# From $R^2$ to $\eta^2$ to $\omega^2$: Caveat Factorem Convergentiae

## Potential Promises and Cautionary Pitfalls of Statistical Ambiguity in Behavioral Economic Modeling

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**Abstract**

Behavioral economics holds tremendous promise by bridging psychological insights and traditional economic frameworks, offering richer, more nuanced models of human decision-making. As this interdisciplinary field continues to mature, it also exposes cautionary pitfalls inherent in integrating diverse disciplinary perspectives—particularly the challenges of maintaining statistical rigor while balancing theoretical breadth.

Richard Thaler's timely contributions exemplify this promise, yet the concluding assertion of his influential 2016 paper—suggesting that the inclusion of psychological variables would yield higher $R^2$ values in economic models—reflects a broader tension in such convergences. While provocative, this statement oversimplifies the interplay between model complexity, statistical significance, and responsible multivariate understanding.

This paper critiques this oversimplification, arguing for an intrinsic pedagogical education fostering in depth understanding of more unbiased statistical measures, such as adjusted-$R^2$, $\eta^2$, $\omega^2$ to evaluate interdisciplinary models. Thaler's conclusion, rather than a misstep, serves as a critical inflection point to discuss the promises and limitations of cross-disciplinary approaches in advancing behavioral economics responsibly.

# 1 Introduction: The Pitfalls of Behavioral Economics and Statistical Missteps

Behavioral economics, as popularized by Richard Thaler, represents a shift in economic thought by incorporating psychological insights into traditional economic models. Thaler's Nobel-winning work, especially his development of concepts like bounded rationality, social preferences, and self-control (e.g., Save More Tomorrow™, reminiscent of psychology's marshmallow effect), has reshaped the field. However, in his 2016 paper, Thaler concluded his paper with a strongly misleading error:

> If economics does develop along these lines the term 'behavioral economics' will eventually disappear from our lexicon. All economics will be as behavioral as the topic requires, and as a result, we will have an approach to economics that yields a higher $R^2$. [Thaler, 2016; p.1597]

In other words, this sentence may be read by an unassuming audience as: by adding psychological variables to economic models, the $R^2$ value would increase, thereby yielding a more accurate representation of economic behavior. While this may sound plausible at first, it neglects critical statistical considerations and misleads researchers about the true value of these models. The real issue is not simply the increase in $R^2$, but whether the added variables truly improve the model's predictive power or just inflate it artificially. This paper aims to critique Thaler's assertion and highlight the importance of more rigorous measures of model fit, such as adjusted-$R^2$, $\eta^2$, and $\omega^2$.

# 2 The Fallacy of $R^2$ Inflation and the Danger of Overfitting

Thaler's claim that adding psychological variables to economic models will increase the $R^2$ value is an oversimplification of the relationship between model complexity and model accuracy. Yes, as more independent variables are added to a regression model, the $R^2$ value will naturally rise. However, this does not necessarily mean that the model is more accurate or that it captures more of the underlying economic behavior. This phenomenon, known as overfitting, occurs when too many variables are included in a model, which results in an artificially high $R^2$ but poor generalizability to other data or situations.

This is where the concept of adjusted-$R^2$ becomes crucial. Unlike the regular $R^2$, which consequently increases as more variables are added, adjusted-$R^2$ accounts for

the number of predictors in the model and penalizes those that do not contribute meaningful information. This adjusted metric provides a more accurate measure of model fit by balancing explanatory power with model complexity. The act of not mentioning adjusted-$R^2$ in Thaler's argument is a significant oversight which leads to the misleading conclusion that simply adding more variables, in this case behavioral, enhances the model.

## 3 Beyond $R^2$: Introducing More Robust Measures of Effect Size

While adjusted-$R^2$ addresses some of the biases associated with including too many variables, it still does not fully capture the magnitude of an independent variable's effect on the dependent variable. This is where measures like $\eta^2$ and $\omega^2$ come into play.

1. $\eta^2$ (eta squared): This measure of effect size quantifies the proportion of variance in the dependent variable that is explained by a single independent variable. While useful in identifying the impact of individual predictors, $\eta^2$ can be inflated by the sample size, which can lead to misleading conclusions when dealing with large datasets.

2. $\omega^2$ (omega squared): As a more reliable and less biased measure of effect size, $\omega^2$ adjusts for sample size and the number of predictors in the model. It is considered a better measure when assessing the strength of a relationship between variables, particularly when the model involves multiple predictors or large sample sizes. In this sense, $\omega^2$ serves as a more robust alternative to $\eta^2$ and provides a clearer picture of an independent variable's impact on the outcome.

By shifting the focus from $R^2$ to these more nuanced effect size measures, researchers can better understand the relationships in their models without falling prey to the temptation of overfitting.

## 4 The Convergence Paradox: More Variables, More Problems

Thaler's claim about the utility of adding psychological variables to economic models is part of a broader trend in which different schools of economic thought—positive eco-

nomics, environmental economics, complexity economics, and behavioral economics—converge. While this interdisciplinary convergence can broaden our understanding of economic systems, it also introduces new risks.

As the complexity of models increases—whether by adding more behavioral factors, environmental considerations, or psychological insights—the potential for overfitting also grows. This accumulation of variables, while it may increase the explanatory power of the model (in terms of $R^2$), can also obscure meaningful relationships and introduce biases that obscure the underlying dynamics of economic behavior. Thus, the effort to converge various analytical approaches is akin to a double-edged sword, where each additional variable introduces potential bias rather than clarity.

The real challenge lies in finding the balance between model complexity and interpretability. As more factors are integrated into economic analysis, it is essential to question whether the increase in complexity enhances our understanding or simply adds noise to the data. This dilemma is particularly acute in behavioral economics, where psychological and neuroeconomic variables, though insightful, may not always translate into more accurate or useful economic models.

## 5 The Future of Behavioral Economics: Moving Beyond Statistical Inflation

The future of behavioral economics should not be about increasing the $R^2$ value by throwing in more psychological variables, but about developing more accurate, nuanced models that account for the complex, multifaceted nature of human decision-making. Statistical tools like adjusted-$R^2$, $\eta^2$, and $\omega^2$ should be used thoughtfully to evaluate the true impact of each variable rather than simply inflating the explanatory power of the model.

Moreover, we must be cautious about the potential bias introduced by increasing model complexity. While the integration of psychological factors into economic models is a significant advance, it is essential that we don't sacrifice model rigor for the sake of theoretical breadth. In the end, a more balanced approach—one that carefully weighs the inclusion of additional variables against the risk of overfitting—will provide a more accurate and meaningful understanding of economic behavior.

## 6 Conclusion: *Caveat Factorem Convergentiae*

In conclusion, Thaler's assertion that the inclusion of psychological variables will necessarily lead to a higher $R^2$ is misleading and overlooks the critical issue of model overfitting. As we move toward more integrated and complex economic models, we must remain vigilant about the biases introduced by adding extraneous variables. Statistical measures like adjusted-$R^2$, $\eta^2$, and $\omega^2$ provide a more accurate means of assessing model fit and effect size, and they should be prioritized in behavioral economics research. *Caveat factorem convergentiae*—let the maker/doer of convergence beware.