

Academic Publishing Incentive Structures and Authorship Behaviors: A Game-Theoretic Model

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Abstract. This study examines how incentive structures in academic publishing shape authorship practices in contemporary performance-oriented academic systems. Growing reliance on publication counts, citation metrics, journal rankings, and authorship positions has made academic authorship a strategic mechanism for allocating institutional rewards. In this context, practices such as reciprocal authorship, honorary authorship, guest authorship, and strategically motivated collaboration have become increasingly visible in scholarly publishing. Drawing on rational choice theory and non-cooperative game theory, the study develops a theoretical model that conceptualizes academic authorship as a strategic interaction shaped by publication pressure, incomplete information, asymmetric monitoring, contribution costs, ethical risks, and reputational incentives. Rather than assuming that academics are purely economically motivated actors, the model treats rational choice as a stylized analytical framework for examining how institutional reward systems may alter the relative attractiveness of honest and strategic authorship practices. The model suggests that reciprocal authorship may emerge as a rational equilibrium under specific conditions, particularly when publication-related rewards are high, genuine contribution costs are substantial, monitoring mechanisms are weak, and ethical or reputational costs remain limited. At the same time, the study emphasizes that this equilibrium is conditional and may be altered by stronger transparency mechanisms, contribution disclosure systems, disciplinary norms, professional identity, and ethical enforcement. The findings suggest that problematic authorship behaviors should be understood not only as individual ethical failures but also as structurally embedded responses to institutional incentive systems. The study argues that sustainable reform requires multidimensional evaluation systems that combine contribution-based assessment, transparent disclosure, institutional accountability, and qualitative judgments of scientific quality, rather than simply replacing authorship counts with new quantitative contribution metrics.

Keywords: Academic publishing, authorship behavior, incentive structures, game theory, publication ethics.

1 Introduction

The transformation of contemporary academia into a highly competitive, metrics-driven environment has fundamentally altered the dynamics of scientific production and scholarly recognition. Over the past several decades, publication quantity, citation performance, journal impact rankings, and international indexation have become dominant indicators of academic success across universities and research institutions worldwide [1] [2] [3]. This shift has intensified the institutionalization of the “publish or perish” culture, in which researchers increasingly operate under persistent pressure to maximize measurable academic output to secure employment, promotion, funding, professional visibility, and institutional legitimacy [4][5].

Although performance-oriented evaluation systems were initially designed to stimulate scientific productivity and accountability, a growing body of literature suggests that these mechanisms may also produce unintended behavioral distortions [6] [7]. As academic reward systems become increasingly reliant on quantifiable indicators, researchers may adapt strategically to institutional incentives rather than exclusively prioritizing scientific quality,

originality, or epistemic rigor [8] [9]. In this context, authorship has emerged as one of the most contested and strategically significant dimensions of academic publishing [10].

Traditionally, authorship has been understood as a formal acknowledgment of intellectual contribution and scientific responsibility. However, the expansion of collaborative research, interdisciplinary projects, and large-scale publication networks has complicated the attribution of scholarly credit [11]. Contemporary academic publishing increasingly exhibits practices such as honorary authorship, ghost authorship, reciprocal authorship, guest authorship, and strategically motivated co-authorship arrangements that blur the line between genuine contribution and institutionalized credit exchange [12] [13]. These developments have raised significant concerns about fairness, accountability, transparency, and the integrity of scientific evaluation systems [14].

Recent scholarship has highlighted that many authorship-related problems are closely tied to institutional incentive structures rather than merely to individual ethical deficiencies [15] [16]. Studies on publication pressure, academic capitalism, research misconduct, and performance-based evaluation have consistently shown that incentive systems influence researchers' decisions regarding publication strategies, collaboration patterns, and the allocation of scholarly credit [9]. Furthermore, the growing integration of artificial intelligence into scholarly production introduces additional complexities by lowering production costs and transforming traditional assumptions about originality, contribution, and academic accountability [17] [18] [19].

Despite these important contributions, the existing literature remains limited in one important respect. Most studies examine problematic authorship from normative, ethical, descriptive, or policy-oriented perspectives, focusing primarily on authorship criteria, contribution transparency, governance mechanisms, or institutional reforms [14] [20]. While these studies acknowledge that incentive structures matter, they generally do not explain the strategic mechanisms through which individual researchers respond to those incentives when making authorship decisions. Consequently, there remains limited theoretical understanding of how problematic authorship practices can emerge as rational outcomes of strategic interaction under performance-oriented academic systems.

To address this gap, the present study develops a game-theoretic model of academic authorship behavior grounded in rational choice and incentive theories. The model conceptualizes academics as strategic actors operating under conditions of incomplete information, asymmetric monitoring, and competitive performance pressure. By explicitly modeling the interaction between publication-related rewards, contribution costs, and expected ethical or reputational sanctions, the study explains the conditions under which reciprocal and strategically motivated authorship may become individually rational despite being collectively detrimental to research integrity.

The theoretical novelty of this study does not lie in the general claim that institutional incentives influence academic behavior, as this relationship has already been well established in the literature on publication pressure, academic capitalism, and research misconduct. Rather, its contribution is to translate these broader structural insights into an authorship-specific analytical framework that formally explains problematic authorship as a strategic coordination problem. Unlike previous research, which has largely documented or evaluated these practices from ethical or policy perspectives, the proposed model identifies the strategic conditions under which reciprocal authorship constitutes a stable equilibrium. In doing so, it links publication ethics, institutional incentive theory, and non-cooperative game theory within a unified explanatory framework.

Accordingly, the study makes three principal contributions. First, it develops a microfoundational explanation of academic authorship by modeling researchers as strategically interacting actors whose decisions depend on publication rewards, contribution costs, monitoring intensity, and the anticipated behavior of others. Second, it advances the authorship literature by explaining reciprocal authorship as a rational equilibrium driven by misaligned institutional incentives, rather than as solely an individual ethical failure. Third, it demonstrates that effective policy responses require changes to the underlying incentive structure, including contribution-based evaluation systems, stronger transparency mechanisms, and improved accountability, rather than relying exclusively on ethical guidelines or individual moral responsibility.

2 Literature Review

The growing dominance of performance-based evaluation systems in academia has intensified scholarly debates about authorship practices, the recognition of contributions, and the ethical implications of publication incentives. As academic careers increasingly depend on quantifiable indicators such as publication counts, citation metrics, journal rankings, and authorship positions, the allocation of scholarly credit has become a strategically significant dimension of academic production. In this context, contemporary literature increasingly questions whether traditional authorship conventions adequately reflect genuine intellectual contribution or merely reproduce institutional hierarchies, disciplinary norms, and incentive-driven behaviors.

Recent studies have examined authorship from multiple perspectives, including contribution attribution systems, mentorship dynamics, academic governance, publication ethics, open science frameworks, and

institutional reward mechanisms. A substantial body of research argues that current authorship structures often create incentive misalignments that encourage opportunistic behavior, distort scholarly recognition, and undermine research integrity. At the same time, emerging discussions on transparency, contributorship models, and digital accountability mechanisms have introduced new theoretical and operational approaches to reform academic publishing systems.

Accordingly, the literature reviewed in this study examines how authorship conventions, institutional incentives, ethical norms, and evaluation systems interact to shape academic behavior. In particular, the reviewed studies provide important conceptual foundations for understanding authorship not merely as a technical publication practice but as a strategic, institutionally embedded mechanism for allocating academic rewards.

Brand (2013) examines the tension between conventional authorship practices and contributorship-based evaluation systems in multi-author academic publications. The study shows that author-order conventions vary widely across disciplines and that authors in intermediate positions on the author list often receive less visibility and attribution of scholarly credit. These disparities can have substantial implications for hiring, tenure decisions, promotions, and professional recognition. Brand argues that current authorship conventions often fail to accurately reflect the distribution of intellectual labor in collaborative research. Consequently, the study advocates adopting standardized contributor-role taxonomies and integrating digital identity systems such as ORCID into the infrastructure of academic publishing. These mechanisms are proposed to foster a more transparent and contribution-sensitive system of scholarly acknowledgment. From a theoretical standpoint, this approach is particularly relevant for modeling academic incentives, as it suggests moving away from simplistic author-order metrics toward multidimensional, contribution-based evaluation frameworks that better align career rewards with genuine intellectual input.

Maurer (2017) extends the authorship discussion to faculty–student collaborative environments, showing how authorship credit allocation and author order shape students' academic participation, motivation, and professional visibility. The study emphasizes that authorship decisions are influenced not only by formal ethical guidelines but also by departmental culture, mentorship practices, and institutional power dynamics. Maurer argues that ambiguity in authorship standards may create unequal recognition structures, particularly disadvantaging early-career researchers and graduate students. Consequently, the article calls for clearer, more transparent authorship guidelines to promote fairness and accountability in scholarly publishing. In the context of theoretical modeling, this work demonstrates that authorship norms are socially constructed and institutionally embedded, implying that mentorship relations and hierarchical academic structures function as endogenous determinants of authorship outcomes and incentive formation.

Joanis and Patil (2021) investigate the comparative implications of alphabetical author ordering and contribution-based ordering systems. Their analysis shows that alphabetical ordering conventions may obscure the actual distribution of intellectual contributions among collaborators, thereby distorting academic credit allocation. The study further argues that author-order conventions influence career trajectories, publication incentives, collaboration dynamics, and research quality within business academia. In particular, alphabetical systems may create strategic incentives unrelated to actual scholarly effort, potentially affecting both collaboration patterns and disciplinary evolution over time. This contribution is theoretically significant because it illustrates how institutionalized authorship conventions can either align incentives with genuine scientific contribution or generate systematic misalignments between productivity metrics and intellectual labor.

Pruschak and Hopp (2022) situate the authorship debate within a broader framework of academic ethics and governance by documenting the prevalence of ghost and honorary authorship across scientific disciplines. Their study argues that ambiguities in existing authorship criteria contribute to the persistence of unethical credit allocation practices. To address these concerns, the authors advocate revising authorship guidelines to establish more precise contribution criteria and to increase awareness through ethics education and institutional training programs. A central emphasis is placed on mandatory contribution disclosure mechanisms as tools for reducing authorship manipulation and strengthening accountability in scientific publishing. According to the authors, transparent reporting of individual contributions can improve the validity of academic evaluation systems and reduce opportunities for strategic inflation of scholarly credit. In theoretical terms, the study introduces an important normative dimension to incentive design by highlighting the regulatory role of transparency and formal disclosure mechanisms in constraining opportunistic behavior.

Chen et al. (2023) propose a comprehensive open science framework to quantify scholarly contributions and reduce authorship disputes, credit inflation, and accountability problems. The framework advocates equal-sharing principles, transparent contribution coefficients, preregistration systems, and traceable contribution records to deter guest authorship and scientific misconduct. The authors argue that quantifying contributions can improve fairness and transparency in collaborative research by making intellectual labor more observable and verifiable. At the same time, the study acknowledges potential limitations of excessive quantification, including junior researchers' vulnerability to coercive evaluation processes and the risk of overreliance on numerical contribution indicators. Nevertheless, the framework provides an important operational and normative blueprint for

restructuring academic incentive systems around transparency, accountability, and verifiability. From a game-theoretical perspective, the study is particularly relevant because it shows how institutional transparency mechanisms may alter payoff structures and reduce the strategic appeal of opportunistic authorship behavior.

Bharathi and Srinivas (2024) critically examine authorship practices in academia by exploring the evolving definitions and classifications of authorship in scientific research. The authors discuss the shift from traditional single-author publications to increasingly collaborative, multi-authored works, emphasizing how contemporary research environments have complicated the attribution of scholarly credit. They identify several categories of contributors, including lead authors, co-authors, and ghost authors, and analyze the ethical and professional implications of each role. Furthermore, the study highlights concerns about fairness, accountability, and transparency in authorship allocation, particularly in interdisciplinary and large-scale research collaborations. The authors argue that unclear authorship practices may lead to disputes, exploitation, and diminished academic integrity, underscoring the need for standardized authorship criteria and ethical guidelines in scholarly publishing.

Montero (2025) critiques the contemporary concept of authorship in scientific research, arguing that it has shifted from a genuine indicator of intellectual contribution and accountability to a distorted form of institutional currency. Drawing on Goodhart's Law, the study explains that authorship positions, particularly first and last authorship, have become targets for academic evaluation and career advancement, thereby diminishing their original meaning and reliability as measures of scholarly contribution. The author further associates this phenomenon with the Matthew Effect, emphasizing how established academic prestige generates cumulative advantages that disproportionately benefit already-recognized researchers. To address these systemic inequalities, the paper advocates a transition from traditional authorship hierarchies toward a quantified, auditable contributorship model. Such a system would replace symbolic byline positions with verifiable numerical assessments of individual contributions, increasing transparency, accountability, and fairness in academic publishing. Ultimately, the study argues that reforming institutional reward mechanisms to prioritize research quality and verified contributions over publication counts is essential for preserving the integrity of scholarly recognition.

Sabolić (2026) critically examines systemic challenges in academic publishing, focusing on the erosion of research integrity driven by perverse incentives, excessive authorship practices, and problematic publication models. The study argues that contemporary academic systems increasingly prioritize quantitative performance indicators, such as citation rankings and publication counts, over the substantive quality and societal relevance of research. In particular, the author highlights the rise of hyperprolific authorship and artificially constructed research topics as consequences of institutional pressures tied to academic evaluation metrics. The paper also discusses ethical and financial concerns surrounding open-access publishing models, emphasizing how these systems may contribute to the inefficient use of public research funds. Furthermore, the study critiques citation-based ranking systems, including highly influential global rankings, for reinforcing distorted academic behaviors and encouraging strategic rather than meaningful scholarly production. To address these issues, Sabolić advocates comprehensive structural reforms, including more holistic evaluation frameworks that prioritize research quality, transparency, social contribution, and ethical responsibility. Ultimately, the article calls for a reorientation of academic publishing toward its fundamental mission of advancing knowledge and serving societal needs.

Taken together, the existing literature shows that authorship practices are deeply intertwined with institutional incentives, academic hierarchies, and evolving systems of scholarly evaluation. Previous studies have extensively examined issues such as ghost authorship, honorary authorship, contribution transparency, author-order conventions, and the growing inadequacy of traditional authorship models in collaborative research environments. Moreover, recent scholarship has increasingly emphasized the need for contribution-based evaluation frameworks, standardized disclosure mechanisms, and transparent accountability systems to address distortions in academic credit allocation.

Despite these important contributions, literature remains fragmented in several respects. First, much of the existing research approaches authorship primarily from ethical, administrative, or policy-oriented perspectives, while relatively little attention has been devoted to modeling authorship behavior as a strategic interaction shaped by institutional incentives. Second, although prior studies acknowledge incentive distortions, few provide a formal theoretical framework that explains why ethically problematic authorship practices may emerge as rational outcomes within contemporary academic systems. Third, the interaction among publication pressure, strategic behavior, institutional reward structures, and contribution-based evaluation mechanisms has not been sufficiently integrated into a unified game-theoretical perspective.

Therefore, this study seeks to address this gap by developing a theoretical model that conceptualizes academic authorship behavior as a strategic decision-making process shaped by incentive asymmetries, incomplete information, and institutional performance pressures. By integrating insights from authorship ethics, incentive theory, and game theory, the study aims to explain how current academic reward systems may unintentionally encourage reciprocal and strategically motivated authorship practices, even in environments that formally emphasize scientific integrity and ethical standards.

3 Theoretical Model

3.1 Structural Framework of the Model

Contemporary academic publishing systems increasingly operate under performance-oriented evaluation regimes in which publication quantity, citation metrics, journal rankings, and international indexation are the primary determinants of academic success. The institutionalization of these quantitative evaluation mechanisms has transformed academic production from a purely knowledge-oriented activity into a strategically incentivized, competitive process. Recent scholarship has emphasized that the current architecture of academic publishing creates substantial incentive distortions between scientific quality and measurable academic output [3]. In parallel, Hyland (2023) conceptualizes modern academia as an “attention economy,” in which visibility, citation accumulation, and reputational competition increasingly dominate scholarly communication.

In this context, academic authorship behaviors can no longer be interpreted solely through ethical or normative frameworks; rather, they must be analyzed as strategic responses to institutional incentive structures. This study therefore develops a game-theoretic framework that conceptualizes academics as rational, utility-maximizing actors operating under competitive pressure, incomplete information, and asymmetric monitoring.

The model should be understood as a stylized theoretical framework rather than a complete representation of all real-world authorship practices. Authorship decisions are shaped by multiple contextual factors, including mentorship relationships, disciplinary traditions, hierarchical power structures, institutional expectations, collaborative norms, and career-stage differences. The purpose of the model is not to reduce this complexity to reciprocal authorship alone, but to analytically isolate one specific mechanism through which performance-oriented incentive structures may encourage strategic authorship exchange.

The model consists of two representative academics, denoted as *A* and *B*, each of whom selects between two alternative authorship strategies:

- a. *H* (Honest Authorship)
Claiming authorship exclusively in cases involving genuine intellectual contribution;
- b. *R* (Reciprocal Authorship)
Participating in reciprocal or strategic co-authorship arrangements independent of actual contribution levels.

These strategies reflect the growing divergence between formal authorship norms and practical publication incentives in contemporary academia. In systems where promotion, funding access, and institutional prestige are strongly tied to publication counts, reciprocal authorship networks may emerge as rational, adaptive mechanisms rather than isolated ethical deviations.

In this framework, reciprocal authorship is treated as an illustrative case of broader incentive-driven authorship behavior. Other authorship problems, such as honorary authorship, guest authorship, coercive authorship, and strategically motivated co-authorship, may emerge through different social and institutional pathways. For example, mentorship relationships may generate legitimate forms of co-authorship when senior academics provide substantial intellectual guidance, but they may also create ambiguity or pressure when hierarchical dependency influences authorship allocation. Similarly, disciplinary traditions may normalize different author-order conventions, while institutional expectations may intensify the pressure to increase publication output.

Empirical evidence increasingly supports this interpretation. Ramassa et al. (2024) demonstrate that publication pressure significantly affects not only publication behavior but also researchers' topic selection, encouraging strategically advantageous research choices. Similarly, Vasen et al. (2023) argue that national academic categorization systems in Latin America have transformed researchers into metric-oriented productivity actors, thereby intensifying competitive publication behavior.

The model's theoretical foundation rests on non-cooperative game theory. Classical game theory shows that individually rational strategies can produce collectively suboptimal outcomes when actors interact under incentive asymmetries [21]. In academic publishing systems, authorship decisions inherently involve strategic interdependence because the utility of one actor's strategy depends on the anticipated behavior of others.

Recent developments in incomplete-information game theory further strengthen the analytical relevance of this framework. Ren et al. (2023) show that actors operating under informational uncertainty adapt toward strategies that maximize long-run payoffs, even under imperfect monitoring. Similarly, Wang et al. (2023) demonstrate that imitation dynamics in incomplete-information environments can stabilize opportunistic equilibria through repeated interaction.

Academic publishing environments exhibit precisely these characteristics. Genuine intellectual contribution is difficult to assess externally, peer-review systems often fail to fully detect authorship inflation, and institutional monitoring mechanisms remain imperfect. Consequently, strategic authorship arrangements may persist because the expected reputational or ethical costs remain relatively low compared with publication-related gains.

Furthermore, power asymmetries within academia intensify these dynamics. Goddixen et al. (2023), examining European PhD students' experiences, find that hierarchical pressures significantly contribute to guest

authorship practices. Their findings suggest that unethical authorship behaviors cannot be fully explained by individual morality alone; rather, institutional dependency structures systematically shape strategic academic behavior.

Therefore, the model does not claim that all authorship decisions are symmetric, voluntary, or purely reciprocal. Rather, it provides a simplified analytical structure for explaining how strategic authorship behavior may become rational under conditions of publication pressure, weak monitoring, and reward systems that privilege measurable output. This simplification is theoretically useful because it clarifies the incentive mechanism at work, while also allowing future research to extend the model by incorporating hierarchy, mentorship, disciplinary variation, multi-actor collaboration networks, and institutional heterogeneity.

Accordingly, the present model conceptualizes academic authorship as a strategic interaction problem in which rational actors navigate tensions between ethical norms and performance-based reward systems. When publication output is the dominant criterion for academic advancement, reciprocal authorship emerges not necessarily as irrational misconduct but as a structurally incentivized equilibrium behavior.

3.2 Utility Function

The model assumes that each academic seeks to maximize total academic utility, subject to institutional constraints and reputational considerations. Individual utility is defined as follows:

$$U_i = \alpha P_i - \beta C_i - \gamma E_i$$

Where:

- P_i denotes publication-related benefits, including promotion opportunities, citation accumulation, academic visibility, funding access, and institutional prestige;
- C_i represents the real contribution cost associated with conducting scientific research, including time investment, intellectual labor, data collection, methodological rigor, and writing effort;
- E_i captures ethical and reputational costs, such as detection risk, credibility loss, institutional sanctions, and long-term reputational damage;
- α , β , and γ represent the relative weights attached to these components.

The specification reflects the central assumptions of rational choice theory: individuals allocate behavior strategically in response to reward structures and expected costs. As institutional systems increasingly prioritize measurable output indicators, the marginal utility of publication-related gains (αP_i) rises substantially. Conversely, where monitoring mechanisms remain weak or symbolic, the expected ethical penalty term (γE_i) remains relatively small.

It is important to clarify that the rational choice assumption employed in this model should not be interpreted as a claim that academics are purely economically motivated, morally indifferent, or uniformly opportunistic actors. Rather, rational choice is used here as an analytical simplification to examine how institutional incentive structures shape the relative attractiveness of different authorship strategies under conditions of publication pressure, incomplete information, and imperfect monitoring.

Academic behavior is undoubtedly shaped by professional identity, disciplinary culture, intrinsic motivation, altruism, collegial norms, and normative commitments to scientific integrity. These factors may increase the subjective value of honest authorship and raise the psychological or reputational cost of engaging in problematic authorship practices. Therefore, the model does not deny the importance of non-economic motivations; instead, it isolates the incentive-based mechanism in order to explain why problematic authorship may become strategically attractive even in academic environments where ethical norms are formally recognized.

In this sense, the utility function should be understood as broader than a narrow economic payoff function. Publication-related benefits include not only material career rewards but also visibility, recognition, symbolic capital, and institutional legitimacy. Similarly, ethical and reputational costs include not only formal sanctions but also guilt, loss of professional identity, damage to collegial trust, and conflict with internalized scholarly norms. Thus, normative commitments can be incorporated into the model as part of the ethical-cost component or as an additional non-economic utility term.

A more extended version of the utility function may therefore be expressed as follows:

$$U_i = \alpha P_i - \beta C_i - \gamma E_i + \delta N_i$$

where N_i represents non-economic motivations such as intrinsic commitment to scientific integrity, professional identity, disciplinary norms, altruism, and internalized ethical values, while δ denotes the relative weight attached to these motivations. If δ is sufficiently high, honest authorship becomes more attractive because the actor derives positive utility from acting consistently with professional and ethical commitments. Conversely, when publication-related rewards are very high and monitoring remains weak, the effect of normative motivations may

be outweighed by institutional incentives favoring reciprocal or strategically motivated authorship. This extension suggests that the model does not reduce academic behavior to economic calculation alone; rather, it shows how different motivational components may interact within a broader incentive structure.

Trueblood et al. (2025) argue that current publishing systems reward productivity metrics more consistently than scientific robustness, thereby encouraging optimization behavior centered on output maximization rather than epistemic quality. Troncoso et al. (2022) similarly demonstrate that publication incentive policies within Chilean state universities directly influence academic behavioral patterns, reinforcing quantity-oriented production incentives.

Under reciprocal authorship arrangements, actors may obtain disproportionately high publication returns while minimizing real intellectual contribution costs. In formal terms:

- a. publication benefits increase ($P_i \uparrow$);
- b. contribution costs decrease ($C_i \downarrow$);
- c. perceived ethical risks remain relatively limited ($E_i \approx \text{low}$).

Consequently, reciprocal authorship becomes utility-enhancing under many institutional conditions.

However, this utility-enhancing logic is not deterministic. If non-economic motivations are strong, if disciplinary cultures strongly value genuine contribution, or if professional identity is closely tied to ethical authorship norms, the perceived utility of reciprocal authorship may decline. In such cases, honest authorship may remain preferable even when metric-based incentives encourage strategic behavior. The model therefore treats reciprocal authorship as a conditional outcome that becomes more likely when institutional rewards for publication output are high, contribution costs are substantial, monitoring is weak, and normative or intrinsic constraints are insufficient to offset these incentives.

This interpretation is further supported by the broader literature on research integrity and incentive structures. Korbmacher et al. (2023) argue that the replication crisis emerged, in part, because academic incentives systematically rewarded novel, publishable findings over reproducibility and methodological transparency. White et al. (2023) likewise document widespread questionable research practices in clinical prediction modeling, underscoring the systemic nature of incentive-induced distortions.

Technological transformations further complicate this utility structure. Carobene et al. (2024) show that artificial intelligence tools increasingly reduce the production costs of scientific writing while generating new ethical ambiguities regarding authorship, originality, and accountability. Wise et al. (2024) also note that AI-assisted academic production challenges traditional notions of scholarly integrity and contribution attribution.

Thus, the proposed utility framework captures a central structural contradiction of contemporary academia: systems designed to promote scientific productivity may simultaneously reduce the relative costs of opportunistic publication behavior while amplifying the rewards associated with visibility and output maximization. At the same time, the expanded utility specification acknowledges that academic decision-making cannot be fully explained by economic or career-related incentives alone. Professional identity, ethical commitment, disciplinary norms, and intrinsic motivation may alter the payoff structure and, under certain conditions, shift the expected outcome from reciprocal authorship toward honest authorship or mixed strategic behavior.

3.3 Strategic Interaction and Game Structure

The strategic interaction between academics *A* and *B* can be represented through the following payoff matrix:

	B: H	B: R
A: H	(2,2)	(1,3)
A: R	(3,1)	(4,4)

The structure of the model resembles a modified prisoner's dilemma in which individually rational decisions generate collectively undesirable outcomes. The central logic of the game emerges from the divergence between short-term individual incentives and long-term collective scientific welfare.

When both academics choose honest authorship (*H·H*), the scientific production process remains ethically consistent and contribution-based. Under this outcome, authorship accurately reflects intellectual labor, research integrity is preserved, and scientific credibility remains relatively strong. However, the total publication output generated under this strategy is comparatively limited because both actors must fully bear the costs associated with genuine scientific contribution, including data collection, methodological rigor, theoretical development, analysis, and writing effort.

By contrast, reciprocal authorship (*R·R*) allows both actors to increase publication counts while reducing the effective contribution burden associated with each publication. In this equilibrium, academics strategically exchange authorship positions across multiple studies, thereby maximizing curriculum vitae expansion, citation potential, institutional visibility, and promotion opportunities with lower marginal effort. Although such

arrangements may weaken the epistemic reliability of scientific production, they remain individually rational because academic reward systems disproportionately value measurable outputs.

The asymmetry becomes particularly visible in unilateral strategy combinations. If one academic adopts honest authorship while the opposing actor chooses reciprocal authorship ($H \cdot R$), the honest actor experiences a structural disadvantage. The honest academic continues to bear the full costs of legitimate research production while simultaneously remaining outside strategic publication networks that artificially increase output volume. Consequently, the reciprocal authorship actor achieves higher visibility and publication accumulation despite lower effective contribution levels.

This outcome reflects a broader structural contradiction within contemporary academia. Scientific institutions formally promote ethical norms for authorship while simultaneously rewarding publication quantity, citation counts, and productivity metrics. As a result, actors who adhere strictly to contribution-based authorship may be competitively disadvantaged in metric-oriented evaluation systems.

The game therefore shows that unethical authorship practices do not necessarily stem from individual immorality alone. Rather, they can arise endogenously from institutional incentive structures that reward output maximization more strongly than epistemic quality or ethical consistency. In this sense, reciprocal authorship becomes a strategically adaptive response to systemic pressures rather than merely an isolated ethical deviation.

These dynamics are strongly supported by recent empirical literature. Morton et al. (2022) argue that authorship allocation in international research collaborations often reflects institutional hierarchy and geopolitical power asymmetries rather than actual intellectual contribution. Their findings suggest that authorship practices are deeply embedded within broader structures of academic inequality and resource dependency.

Goddiksen et al. (2023) further reveal that many doctoral researchers face direct or indirect pressure to include senior academics as authors despite limited contributions. Their findings indicate that authorship inflation often arises from hierarchical dependencies, in which junior scholars strategically comply with institutional power structures to secure future career opportunities.

From a game-theoretical perspective, these hierarchical relations introduce asymmetric bargaining power into the strategic interaction. Actors with institutional authority, reputational capital, or editorial influence may exert indirect pressure on authorship allocation decisions, thereby altering payoff expectations for other participants. Consequently, the academic publication game cannot be understood purely as a symmetric interaction among equal actors; instead, it often involves structurally unequal strategic environments.

The increasing integration of artificial intelligence technologies into scientific publishing further complicates these interactions. Alvero et al. (2024) argue that large language models increasingly blur distinctions between human-generated and machine-assisted scholarly production. This transformation destabilizes conventional assumptions regarding originality, intellectual contribution, and authorship legitimacy.

Likewise, Wise et al. (2024) emphasize that AI-supported writing systems fundamentally challenge traditional definitions of academic integrity and contribution attribution. When technological systems substantially reduce writing costs, the relationship between effort, contribution, and publication output becomes increasingly distorted. In game-theoretical terms, artificial intelligence lowers the marginal cost of publication production while potentially increasing the strategic attractiveness of reciprocal authorship arrangements.

Another important dimension concerns imperfect monitoring and incomplete information. Academic institutions often lack the capacity to fully verify the actual contribution level of each listed author. Peer reviewers typically evaluate the scientific content of manuscripts rather than the authenticity of contribution distribution among co-authors. This informational asymmetry significantly reduces the expected probability of detection for reciprocal authorship arrangements.

Incomplete-information game theory provides an important analytical framework for understanding this problem. Ren et al. (2023) demonstrate that under informational uncertainty, actors rationally gravitate toward strategies that produce higher expected payoffs, even when those strategies generate collectively inefficient outcomes. Similarly, Wang et al. (2023) show that imitation dynamics within networked systems can stabilize opportunistic equilibria through repeated strategic interaction.

Applied to academia, these findings imply that reciprocal authorship practices may spread through institutional imitation mechanisms. As academics observe that strategically networked actors obtain promotions, funding, visibility, and publication success more rapidly, reciprocal authorship behaviors may gradually become normalized within academic culture itself. This normalization process reduces the perceived ethical cost associated with such practices and further stabilizes the equilibrium.

Moreover, repeated interaction effects intensify incentives for strategic coordination. Academic communities are not composed of isolated one-time interactions; rather, researchers repeatedly collaborate across projects, conferences, journals, and institutional networks. In repeated-game environments, reciprocal arrangements become easier to sustain because long-term cooperation among strategically aligned actors increases expected cumulative benefits.

This dynamic resembles collusive equilibria frequently discussed in industrial organization and repeated-game theory. Although reciprocal authorship may remain formally unethical, repeated interaction structures reduce incentives for defection because exclusion from collaborative publication networks may impose substantial long-term career costs.

The model therefore illustrates that academic authorship behavior increasingly operates as a strategic coordination mechanism shaped by:

- a. institutional publication incentives,
- b. citation-oriented evaluation systems,
- c. asymmetric monitoring structures,
- d. hierarchical academic power relations,
- e. repeated interaction dynamics,
- f. visibility competition within the attention economy,
- g. and technological transformations associated with artificial intelligence.

Consequently, authorship practices cannot be adequately explained through purely normative or individual-level ethical frameworks. Instead, they should be understood as equilibrium behaviors emerging from structurally embedded incentive systems within contemporary academic capitalism.

3.4 Equilibrium Analysis

Within the proposed framework, reciprocal authorship (K) constitutes the dominant strategy for both players because it generates higher expected utility regardless of the opponent's action. The Nash equilibrium therefore emerges as:

$$(K, K)$$

This equilibrium illustrates a fundamental contradiction between individual rationality and collective scientific welfare. Although reciprocal authorship may maximize short-term individual utility, widespread adoption erodes the integrity, reliability, and credibility of scientific production systems over time.

However, this equilibrium should not be interpreted as unconditional or universally applicable across all academic contexts. Its emergence depends on the relative magnitude of publication-related rewards, contribution costs, and expected ethical or reputational penalties. In particular, the model is sensitive to the intensity of ethical enforcement and reputational accountability. When ethical enforcement is weak, contribution verification is limited, and the probability of detection is low, the expected ethical-cost term remains small. Under such conditions, reciprocal authorship becomes more attractive because publication-related benefits outweigh the expected ethical and reputational costs.

Monitoring and transparency mechanisms play a crucial role in altering the equilibrium conditions of the model. The assumption of incomplete information does not imply the complete absence of monitoring; rather, it suggests that actual intellectual contribution is only imperfectly observable to external evaluators, editors, institutions, and readers. Mechanisms such as ORCID integration, standardized contributor-role taxonomies, mandatory contribution disclosure statements, preregistration, open data, open peer review, and other open science practices reduce this information asymmetry by making individual roles, research processes, and contribution claims more visible and traceable [10] [14] [20].

In game-theoretical terms, these mechanisms alter the payoff structure by increasing the probability that authorship inflation or reciprocal authorship will be detected. ORCID strengthens researcher identification and makes publication patterns more traceable across institutions and journals, while contributor-role taxonomies and contribution disclosure statements make it more difficult for authorship credit to remain purely symbolic because each author's role must be specified [10] [20]. Open science practices further increase transparency by allowing research inputs, data, protocols, and outputs to be evaluated more directly, thereby supporting more verifiable contribution records [14]. Together, these mechanisms increase the expected ethical and reputational cost associated with strategic authorship manipulation.

Knöchelmann (2024) argues that “publish or perish” narratives increasingly shape formal authorship identities within the humanities, generating pressure toward metric-oriented productivity behavior. Addaquay (2026) similarly demonstrates that global knowledge production systems embed unequal incentive architectures that systematically influence scholarly choices.

The equilibrium structure also reflects broader institutional incentive dynamics identified in public goods and collective action literature. Flores and Han (2024) show that institutional incentives significantly influence cooperative equilibrium formation in public goods environments. Analogously, academic publishing systems may unintentionally stabilize ethically problematic equilibria when publication metrics dominate evaluation mechanisms.

At the same time, stronger monitoring may alter the payoff structure of the game. Mandatory contribution disclosures, transparent author-role taxonomies, active institutional monitoring, editorial sanctions, and

reputational consequences increase the expected value of ethical and reputational costs. As this cost rises, the utility advantage of reciprocal authorship declines. In formal terms, reciprocal authorship remains attractive only when expected publication-related benefits exceed the combined costs associated with ethical risk, reputational damage, and potential institutional sanction. If the ethical-cost component becomes sufficiently large, honest authorship may become the more rational strategy, and the equilibrium may shift from reciprocal authorship toward honest authorship or mixed strategic outcomes.

Therefore, the model does not imply that reciprocal authorship will necessarily emerge in every academic setting. Rather, it predicts that reciprocal authorship is most likely in systems where publication rewards are high, contribution costs are substantial, monitoring is weak, and ethical enforcement is inconsistent. Conversely, stronger enforcement, transparent contribution verification, and higher reputational accountability can reduce the attractiveness of reciprocal authorship and support more honest authorship practices.

From this perspective, unethical authorship practices should not be interpreted merely as isolated deviations from academic norms. Rather, they emerge as predictable equilibrium outcomes generated by structurally misaligned institutional incentives.

This sensitivity analysis also clarifies the policy relevance of the model. If problematic authorship is partly sustained by low expected ethical costs and limited observability of individual contributions, then reforms should not focus only on moral exhortation or general ethical awareness. They should also increase the traceability of publication behavior, strengthen contribution verification, and raise the expected reputational and professional costs of authorship manipulation. By changing the payoff structure itself, mechanisms such as ORCID, contributor-role taxonomies, contribution disclosure statements, and open science practices may destabilize reciprocal authorship as an equilibrium and make honest authorship more strategically viable [10] [14] [20]. However, their effect remains limited if they are implemented only symbolically and are not connected to editorial decisions, institutional evaluation, promotion criteria, or reputational accountability.

3.5 Interpretation of the Model and Broader Implications

The theoretical model developed in this study suggests that many contemporary academic integrity problems are systemic rather than purely individual in origin. Existing incentive systems shape academic behavior by rewarding visibility, productivity, and measurable output more strongly than epistemic rigor or ethical consistency.

Liu et al. (2023) emphasize that data infrastructures, measurement systems, and evaluative metrics are increasingly shaping scientific conduct. Likewise, White et al. (2023) document the emergence of questionable research practices in environments marked by excessive performance pressure and inadequate oversight.

The expansion of attention-based academic competition further intensifies these dynamics. Hyland (2023) argues that academic communication increasingly operates according to visibility logics in which citation accumulation and reputational competition become central determinants of scholarly success. Under such conditions, publication quantity may gradually substitute for substantive scientific contribution.

Moreover, the rapid integration of artificial intelligence into academic publishing introduces additional structural challenges. Carobene et al. (2024) note that AI technologies reduce production costs while complicating accountability structures surrounding authorship and originality. Wise et al. (2024) similarly argue that AI-driven academic production necessitates a fundamental reconsideration of integrity, authorship, and scholarly responsibility.

At the same time, the model should not be interpreted as suggesting that academic behavior is determined exclusively by economic incentives or career-oriented calculations. Academic authorship decisions are also shaped by professional identity, disciplinary culture, intrinsic motivation, altruism, collegial norms, and internalized commitments to scientific integrity. These non-economic motivations may increase the attractiveness of honest authorship and reduce the likelihood of strategic authorship exchange, particularly in academic environments where genuine contribution, transparency, and ethical responsibility are strongly valued.

Incorporating such motivations into the model would make the emergence of reciprocal authorship conditional rather than automatic. Strong professional identity, internalized ethical norms, altruistic commitments, or disciplinary cultures that strongly emphasize genuine contribution may increase the payoff associated with honest authorship and reduce the attractiveness of reciprocal authorship. Under such conditions, the expected outcome may shift from reciprocal authorship toward honest authorship or mixed strategic behavior. However, where publication pressure is intense, monitoring is weak, and institutional rewards remain strongly tied to publication quantity, non-economic motivations may be insufficient to prevent the stabilization of problematic authorship practices.

The model's broader implication is therefore institutional rather than purely ethical. As long as academic systems disproportionately reward quantitative productivity metrics, strategic publication behaviors, such as reciprocal authorship, are likely to remain rational equilibrium outcomes. Sustainable reform consequently

requires not only stronger ethical awareness among researchers but also a structural redesign of academic incentive architectures.

This means that ethical culture and professional identity remain important, but their effectiveness depends on whether institutional incentive structures support or undermine them. If evaluation systems reward genuine contribution, transparency, research quality, and accountability, non-economic motivations may reinforce honest authorship practices. Conversely, if academic reward systems continue to prioritize publication counts, citation accumulation, and symbolic productivity, even ethically committed researchers may face structural pressures that make strategic authorship behavior more attractive. Therefore, sustainable reform requires aligning institutional incentives with the professional and normative values that academia formally endorses.

4 Conclusion

This study has examined the relationship between academic publishing incentive structures and authorship behaviors using a game-theoretic, incentive-based analytical framework. By conceptualizing academics as rational actors operating under publication pressure, incomplete information, asymmetric monitoring, and institutional competition, the study demonstrates that strategically motivated authorship practices may emerge not as isolated ethical deviations but as predictable outcomes of contemporary academic reward systems.

The findings indicate that the growing dominance of quantitative evaluation mechanisms—including publication counts, citation metrics, journal rankings, and authorship positions—has transformed authorship into a form of institutional currency within academic capitalism. Under these conditions, reciprocal authorship arrangements may be individually rational because they maximize visibility, productivity indicators, and career-related rewards while minimizing the effective costs of genuine scientific contribution. Consequently, a structural divergence emerges between individually rational behavior and collectively desirable scientific outcomes.

The theoretical model further illustrates that ethical authorship practices become increasingly difficult to sustain in systems that reward measurable productivity more consistently than epistemic quality, transparency, or reproducibility. In particular, weak monitoring mechanisms, hierarchical academic dependencies, repeated interaction dynamics, and strategic publication networks contribute to the normalization and institutional stabilization of reciprocal authorship practices. The integration of artificial intelligence technologies into academic production further intensifies these dynamics by reducing publication costs and complicating conventional definitions of intellectual contribution and accountability.

Importantly, the study suggests that many contemporary authorship-related ethical problems should be understood as systemic rather than purely individual. While individual ethical responsibility remains important, focusing exclusively on personal morality risks obscuring the structural incentive configurations that generate opportunistic behavior. In this sense, unethical authorship practices are not merely the result of moral failure; they are also products of institutional environments that reward output maximization and symbolic productivity.

The broader implication of the study is that sustainable reform in academic publishing requires a fundamental reconsideration of institutional evaluation systems. Policies focused solely on ethical guidelines or misconduct sanctions may remain insufficient unless paired with structural changes to academia's incentive architecture. Contribution-based evaluation models, transparent disclosure mechanisms, standardized contributorship taxonomies, stronger accountability systems, and multidimensional assessment frameworks may help reduce distortions associated with traditional authorship practices. Likewise, shifting institutional priorities from publication quantity to scientific quality, reproducibility, transparency, and societal contribution may help restore the epistemic integrity of scholarly communication.

However, contribution-based evaluation systems should not be understood as a complete solution that automatically eliminates strategic behavior. A central risk is that contribution reporting itself may become subject to the same incentive distortions that affect traditional authorship metrics. If contribution statements are converted into rigid quantitative scores or used mechanically in promotion and funding decisions, researchers may strategically exaggerate, fragment, or negotiate their reported contributions in order to maximize evaluative advantage. In this sense, contribution-based evaluation may also become vulnerable to Goodhart-type dynamics, where a measure loses its validity once it becomes a target of evaluation.

Therefore, the reform implication of the model is not merely to replace authorship counts with contribution counts. Rather, contribution-based evaluation must be designed as a transparency and accountability mechanism embedded within broader qualitative and institutional review processes. To reduce opportunistic adaptation, contribution reports should be combined with standardized author-role taxonomies, narrative contribution statements, editorial verification, institutional audit mechanisms, and, where appropriate, supporting evidence such as preregistration records, data-management logs, methodological documentation, project protocols, or open science materials.

From an institutional perspective, the most feasible reforms are those that can be implemented incrementally by universities, publishers, funding agencies, and evaluation bodies without requiring a complete redesign of the

academic reward system. Universities can revise promotion and tenure criteria by reducing the mechanical weight of publication counts and by requiring documented evidence of individual contribution, research quality, methodological rigor, mentoring responsibility, and openness. Such reforms would reduce the publication-related benefit of symbolic authorship and increase the value of demonstrable scholarly labor.

Publishers and journals can contribute by making contribution disclosure statements mandatory, adopting standardized author-role taxonomies such as CRediT, requiring authorship confirmation from all listed authors, and linking author contributions to editorial accountability. These mechanisms would increase the observability of individual contributions and raise the expected reputational cost of authorship manipulation. Funding agencies can further alter the payoff structure by evaluating applicants through project quality, openness, reproducibility, data-sharing practices, and documented team contributions rather than relying predominantly on publication volume or journal prestige.

Ranking systems and national evaluation bodies are more difficult to reform because they often depend on standardized and comparable indicators. Nevertheless, even partial changes may be feasible. For example, ranking and assessment systems could reduce excessive reliance on raw publication counts, incorporate responsible research assessment principles, and reward transparency, open data, reproducibility, and verified contribution practices. These changes would not eliminate strategic behavior entirely, but they would weaken the incentive to accumulate symbolic authorship credit and strengthen the incentive to produce verifiable, high-quality scholarly contributions.

In terms of the model, these reforms alter the payoff structure in three ways. First, they reduce the relative publication benefit associated with reciprocal authorship by lowering the evaluative value of mere byline accumulation. Second, they increase the expected ethical and reputational cost of contribution-free authorship by making authorship claims more visible and verifiable. Third, they increase the utility of honest authorship by rewarding genuine contribution, transparency, and research quality. Therefore, feasible institutional reform does not depend on a single universal policy, but on coordinated changes that reduce the rewards of symbolic productivity and increase the benefits of accountable scholarly contribution.

Nevertheless, the present study has several limitations. First, the proposed model is theoretical in nature and does not empirically test whether reciprocal authorship functions as a rational equilibrium in specific academic contexts. Therefore, the equilibrium logic developed in this study should be interpreted as a theoretically derived possibility rather than as an empirically demonstrated fact. Future research may extend the analysis through empirical investigations, experimental designs, bibliometric modeling, or longitudinal studies that examine the relationship between institutional incentives and authorship behavior across disciplines and national academic systems.

Empirical validation of the model would require multiple forms of evidence. Future studies could use survey data to examine researchers' perceptions of publication pressure, expected career rewards, monitoring intensity, reputational risks, and willingness to engage in reciprocal or strategically motivated authorship. Bibliometric and co-authorship network analyses could also identify patterns consistent with strategic reciprocity, such as repeated co-authorship among closed groups, reciprocal author-order arrangements, dense publication clusters, or unusually high publication productivity relative to observable contribution capacity. In addition, contribution disclosure records, CRediT-based author-role taxonomies, institutional promotion criteria, and qualitative interviews with researchers, doctoral students, editors, and academic administrators could provide stronger evidence regarding how authorship decisions are shaped in practice.

Second, the model simplifies the complexity of real-world authorship dynamics. Authorship decisions are not always made among equal and independent actors; they often occur within mentorship relationships, research teams, disciplinary traditions, hierarchical academic structures, and institutional cultures. Seniority, supervision, resource dependency, laboratory organization, journal conventions, and national evaluation systems may all shape authorship allocation. Therefore, the two-actor reciprocal authorship framework should be interpreted as a stylized model that isolates one strategic mechanism rather than as a comprehensive account of all authorship practices. Future research may extend the model by introducing asymmetric power relations, multi-actor collaboration networks, disciplinary differences, mentorship structures, and institutional-level constraints into the game structure.

Third, another limitation concerns disciplinary variation. Authorship conventions differ significantly across academic fields, and the model does not claim that reciprocal authorship operates in the same way in medicine, physics, engineering, social sciences, and humanities. Rather, the framework should be understood as a general strategic model whose parameters vary across disciplinary contexts. Publication-related rewards, contribution costs, monitoring intensity, reputational risks, author-order conventions, collaboration norms, and ethical expectations may all differ across fields. For example, biomedical sciences may rely more heavily on contribution disclosure requirements and journal-level authorship policies, whereas humanities disciplines may attach greater value to single-authored work. Similarly, physics and engineering may involve large-scale collaborative publication norms that alter the meaning of individual authorship credit. Therefore, the model is generalizable at

the level of strategic logic, not at the level of identical disciplinary authorship conventions. Future research should test the model separately across fields with different collaboration norms, author-order traditions, contribution disclosure practices, and evaluation criteria. Comparative disciplinary studies would help determine where the model's predictions are strongest, where they require modification, and how authorship incentives operate under different scholarly cultures.

Fourth, although the model emphasizes rational choice and incentive-based behavior, academic authorship decisions are also shaped by professional identity, intrinsic motivation, disciplinary culture, altruism, collegial norms, and internalized commitments to scientific integrity. These non-economic motivations may alter the payoff structure and, under certain conditions, shift authorship behavior away from reciprocal authorship toward honest authorship or mixed strategic outcomes. Future studies should therefore examine how institutional incentives interact with ethical culture, professional identity, and disciplinary norms in shaping authorship behavior.

Additionally, future studies may further explore the implications of artificial intelligence-assisted publishing, algorithmic evaluation systems, and digital contributorship infrastructures for the evolution of academic reward mechanisms. As AI technologies reduce some production costs and complicate the attribution of intellectual contribution, empirical research will be needed to determine whether these tools intensify authorship inflation, reshape contribution expectations, or support more transparent forms of authorship accountability.

In conclusion, the study argues that authorship behavior in contemporary academia cannot be adequately understood through purely ethical or normative perspectives alone. Rather, authorship practices increasingly reflect strategic responses to institutional incentive systems embedded in competitive academic environments. However, this argument should not be read as a claim that reciprocal authorship has been empirically proven to operate as a universal equilibrium. Instead, the model offers a testable theoretical explanation of how such an equilibrium may emerge under specific conditions: intense publication pressure, high publication-related rewards, weak monitoring, limited contribution transparency, and insufficient alignment between institutional incentives and scholarly norms. Addressing the growing challenges surrounding academic integrity therefore requires not only stronger ethical awareness among researchers but also a structural transformation of the incentive systems that govern scientific production.

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