

Value from data: Which variables matter?

A new method to overcome the limits of ‘t-statistics’

Science is full of t-statistics. They act as a hallmark for rigor because not only do they pinpoint the effect of a single variable, but they also distinguish signal from noise. Still, they have significant limitations:

- t-stats do not capture ‘shared’ information
- t-stats do not apply to predictions (only models)
- t-stats do not consider complexity (only linear)

We have written before about Relevance-Based Prediction (RBP), an extremely transparent and interpretable technique that forms predictions as weighted averages of the past, where the weights carefully consider which variables and experiences to use for each task. It turns out that this RBP “thought process” also gives a measure of how important every variable is to the reliability of every individual prediction task, which we call Relevance-Based Importance (RBI).

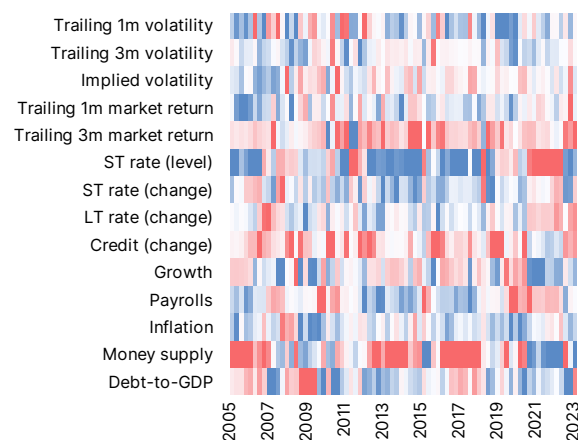
It is almost never the case that a variable is always important, or that it is never important – though this is what a summary t-statistic might lead us to believe. More likely, variables are *sometimes* important, and sometimes not, depending on the circumstance. Consider how inflation suddenly arose as a major factor in the aftermath of Covid following decades of status quo. Or how rain on a summer day makes the temperature irrelevant when we decide whether to go to the beach. RBI reveals not only the importance of a variable given current circumstances, but also its signal to noise contribution. Thus, RBI brings the virtues of t-statistics but also adapts to each unique situation.

When there is no complexity, an average of RBI across all prediction tasks delivers the same information as a t-statistic. But when variables are correlated, relationships shift, and we care about explaining individual predictions, simple t-stats fall short and they can be misleading.

Knowing when and how a variable matters makes data more useful, and more interesting too.

For more on this topic, see our 2024 working paper: **“Relevance-Based Importance: A Comprehensive Measure of Variable Importance in Prediction”** by Megan Czasonis, Mark Kritzman, and David Turkington.

Example: Variable Importance by Prediction Predicting S&P 500 Volatility 2005-2023



Notes. Using training data from Q1 1986 through Q4 2004, we predict subsequent one-quarter (63-day) volatility of daily total returns of the S&P 500 index over the period Q1 2005 through Q4 2023. For additional details, please refer to the paper cited below.


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