

# RETESTING INVESTMENT ANOMALIES WITH DR. LU ZHANG

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Last week's podcast was in a new special-edition format, jointly hosted with Wesley Gray, CEO of Alpha Architect. Gray is a Philadelphia-area PhD and investment manager. He plans to join me in our Wharton School studio to help profile academic work that is most relevant to investors.

Introducing this week's guest, Dr. Lu Zhang of Ohio State University, Gray described him as one of the world's premiere experts on asset pricing who is examining the "factor wars" that are raging in academic circles.

Zhang and his team spent three years assembling SAS code to test 447 different investment anomalies—that is, investment strategies or investment factors found to deliver excess returns—in the finance literature to see if he could replicate the results.<sup>1</sup>

His controversial conclusion: **most anomalies can't be replicated.**

The table below shows the category and number of investment strategies that Zhang tested.

Category	Number
Momentum	57
Value-versus-growth	68
Investment	38
Profitability	79
Intangibles	103
Trading frictions	102

The general categories can be described like this:

- 1) **Momentum**: The tendency of stocks that are appreciating to continue to appreciate
- 2) **Value versus growth**: The tendency of stocks that have lower price multiples relative to some fundamental measure of value like [book value](#), or earnings or [dividends](#) to show outperformance over higher multiple stocks

- 3) **Investment:** The tendency of firms that expand their assets and invest less to outperform more rapidly expanding firms
- 4) **Profitability:** The tendency of firms that have higher levels of returns on capital such as [return on equity](#) or [return on assets](#) to have higher returns than firms with lower returns on capital
- 5) **Intangibles:** The tendency of firms that have high levels of R&D or invest in branding/advertisements (i.e. high intangible value) to outperform firms with low intangible value
- 6) **Trading frictions:** The tendency of firms that have lower [betas](#) and [volatility](#) as well as less [liquidity](#) to outperform stocks with higher beta, volatility and liquidity

When Zhang tested these 447 academic anomalies, trading frictions (liquidity) surprised him by being the category with the highest number of academic anomalies that he could not replicate, followed by intangibles. Many of the momentum results he was able to replicate, and some of the classic value investing research also withstood his retests.

### Anomalies that cannot be replicated across categories:

	Number	%
Momentum	20	35%
Value-versus-growth	37	54%
Investment	11	29%
Profitability	46	58%
Intangibles	77	75%
Trading frictions	95	93%

For definitions of terms in the chart, visit our [glossary](#).

### The Good and Bad News for Factor Investors

Zhang was able to replicate a number of the long-standing factor anomalies—value, momentum, profitability and the investment factor premiums. The bad news, according to Zhang, is that there are not many free lunches, and naïve investors for professional investors to take advantage of.

There are, however, real factor premiums and persistent factor premiums that Zhang believes in. His research does not suggest just to go out and buy the S&P 500—it suggests quantitative factor tilting can add to portfolio returns.

Why do these factor premiums exist? Zhang believes that no matter how many [arbitrage](#) trades are placed against these factor premiums, these factors exist in equilibrium—which is great news for quant managers who can structure portfolios to take advantage of these premiums.

### The Q-Factor Model

After testing all the anomalies and seeing which ones he could replicate, Zhang wanted to explain all the results with his Q-factor model. The Q-factor model is based on the net present value rules in corporate finance.<sup>2</sup> Let's compare the Q-factor model to some of the other academic models being used to explain market returns. You have the original [Fama a](#)

nd French three-factor model, which states that a portfolio's returns can be explained by three factors:

- 1) **MKT**: The market risk premium and your beta to market risk
- 2) **Size (SMB)**: How tilted to small-cap stocks the portfolio is
- 3) **Value (HML)**: How tilted to value stocks the portfolio is

This original Fama and French three-factor model was later expanded to include momentum (UMD) and how exposed a portfolio is to stocks that are up versus down.

Fama and French more recently have been utilizing a five-factor model. The five factors are the original three plus the following:

- 4) **CMA**: The investment factor as described above—firms expanding assets lag firms **more conservatively expanding; hence, CMA (conservative minus aggressive)**
- 5) **Robust minus weak**: The RMW factor looks at firms with high returns on equity versus firms with low return on equity, a profitability factor premium

Zhang's Q-factor model looks at:

- 1) The market factor
- 2) The [size](#) factor
- 3) The investment factor
- 4) The ROE factor

Notably absent in Zhang's Q-factor model is the value factor. He thinks the value factor is subsumed when he includes his investment factor. Evidence: Zhang shows the five-factor model has insignificant [alphas](#) when run through his Q-factor model but the reverse is not true—the Fama and French five-factor model does not explain away the Q-factor alphas.

I will focus on this Q-factor model in greater detail in the future, as I think this foundation is important.

### How to Compound Wealth *High*

Gray asked Dr. Zhang if he wanted to compound his wealth *high* for the next 20 years, of all the investment anomalies and factors he researched, what would his personal account strategy be?

Zhang replied that he would look for firms that have high returns on equity that are doing little investment. He believes that companies doing little investment have a high cost of equity, and the cost of equity is associated with expected returns going forward. Gray commented that there are few direct ways of accessing this investment strategy today.

Few strategies might incorporate the low investment screen directly; there may be good indirect ways of getting these tilts. Many indexes focus on ROE as a selection variable, and often we'll see interaction and exposure to the low investment factor as well. We'll explore this in future posts.

Thanks to Wes Gray for joining me as co-host on the podcast—I look forward to more joint sessions. Dr. Zhang is doing great things—I encourage you all to follow his work.

Listen to the full conversation:

<sup>1</sup>A presentation summarizing Zhang's work can be found [here](#).

<sup>2</sup>Dr. Zhang thinks the q-factor model applies to real economy stocks more than financial stocks, but Dr. Zhang does not think the q-factor model results would change much including financial firms.

For standardized performance and the most recent month-end performance click [here](#) NOTE, this material is intended for electronic use only. Individuals who intend to print and physically deliver to an investor must print the monthly performance report to accompany this blog.

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## DEFINITIONS

**Momentum** : Characterized by assets with recent price increase trends over time. This term is also associated with the Momentum Factor which associates these stock characteristics with excess return vs the market over time.

**Value** : Characterized by lower price levels relative to fundamentals, such as earnings or dividends. Prices are lower because investors are less certain of the performance of these fundamentals in the future. This term is also related to the Value Factor, which associates these stock characteristics with excess returns vs the market over time.

**Growth** : Characterized by higher price levels relative to fundamentals, such as dividends or earnings. Price levels are higher because investors are willing to pay more due to their expectations of future improvements in these fundamentals.

**Book Value** : refers to the net asset value of a company determined by subtracting liabilities and intangible assets from Total assets.

**Dividend** : A portion of corporate profits paid out to shareholders.

**Return on Equity (ROE)** : Measures a corporation's profitability by revealing how much profit a company generates with the money shareholders have invested.

**Return on assets (ROA)** : Firm profits (after accounting for all expenses) divided by the firm's total assets. Higher numbers indicate greater profits relative to the level of assets utilized to generate them.

**Beta** : A measure of the volatility of a security or a portfolio in comparison to a benchmark. In general, a beta less than 1 indicates that the investment is less volatile than the benchmark, while a beta more than 1 indicates that the investment is more volatile than the benchmark.

**Volatility** : A measure of the dispersion of actual returns around a particular average level.&nbsp;.

**Liquidity** : The degree to which an asset or security can be bought or sold in the market without affecting the asset's price. Liquidity is characterized by a high level of trading activity. Assets that can be easily bought or sold are known as liquid asset.

**Arbitrage Mechanism** : The ability to compare the price of an ETF and its underlying basket and exchange one for the other utilizing the creation and redemption process.

**Fama-French** : Refers to a factor-based model to describe stock returns developed by Eugene Fama and Kenneth French. Their original three-factor model breaks down the components of stock returns to market risk, company size and book to market ratio, or value. &nbsp;.

**Size** : Characterized by smaller companies rather than larger companies by market capitalization. This term is also related to the Size Factor, which associates smaller market-cap stocks with excess returns vs the market over time.

**Alpha** : Can be discussed as both risk-adjusted excess return relative to a specific benchmark, or absolute excess return relative to a benchmark. It is sometimes more generally referred to as excess returns in general.