



When "Other Things" Won't Stay Equal: Structural Limitations of *Ceteris Paribus* in Complex Economic Systems

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Abstract: This article provides a systematic examination of the methodological foundations and principal limitations of the *ceteris paribus* ("other things being equal") assumption. It explores the challenge of balancing abstraction and empirical reality, discusses the aggregate demand-aggregate supply (AD-AS) model as a representative example of a highly abstract analytical framework, and examines the role of *ceteris paribus* in economic policy analysis and its ambiguity in empirical validation. The paper synthesizes the principal critical approaches to *ceteris paribus* within a unified methodological framework. These include omitted variable bias (OVB), the behavioral economics critique of the *homo economicus* model - particularly concerning risk preferences and the shape of the utility function - the unrealistic nature of the assumption that all other conditions remain constant in complex and dynamic economic systems, and the limitations of Friedman's instrumentalist methodology. The central argument of the paper is that these limitations are not incidental but structural, indicating that *ceteris paribus* can no longer be regarded solely as an a priori and empirically untestable methodological postulate. Instead, they provide a foundation for its data-driven, dialectical reinterpretation and for the development of a quantitative measure of its empirical validity.

Keywords: *ceteris paribus*, economic methodology, abstraction, omitted variable bias (OVB).

INTRODUCTION

Economic science has historically relied on the *ceteris paribus* ("all other things being equal") assumption as one of its fundamental methodological principles. Under this assumption, the effect of a particular economic variable is examined while all other relevant factors are held constant. Such abstraction enables researchers to isolate and analyze individual causal relationships within otherwise complex economic processes. However, real-world economic systems are characterized by high levels of complexity, numerous interdependent variables, and dynamic feedback mechanisms, that continuously reshape economic outcomes over time. Under such conditions, the assumption that "all other factors remain constant" becomes increasingly difficult to justify as a realistic representation of economic processes.

This limitation has become even more evident in light of the behavioral economics critique of the *homo economicus* model, which demonstrates that economic agents' decisions systematically deviate from the assumptions of classical rationality [1]. Subsequent research in behavioral economics has further shown that interactions among

boundedly rational and heterogeneous agents can generate complex aggregate dynamics, feedback effects, and coordination failures that traditional economic models are often unable to capture [2].

Against this background, an important methodological question arises: **What are the methodological foundations of the *ceteris paribus* assumption, and what are its principal limitations in modeling complex economic systems?** This question constitutes the central research question of the present study. Accordingly, the paper aims to provide a systematic and critical assessment of the methodological status of the *ceteris paribus* assumption and the principal limitations associated with its application.

The paper makes three main contributions. First, it integrates the principal strands of criticism of the *ceteris paribus* assumption—including omitted variable bias (OVB), behavioral economics, the complexity of economic systems, and empirical indeterminacy—into a coherent methodological framework. Second, it reexamines Friedman’s instrumentalism, arguing that it represents an insufficient methodological position for the analysis of complex, multifactor economic systems. Third, it provides a theoretical justification for the development of a quantitative validity measure for the *ceteris paribus* assumption, enabling a more objective evaluation of its realism beyond traditional qualitative assessment.

The paper is organized as follows. It begins by examining the historical origins and methodological foundations of the *ceteris paribus* assumption. It then discusses the balance between abstraction and empirical reality, the aggregate demand-aggregate supply (AD-AS) model as a representative example of a highly abstract analytical framework, and the role of the assumption in economic policy analysis. The paper subsequently examines its limitations in complex economic systems, the challenges of empirical testing, omitted variable bias (OVB), the behavioral economics critique, and Friedman’s instrumentalism. Finally, it concludes by reflecting on the methodological balance between abstraction and empirical reality and by proposing the development of a Ceteris Paribus Validity Coefficient (CPV) as a potential framework for quantitatively assessing the validity of the assumption.

METHODOLOGICAL FOUNDATIONS OF THE *CETERIS PARIBUS* ASSUMPTION

The *ceteris paribus* assumption has deep historical and philosophical roots in economic thought. Economists have traditionally analyzed economic phenomena by isolating specific factors while temporarily holding other relevant conditions constant. However, its systematic formulation as a methodological principle of political economy is closely associated with John Stuart Mill, who emphasized the role of abstraction and isolation of causal factors as essential elements of economic reasoning. According to Mill, economic laws describe underlying tendencies rather than universally deterministic relationships, while conceptually holding other relevant conditions constant, which reflects the core logic of the *ceteris paribus* approach [3, 4].

This methodological approach was later developed and systematized by Alfred Marshall within the framework of partial equilibrium analysis. Marshall established the analytical practice of examining a particular market while assuming that other relevant conditions remained unchanged, thereby making *ceteris paribus* a practical tool for economic analysis [5, 6].

Subsequently, Milton Friedman's instrumentalist methodology further reinforced the methodological justification of abstraction by arguing that the validity of a model should be assessed primarily by its predictive performance rather than by the literal realism of its assumptions [7]. These contributions shaped the role of the *ceteris paribus* assumption as one of the foundational methodological tools of modern economic theory.

THE BALANCE BETWEEN ABSTRACTION AND REALITY IN ECONOMIC MODELING

One of the central and most challenging issues in economic modeling is the relationship between abstraction and empirical reality. An economic model is a simplified representation of real-world processes designed to describe complex phenomena in a form that enables systematic analysis and prediction. Accordingly, a model must achieve a balance between analytical tractability and sufficient representation of the relevant features of economic reality, avoiding excessive complexity that would limit its practical usefulness.

At the same time, every model provides only a partial representation of reality, as it is impossible to incorporate all factors, behavioral patterns, sources of uncertainty, and contextual conditions simultaneously. An attempt to capture every possible determinant would make the model excessively complex and potentially unsuitable for analytical purposes. Therefore, economists necessarily rely on abstraction by excluding certain factors and focusing on those variables considered most relevant for explaining the phenomenon under investigation. However, the relationship between the degree of abstraction and predictive accuracy is neither straightforward nor necessarily negative.

While greater abstraction generally increases analytical simplicity and may reduce the model's correspondence with specific empirical conditions, abstraction can be analytically justified when it helps isolate theoretically important mechanisms. This is particularly relevant in relatively stable environments, contexts characterized by robust causal relationships, and long-term analyses where temporary fluctuations may be less central to the underlying mechanism [4, 7, 8].

The AD-AS Model as an Example of High Abstraction

The AD-AS model represents one of the most abstract analytical frameworks in macroeconomics. It describes the economy through two fundamental relationships: aggregate demand (AD) and aggregate supply (AS). Although real economies are shaped by a much wider range of factors—including technological change, international trade, financial markets, institutional conditions, and expectations—the simplicity of this framework provides substantial analytical value highlighting the core relationships among key macroeconomic variables such as inflation, employment, and output. For this reason, the AD-AS model remains a central instrument for analyzing macroeconomic conditions and policy alternatives, offering policymakers an intuitive and accessible representation of key economic mechanisms.

This example demonstrates that a simple model is not necessarily an inferior model. The AD-AS framework highlights an important methodological distinction: a relatively low validity of the *ceteris paribus* assumption (expressed through a low CPV value, hypothetically around 0.2-0.4 at the macroeconomic level) does not automatically imply

that a model lacks analytical or practical value. CPV is not intended to measure the overall quality, predictive performance, or usefulness of a model; rather, it represents the degree to which the *ceteris paribus* assumption remains valid under specific analytical conditions. Therefore, the communicative value of a model may be partly independent of its CPV level. A model may consequently have a relatively low CPV while still retaining considerable educational, analytical, and policy relevance.

More advanced frameworks that build upon AD-AS foundations, including Dynamic Stochastic General Equilibrium (DSGE) models and New Keynesian (NK) models, incorporate a broader set of behavioral mechanisms, structural relationships, and empirical information. Increasingly, some modern approaches also utilize large-scale datasets associated with Big Data methods. These extensions aim to provide a more comprehensive representation of economic processes and may increase the empirical validity of the assumptions underlying the models while preserving the explanatory clarity and communicative advantages of more simplified frameworks.

In summary, a highly abstract model may provide a less detailed representation of reality while remaining analytically valuable if it successfully captures the essential mechanisms of complex phenomena. Conversely, more sophisticated models seek to improve empirical accuracy and realism while preserving explanatory power, transparency, and interpretability.

THE ROLE OF THE *CETERIS PARIBUS* ASSUMPTION IN POLICY ANALYSIS

The *ceteris paribus* assumption plays an important role in economic policy analysis by enabling researchers to identify theoretically grounded causal relationships and conduct normative evaluations of alternative policy interventions aimed at achieving specific economic objectives. Its function therefore extends beyond that of a purely descriptive analytical tool, providing a conceptual framework for comparing policy alternatives, assessing their likely consequences, and supporting evidence-based economic decision-making. However, the application of the *ceteris paribus* assumption in policy analysis also raises important theoretical and practical challenges regarding its reliability, applicability, and interpretation.

Policy environments are characterized by multiple interacting factors, dynamic feedback mechanisms, and time lags that complicate the isolation of individual causal effects. Moreover, policy interventions often involve trade-offs, distributional consequences, and institutional constraints that cannot be adequately captured under *ceteris paribus* conditions. As a result, translating predictions derived from simplified theoretical models into effective and actionable policy recommendations remains a significant methodological challenge.

PRINCIPAL LIMITATIONS OF THE *CETERIS PARIBUS* ASSUMPTION

Limitations of the *Ceteris Paribus* Assumption in Complex Economic Systems

One of the central criticisms of the *ceteris paribus* assumption concerns its limited applicability in real-world economic environments. Economic systems are characterized by high levels of complexity, continuously evolving interdependent variables, and dynamic

feedback mechanisms, making the practical assumption that "all other factors remain constant" increasingly difficult to sustain. Economic analysis, understood as a dialectical process, typically begins with a high degree of abstraction and gradually moves toward the identification of real economic interactions, tensions, and contradictions, thereby requiring the continuous refinement and adaptation of theoretical models [9].

This challenge is particularly evident in Nijkamp's analysis of spatial-economic systems. Nijkamp argues that the *ceteris paribus* assumption can be a valid and productive analytical strategy under relatively stable conditions; however, in highly dynamic environments characterized by complex spatial-temporal interactions, maintaining stable equilibrium trajectories within dynamic models becomes increasingly problematic. As a result, the explanatory capacity of the *ceteris paribus* approach may become significantly constrained [10].

Importantly, Nijkamp does not dismiss the analytical value of the *ceteris paribus* assumption. Instead, he emphasizes that its validity is strongly context-dependent. This perspective is reflected in the proposed **Context Validity Weight (CVW)** component of the **Ceteris Paribus Validity Coefficient (CPV)** framework, which seeks to quantify, on a scale from 0 to 1, the degree to which the assumption of "other conditions remaining constant" is realistic within a specific research context. Under experimental and highly controlled conditions, CVW would be expected to be relatively high (typically above 0.8); in microeconomic studies, it may take intermediate values (approximately 0.5-0.7); whereas in macroeconomic environments characterized by external shocks and uncertainty, it would generally be expected to be lower (approximately 0.1-0.3). Thus, the evolutionary and computational approaches advocated by Nijkamp, together with Big Data, provide methodological tools that can strengthen the empirical assessment and applicability of the *ceteris paribus* assumption in complex economic systems.

The Ambiguity of the *Ceteris Paribus* Assumption and Problems of Empirical Testing

A second fundamental limitation of the *ceteris paribus* assumption concerns its inherent ambiguity, which creates challenges for the empirical testing of economic theories. When a theoretical prediction is not supported by empirical evidence, researchers may argue that the "other conditions" were not adequately controlled or that an additional unobserved factor affected the observed outcome. As a result, the strict rejection of economic hypotheses becomes difficult, because the interpretation of empirical findings depends not only on theoretical assumptions but also on the specification of auxiliary conditions [11]. Furthermore, it is often unclear which factors should be treated as constant and which should be allowed to vary, thereby limiting the possibility of rigorous empirical validation.

Rol emphasizes that *ceteris paribus* clauses are not always formulated or applied in a methodologically appropriate manner. Their purpose is to shield theoretical claims from the influence of external confounding factors; however, when such clauses are insufficiently specified, there is a risk that important variables are implicitly absorbed into the theoretical assumptions rather than explicitly identified, measured, and controlled for. As Rol observes, "...economists who do not specify the clause well enough tend to fence variables in rather than off" [12].

Omitted Variable Bias (OVB)

The ambiguity of the *ceteris paribus* assumption is closely related to the problem of omitted variable bias, which represents one of the most significant empirical challenges arising from incomplete model specification. When relevant explanatory variables are excluded from a model, estimated coefficients may become biased, leading to potentially misleading causal interpretations. The source of this bias can be formally expressed as follows:

$$\text{Bias} = E[\hat{\beta}] - \beta = (X'X)^{-1}X'u \quad (1)$$

In this formulation, the bias is determined by the relationship between the regressors and the omitted components of the error term, expressed through the term $(X'u)$. More specifically, omitted variable bias arises when the independent variables are correlated with omitted factors contained in the error term (u).

The assumption that "other factors remain constant" may lead researchers to overlook relevant correlations among variables, resulting in omitted variable bias and biased estimates when important determinants are excluded from the analysis [13, 14].

From a methodological perspective, it is important to distinguish between two types of omitted variables, because Big Data has different capacities to address each type:

- **Omission of observable variables:** These are factors that can, in principle, be measured and incorporated into the model. This is where Big Data provides its primary contribution: high-dimensional datasets enable researchers to include a broader range of relevant variables in empirical analysis, thereby reducing the correlation between the regressors (X) and the error term (u), mitigating omitted variable bias and improving the reliability of coefficient estimates.
- **Omission of unobservable variables:** These refer to factors that are inherently difficult or impossible to measure directly, such as abilities, habits, motivation, preferences, or emotional states. Even with extremely large datasets, such variables often remain only partially observed. Consequently, their influence cannot be eliminated completely. However, their potential impact can be assessed and partially mitigated through econometric approaches such as instrumental variable estimation, robustness checks, sensitivity analysis (e.g., [15-17]), and related methods designed to evaluate the sensitivity of results to unobserved confounders.

This distinction has direct implications for the structure of the proposed **Ceteris Paribus Validity Coefficient (CPV)** framework. The inclusion of observable variables increases the number of relevant factors explicitly represented in the model (N_{modeled}), whereas the remaining influence of unobservable factors is reflected in the abstraction index (I_{abs}). Accordingly, Big Data may reduce (I_{abs}) and increase the ratio ($N_{\text{modeled}}/N_{\text{relevant}}$); however, it cannot completely eliminate omitted variable bias or reduce it to zero.

Behavioral Economics Critique: Limitations of the *Homo Economicus* Model

Another important limitation of the *ceteris paribus* assumption is related to the behavioral economics critique of the *homo economicus* model. Contemporary research demonstrates that economic agents do not always behave according to the assumptions of full rationality. Instead, their decisions are shaped by limited information, heterogeneous beliefs, adaptive

expectations, heuristics, and cognitive biases, which may lead to systematic deviations from the predictions of standard rational-choice models [1, 2].

In this context, Kahneman and Tversky's Prospect Theory represents a fundamental contribution that transformed the understanding of economic decision-making by demonstrating that individual choices systematically deviate from the predictions of the standard rational-choice framework.

The theory shows that decisions depend not only on objective economic conditions but also on reference points, perceptions of gains and losses, contextual factors, and psychological characteristics. Consequently, the applicability of the *ceteris paribus* assumption becomes more limited when analyzing behavioral processes in which preferences, expectations, and evaluations are themselves context-dependent, varying with framing effects, social environment, past experiences, and reference points. Such variability challenges the assumption that behavioral responses remain stable under otherwise identical conditions, which is essential for isolating causal effects.

The three central mechanisms of Prospect theory illustrate these limitations:

1. **Loss Aversion:** Individuals tend to perceive losses as more significant than equivalent gains. This challenges the classical assumption that economic agents evaluate gains and losses symmetrically and make decisions solely according to objective changes in wealth or utility.
2. **Diminishing Sensitivity:** Individuals' sensitivity to changes in outcomes decreases as they move further away from a reference point. This implies that the psychological impact of gains and losses is not proportional to their objective magnitude, challenging the assumption that economic agents evaluate changes linearly across different levels of outcomes.
3. **Probability Weighting:** Individuals tend to overweight small probabilities and underweight large probabilities. This challenges the assumption that economic agents process probabilities according to their objective likelihoods, as assumed in traditional expected utility models [1].

Risk Preferences and the Shape of the Utility Function

In general, in low-value risky situations, individuals may be more inclined to take risks (Risk Taker), whereas in high-value decision-making situations they tend to avoid risks (Risk Averse). A risk-neutral attitude (Risk Neutral) represents an intermediate position between these two behavioral states.

Moreover, risk preferences may change even for the same individual depending on the scale of potential gains or losses. In decisions involving relatively small values, individuals may be more willing to accept uncertainty, whereas in choices involving substantial economic consequences they may behave more cautiously. Such differences are related not only to individual characteristics but also to the shape of the value function and the range of outcomes over which decisions are made. Therefore, risk attitudes are determined not solely by personal traits but also by the economic significance and perceived value of a particular choice.

Formally, according to the Arrow-Pratt framework, individuals' attitudes toward risk are determined by the curvature of the utility function $u(x)$, as reflected in the sign of its second derivative [18, 19]:

- $u''(x) > 0$ – the utility function is convex, indicating risk-seeking behavior;
- $u''(x) = 0$ – the utility function is linear, corresponding to risk neutrality;
- $u''(x) < 0$ – the utility function is concave, indicating risk aversion.

However, according to the Friedman-Savage hypothesis, an individual's utility function may exhibit different curvatures over different ranges of wealth. It may be convex at lower wealth levels, approximately linear over an intermediate range, and concave at higher wealth levels. This structure explains how the same individual may exhibit risk-seeking behavior in some circumstances, risk-neutral behavior in others, and risk-averse behavior under different conditions [20]. Graphically, this relationship is represented in Figure 1.

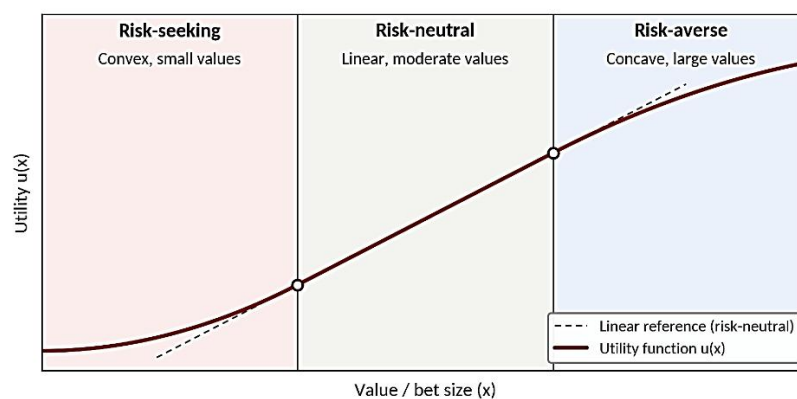


Figure 1: Shape of the utility function under the Friedman-Savage hypothesis: convex (risk-seeking), linear (risk-neutral) and concave (risk-averse) segments [20].

- **Low-value risks:** When the amount exposed to risk is insignificant relative to an individual's overall resources, its potential loss has only a limited impact on overall well-being. At the same time, the possibility of substantially increasing a small amount of money may appear attractive. Consequently, individuals may sometimes accept risks with a negative expected monetary value, such as purchasing lottery tickets or participating in small-scale gambling activities. In such situations, the utility function may exhibit a convex shape, reflecting risk-seeking behavior.
- **Intermediate-value range:** In this range, the marginal value of additional units of wealth is relatively stable, and the perception of gains and losses tends to be more balanced. Decision-making is more closely associated with the evaluation of expected value, while the utility function is approximately linear, corresponding to risk-neutral behavior.
- **High-value risks:** In decisions involving substantial economic stakes, diminishing marginal utility becomes dominant. A significant loss may have a major impact on an individual's financial security, affecting savings, solvency, or living conditions. Therefore, individuals are often willing to pay a premium to reduce uncertainty, for

example, by purchasing insurance, diversifying assets, or choosing a safer outcome even when its expected monetary value is relatively lower. In such cases, the utility function is concave, reflecting risk-averse behavior.

Thus, risk attitudes can be considered **local** rather than fixed: they depend on the specific segment of the utility (value) function within which a particular decision is located. This idea represents the central contribution of the Friedman-Savage model [20], which demonstrated why the same individual may display different attitudes toward risk across different situations. The formal analysis of risk and choice was later extended by Markowitz [21], who developed portfolio selection theory based on the relationship between risk and expected return.

The Impact of Behavioral Economics on CPV

Evidence from behavioral economics challenges an implicit assumption underlying the *ceteris paribus* framework: that behavioral responses remain sufficiently stable under otherwise equal conditions to support reliable prediction. Instead, behavioral responses vary across contexts and decision environments, making human behavior itself one of the most important "other relevant factors" that cannot always be assumed to remain constant.

Within the CPV framework, the insufficient incorporation of behavioral factors affects the validity of the *ceteris paribus* assumption in three main ways. First, I_{abs} (the index representing the influence of factors abstracted from the model) increases because certain behavior-driven decision patterns are implicitly assumed to remain constant under *ceteris paribus* conditions, even though they may vary systematically across contexts. For example, behavioral parameters such as loss aversion and probability weighting can change depending on factors such as the stakes involved, framing effects, and reference points. Ignoring this contextual variability may lead to model misspecification and weaken the empirical foundations of the *ceteris paribus* assumption.

Second, the Context Validity Weight (CVW) declines, reflecting a lower degree of confidence that "other conditions" can realistically be considered unchanged within a given analytical environment. Third, N_{relevant} (the number of theoretically important variables) increases, because the model must incorporate additional psychological and behavioral determinants. If a substantial share of these additional variables is not represented in the model, its correspondence with real-world processes declines, and consequently the CPV value is reduced.

This is where another key advantage of Big Data becomes apparent. Large-scale observation of actual behavioral patterns enables researchers to identify systematic regularities in human decision-making, increase the number of relevant variables incorporated into the model (N_{modeled}), and reduce the degree of abstraction embedded in the traditional rationality assumption.

Limitations of the *Ceteris Paribus* Assumption in Economic Policy Management

The limitations of the *ceteris paribus* assumption become particularly evident in the formulation and implementation of economic policy. In real policy environments, it is essential to consider historical, institutional, cultural, and geopolitical contexts, as an

abstract approach based solely on the analysis of a single variable may lead to inappropriate or ineffective policy decisions. As Rol emphasizes, "abstract theorising conceptually leads one away from the concrete detail of real world situations in which policies take place". He further argues that "as every new context provides the policy maker with a new distribution of the factors that are to help the policy to be successful, it is unclear how the purely theoretical knowledge has to be supplemented with information about the relevant facts of the situation given" [12, p. 44].

FRIEDMAN'S INSTRUMENTALISM AND ITS CRITIQUE IN THE ERA OF BIG DATA

Addressing criticisms of the *ceteris paribus* assumption requires consideration of Milton Friedman's instrumentalist methodology, according to which the validity of an economic model should be judged primarily by its empirical implications rather than by the literal realism of its assumptions. The central criterion is therefore the model's ability to provide reliable explanations and accurate predictions of economic phenomena [7]. If a simplified model produces reliable predictions, its use may be justified even when some of its assumptions are highly abstract. This perspective contributed significantly to the widespread acceptance of economic models based on the *ceteris paribus* assumption. However, critics argue that this approach creates an important methodological challenge.

If a model's prediction fails, it can often be argued that some "other condition" has changed, thereby protecting the model from direct rejection [11]. This creates a methodological asymmetry: the model is difficult to falsify, and the *ceteris paribus* clause may function as an ad hoc shield that weakens the empirical content of the theory. Consequently, the theory becomes less empirically testable, raising questions about the clarity of its scientific status.

Under such circumstances, it becomes difficult to determine whether the theory itself is inadequate or whether the failure resulted from inappropriate assumptions about the conditions under which the model was applied. Nevertheless, Friedman's position remains influential. Supporters of instrumentalism correctly emphasize that, in some circumstances, a simple but empirically successful model may be more useful than a highly complex framework that lacks transparency and interpretability. For example, simplified models such as the law of demand continue to provide substantial analytical value despite their abstract assumptions.

It should be noted that, in the era of Big Data, Friedman's dichotomy of "realism versus predictive accuracy" is becoming less rigid, for at least four reasons:

1. **Improved predictive accuracy:** Big Data reduces the level of abstraction associated with the *ceteris paribus* assumption by enabling researchers to incorporate a broader range of relevant variables into empirical models. Consequently, machine learning methods allow the identification of more complex relationships and may improve predictive performance [22].
2. **The growing demand for interpretability and causal understanding:** Contemporary policy analysis requires answers not only to the question "what will happen?" but also to "why will it happen?"—that is, an understanding of the causal mechanisms generating observed outcomes. From this perspective, approaches focused exclusively on predictive accuracy remain insufficient, because high predictive

performance does not automatically imply causal identification. Pearl emphasizes that statistical associations observed in data do not necessarily imply causal relationships and that identifying causal structures is essential for meaningful inference and decision-making [23].

3. **The Lucas critique:** Econometric models based on historical data may demonstrate strong predictive performance under past conditions but become unreliable when used to evaluate major changes in policy regimes. This occurs because economic agents adjust their expectations and behavior in response to new policy environments, causing structural parameters and previously observed relationships to change. Therefore, models based solely on historical regularities may fail to accurately predict the effects of new policy interventions [24].
4. **Enhanced interpretability:** Recent developments in explainable artificial intelligence (XAI) and machine learning interpretation methods, including SHAP (*SHapley Additive exPlanations*), LIME (*Local Interpretable Model-agnostic Explanations*), and Partial Dependence Plots, enable researchers to examine the contribution of individual variables and identify mechanisms underlying model predictions. As a result, models can achieve both predictive accuracy and interpretability, substantially weakening the traditional "realism versus accuracy" dichotomy.

THE CETERIS PARIBUS VALIDITY COEFFICIENT (CPV)

It is precisely this methodological logic that motivates the formulation of the Ceteris Paribus Validity Coefficient (CPV), which seeks to quantify an aspect that receives limited attention in Friedman's instrumentalist approach: the extent to which the *ceteris paribus* assumption is realistic and empirically justified within a given model. In its general form, the coefficient can be expressed as follows:

$$CPV = \left(\frac{N_{\text{modeled}}}{N_{\text{relevant}}} \right) \times (1 - I_{\text{abs}}) \times CVW \quad (2)$$

Here, N_{modeled} represents the number of theoretically relevant variables explicitly included in the model, while N_{relevant} denotes the complete set of such variables identified through systematic literature review or expert judgment. The ratio $N_{\text{modeled}}/N_{\text{relevant}}$ reflects the degree of model completeness. I_{abs} captures the influence of abstracted (excluded) factors, and CVW represents the contextual plausibility that other conditions remain constant. A CPV close to 1 indicates strong empirical support for the *ceteris paribus* assumption, whereas a value close to 0 suggests limited validity.

The ratio $N_{\text{modeled}}/N_{\text{relevant}}$ conceptually reflects the logic of RESET-type specification tests, which examine whether important omitted functional components may affect model adequacy [25].

The index I_{abs} , ranging between 0 and 1, represents the influence of abstracted factors—that is, the degree to which potentially relevant factors remain excluded from the model and therefore contribute to the risk of omitted variable bias (OVB).

The CVW component, also ranging between 0 and 1, represents the previously discussed Context Validity Weight, which captures the extent to which the assumption that

"other conditions remain constant" is realistic within a specific analytical environment. A CPV value approaching 1 indicates that the *ceteris paribus* assumption is highly plausible and empirically supported within the model, whereas a value approaching 0 suggests that the assumption has limited validity and provides little explanatory value.

The application of Big Data has the potential to substantially increase CPV by expanding the coverage of relevant variables, as indicated by a higher $N_{\text{modeled}}/N_{\text{relevant}}$ ratio, and by reducing the degree of abstraction represented by I_{abs} . At this stage, CPV is introduced as a conceptual framework, with its formal structure, component operationalization, and empirical interpretation outlined at a preliminary level.

The development of a complete quantitative formulation, estimation methodology, and empirical validation of the coefficient remains an important direction for future research. This would include operationalizing each component (e.g., via expert panels, specification tests, or meta-analyses), testing the coefficient's sensitivity to different modeling choices, and examining its correlation with out-of-sample predictive performance across various economic domains.

CONCLUSION

The central challenge of *ceteris paribus*-based modeling lies in maintaining a balance between abstraction and empirical reality. An excessively simplified model may be theoretically elegant but practically ineffective, whereas an overly complex model may become analytically intractable and difficult to apply. The limitations examined in this paper - including omitted variable bias (OVB), the behavioral economics critique of the *homo economicus* model, the unrealistic assumption that "other conditions remain constant" in complex and interconnected systems, difficulties of empirical validation, and the limitations of Friedman's instrumentalism - demonstrate that achieving this balance is difficult within the framework of traditional, a priori *ceteris paribus* assumptions.

Importantly, these limitations are structural rather than accidental. They arise from the inherent complexity of real economic systems, as well as from the bounded rationality, behavioral heterogeneity, and systematic deviations from the standard rationality assumption of economic agents. Therefore, addressing these challenges does not require rejecting the *ceteris paribus* principle itself, but rather reconsidering its methodological status: moving from an artificial, a priori assumption that "other factors" remain unchanged toward an empirically grounded, data-driven assessment of which factors can realistically be controlled or isolated. This transformation increases the importance of Big Data and machine learning methods, which enable the analysis of economic processes within multidimensional and dynamic environments while reducing excessive dependence on predetermined *ceteris paribus* assumptions.

Accordingly, the limitations identified in this paper point toward two interconnected directions for future research. The first concerns the dialectical, data-driven reinterpretation of the *ceteris paribus* principle in the era of Big Data, in which the relationship between abstraction and empirical reality is understood not as an antagonistic opposition but as a dynamic interaction. The second involves the development of a quantitative instrument for assessing the validity of this assumption - the Ceteris Paribus Validity Coefficient (CPV) - which transforms the qualitatively identified limitations

discussed in this paper (OVB, contextual stability, and model specification completeness) into measurable and operational indicators. Both directions represent logical extensions of the methodological framework developed in this study.

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