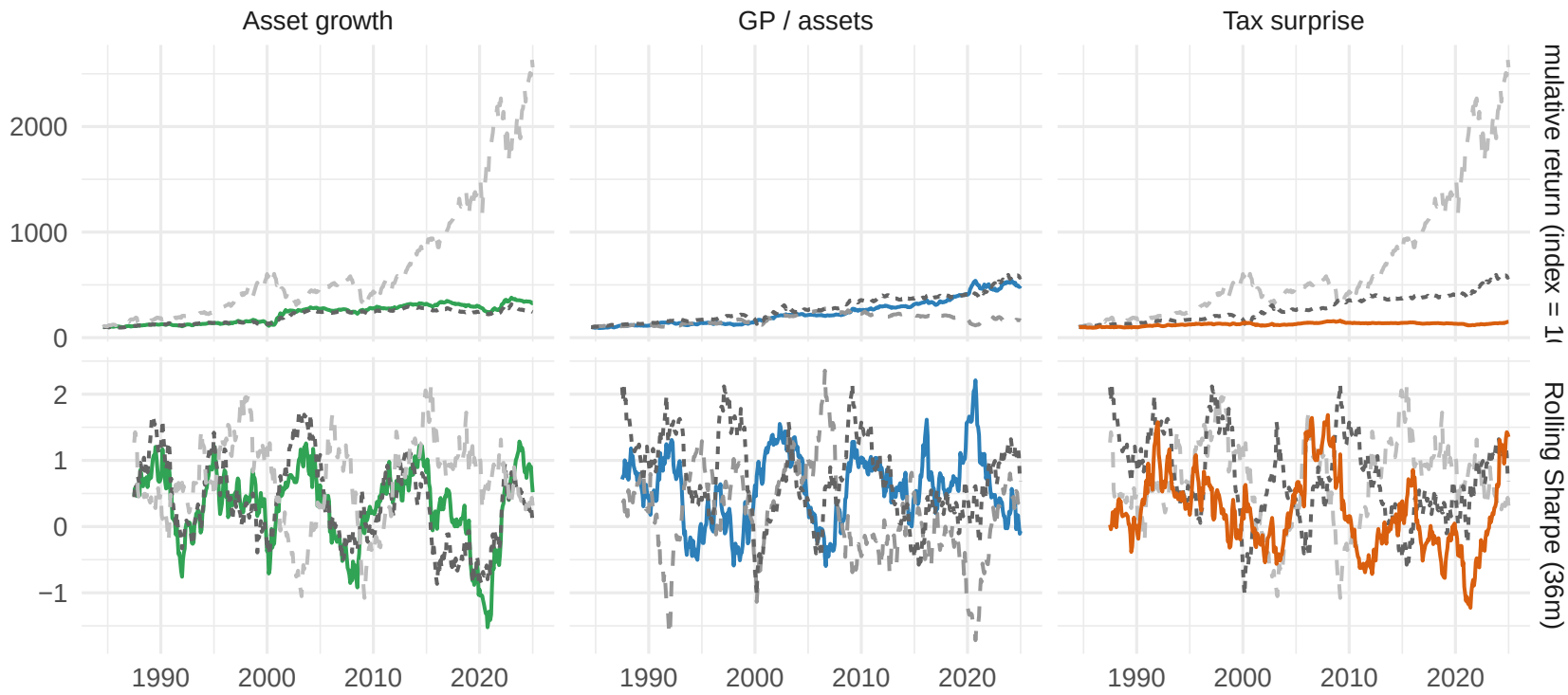


The market earns the highest cumulative return but at roughly 15% annualised volatility and a 56% maximum drawdown. Gross profitability dominates on a Sharpe basis.

Comparison with Fama–French benchmarks

We pair each characteristic with the closest FF5 factor (Fama & French, 2015): profitability with **RMW** and **HML**, earnings quality with **RMW** and the market, investment with **CMA** and the market ($T = 36$ rolling Sharpe as in section~(c)).

GP / assets tracks RMW more closely than HML; **tax surprise** is less tied to either benchmark; **asset growth** moves opposite to CMA.



(d) Spanning regressions

For factor i and model m we estimate on the common sample (1967–2024):

$$\text{CAPM:} \quad r_{i,t} = \alpha_i + \beta_i \, \text{Mkt\_RF}_t + \varepsilon_{i,t}$$

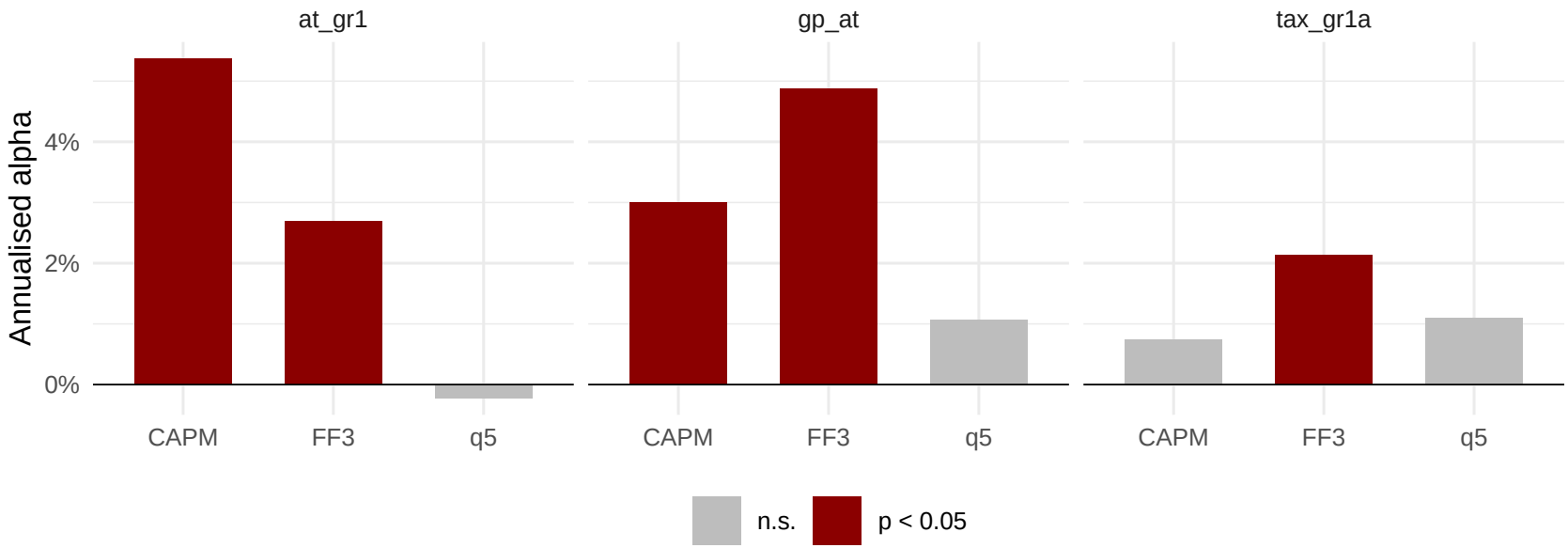
$$\text{FF3:} \quad r_{i,t} = \alpha_i + \beta_{i,1} \, \text{Mkt\_RF}_t + \beta_{i,2} \, \text{SMB}_t + \beta_{i,3} \, \text{HML}_t + \varepsilon_{i,t}$$

$$\text{q5:} \quad r_{i,t} = \alpha_i + \sum_{k \in \{\text{MKT, ME, IA, ROE, EG}\}} \beta_{i,k} \, F_{k,t} + \varepsilon_{i,t}$$

α_i is the annualised intercept; R^2 measures explained variation. Factors are long–short; we do not subtract the risk-free rate again.

Factor	Model	Alpha (ann.)	p-value	R-squared
Asset growth	CAPM	5.37%	0.001	0.16
Asset growth	FF3	2.68%	0.001	0.64
Asset growth	q5	-0.22%	0.857	0.60
Gross profits-to-assets	CAPM	3.00%	0.014	0.03
Gross profits-to-assets	FF3	4.88%	0.000	0.36
Gross profits-to-assets	q5	1.07%	0.355	0.31
Tax expense surprise	CAPM	0.73%	0.414	0.04

Spanning results



CAPM leaves large significant alphas ($R^2 \approx 0.04$–0.16). FF3 raises R^2 but cannot price profitability and investment anomalies. The Hou et al. (2021) q5 model drives all three alphas toward zero.

Summary

1. **Interpretation.** The three factors map to profitability, earnings quality, and investment; correlations match that structure.
2. **Performance.** Positive mean returns, low volatility, regime-dependent rolling Sharpe; premia differ from but relate to FF5 legs (RMW, HML, CMA); no post-publication decay.
3. **Spanning.** CAPM and FF3 leave economically large α; the augmented q-factor model spans all three factors on the common sample.

References

Novy-Marx, R. (2013). *Journal of Financial Economics*. \ Thomas, J., & Zhang, F. X. (2011). *Journal of Accounting Research*. \ Cooper, M. J., Gulen, H., & Schill, M. J. (2008). *Journal of Finance*. \ Fama, E. F., & French, K. R. (1993). *Journal of Financial Economics*. \ Fama, E. F., & French, K. R. (2015). *Journal of Financial Economics*. \ Hou, K., Mo, H., Xue, C., & Zhang, L. (2021). *Review of Finance*. \ Jensen, T. I., Kelly, B., & Pedersen, L. H. (2023). *Journal of Finance*.