JOURNAL OF ECONOMICS AND BEHAVIORAL STUDIES

Vol. 17 No. 4 ISSN 2220-6140

Editorial

Journal of Economics and Behavioral Studies (JEBS) provides a distinct avenue for quality research in the ever-changing fields of economics & behavioral studies and related disciplines. Research work submitted for publication consideration should not be limited to conceptualization of economics and behavioral developments but comprise interdisciplinary and multi-facet approaches to economics and behavioral theories and practices as well as general transformations in the fields. Scope of the JEBS includes: subjects of managerial economics, financial economics, development economics, finance, economics, financial psychology, strategic management, organizational behavior, human behavior, marketing, human resource management and behavioral finance. Author(s) should declare that work submitted to the journal is original, not under consideration for publication by another journal and that all listed authors approve its submission to JEBS. Author (s) can submit: Research Paper, Conceptual Paper, Case Studies and Book Review. Journal received research submissions related to all aspects of major themes and tracks. All submitted papers were first assessed by the editorial team for relevance and originality of the work and blindly peer-reviewed by the external reviewers, depending on the subject matter of the paper. After the rigorous peer-review process, the submitted papers were selected based on originality, significance and clarity of purpose. The current issue of JEBS comprises papers of scholars from Morocco, Uganda, Germany, Iraq and France. Commitment and Organizational Citizenship Behaviors, Performing without Pressure, Financial Risk Management and Financial Performance of Construction Companies, Property Rights and Entrepreneurship, Human Capital and Graduate Employability, Premature Mortality From Non-Communicable Diseases and Foreign Direct Investment and Exports as a Capacity to Import were some of the major practices and concepts examined in these studies. The current issue will therefore be a unique offer where scholars will be able to appreciate the latest results in their field of expertise and acquire additional knowledge in other relevant fields.

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TABLE OF CONTENTS

Description	Pages
Title	I
Editorial	II
Editorial Board	III
Table of Contents	IV
Papers	V
Continuance Commitment and Organizational Citizenship Behaviors among Moroccan University Faculty: The Mediating Role of Academic Leadership and Social Justice Hayat EL ADRAOUI	1
Financial Risk Management and Financial Performance of Construction Companies in Greater Kampala Metropolitan Area Frederick Nsambu Kijjambu, Benjamin Musiita, Sheila Akampwera	13
Performing without Pressure? The Effect of Ghost Games on Effort-based and Skill-based Tasks in the German Football Bundesliga Christoph Bühren, Dominic Jung	25
Property Rights and Entrepreneurship in the Context of Conflict: Evidence from Amuda, Northeast Syria Musallam Abedtalas, Rohat Zada, Khorshid Elika, Giwan Hamo, Abdulhaleem Sulaiman, Mohamad Ahmad	35
Human Capital and Graduate Employability in Public Universities in South- Western Uganda Alex Twinomuhwezi, Nixon Kamukama, Charles Tushabomwe-Kazooba	49
Premature Mortality From Non-Communicable Diseases in Latin America and The Caribbean: A Time-Series Analysis of Progress Toward SDG 3.4 Willy Rwamparagi Kagarura, Patrick Kagambo John Nahabwe	59
Foreign Direct Investment and Exports as A Capacity to Import Vis-À-Vis Trade Balance in Sub-Saharan Africa Patrick Kagambo John Nahabwe, Willy Rwamparagi Kagarura	75

PAPERS

Journal of Economics and Behavioral Studies (JEBS)
Vol. 17, No. 4, 2025 (ISSN: 2220-6140)

Continuance Commitment and Organizational Citizenship Behaviors among Moroccan University Faculty: The Mediating Role of Academic Leadership and Social Justice

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Abstract: University faculty members play a central role in knowledge production and student development. In Moroccan public universities, however, academic staff operate in challenging conditions characterized by limited recognition, weak academic leadership, and perceived organizational injustice. These conditions tend to foster continuance commitment, driven primarily by job security and constrained labor market opportunities, raising questions about its impact on organizational citizenship behaviors (OCB). The objective of this study is to examine the relationship between organizational commitment—particularly continuance commitment—and OCB among Moroccan university faculty members, while assessing the mediating roles of academic leadership and perceived social justice. A quantitative research design was adopted, based on survey data collected from faculty members in Moroccan public universities. The hypothesized relationships were tested using structural equation modelling. The results show that continuance commitment does not directly promote OCB. While academic leadership significantly influences perceptions of social justice, neither leadership nor social justice mediates the relationship between commitment and OCB. Citizenship behaviors appear instead to be primarily driven by normative obligations and professional responsibility rather than by managerial or governance mechanisms. Qualitative insights further reveal a strong professional focus on teaching and research, accompanied by distancing from administrative and managerial processes. These findings highlight a distinctive contextual pattern in Moroccan higher education, where OCB develops independently of leadership and justice mechanisms. The study contributes original empirical evidence from a non-Western academic context and underscores the need to rethink governance, leadership development, and human resource management practices in public universities.

Keywords: *Organizational commitment; Organizational citizenship behaviors (OCB); Leadership; Organizational justice; Higher education, Morocco*.

1. Introduction

Higher education plays a central role in the development of societies by training future generations and producing the scientific knowledge required for innovation and competitiveness. In Morocco, this sector is undergoing profound transformations marked by the growing demand for education, the massification of student enrollment, and the gradual transformation of university governance models (CSEFRS, 2021; UNESCO, 2023). However, these changes are accompanied by persistent dysfunctions, including limited financial resources, administrative burdens, and inequalities between disciplines and institutions.

Within this complex environment, faculty members are increasingly solicited beyond their traditional teaching mission. They are expected to contribute to scientific research, participate in institutional life, and assume administrative or managerial responsibilities, often under constraining working conditions. Empirical studies show that difficult work environments, limited institutional recognition, and insufficient organizational support tend to orient teachers' organizational commitment toward continuance commitment, motivated more by job stability and lack of alternatives than by affective or normative attachment (Ahsina, 2017)

At the same time, administrative positions in universities are often perceived as sources of financial compensation or career advancement rather than as opportunities for collective service and academic leadership (El Antaki, 2010; Bryman, 2007). This situation generates tensions and even intra-departmental competition, where rivalry for managerial roles undermines cooperation and weakens the emergence of organizational citizenship behaviors (OCB).

Theoretically, organizational commitment—conceptualized by Meyer and Allen (1991)—is a major determinant of OCB, defined by Organ (1988) as discretionary behaviors that promote cooperation, solidarity, and the effective functioning of organizations. Research has shown that affective commitment, fair leadership,

and perceived organizational justice enhance the expression of OCB, such as altruism, cooperation, and voluntary participation in collective activities (Podsakoff, MacKenzie, Paine, & Bachrach, 2000; Lapointe, Vandenberghe, & Panaccio, 2011; Bélanger & Paquet, 2007).

However, in Moroccan universities, academic leadership is often weakened by institutional paradoxes—such as the lack of transparency in appointments, limited evaluation culture, and the prevalence of relational or political logics. These practices tend to reduce perceptions of organizational justice (Greenberg, 1990; Colquitt, 2001) and reinforce rivalry among academics, thereby constraining altruism and cooperation.

While international studies have extensively explored the link between commitment, justice, and citizenship behaviors, research in the Moroccan higher education context remains scarce. Existing studies highlight that working conditions, professional autonomy, and recognition are key determinants of teachers' motivation and collective participation (Ahsina, 2017). These findings underline the importance of examining how commitment, leadership, and social justice interact to foster—or hinder—the development of organizational citizenship behaviors in universities.

This study adopts this perspective by proposing a conceptual framework linking the dimensions of organizational commitment, academic leadership, and social justice, while integrating internal rivalry as a contextual factor. It seeks to answer a central question: To what extent does organizational commitment influence the expression of OCB, and how do academic leadership and perceived social justice mediate this relationship within Moroccan universities?

2. Literature Review

Organizational Citizenship Behaviors (OCB) in the University Environment

Organizational citizenship behaviors (OCB) refer to discretionary and voluntary actions that are not formally rewarded but contribute to organizational effectiveness (Organ, 1988). In academic institutions, these behaviors take on a particular significance due to the centrality of professional autonomy, peer regulation, and collegial norms. Faculty OCB typically includes cooperation among colleagues, voluntary involvement in committees, mentoring of students and junior staff, and informal contributions to institutional life.

Early research in the sociology of education has emphasized that a substantial part of academic work remains invisible and weakly recognized. Tardif and Lessard (1999), for instance, underline that teaching relies heavily on informal practices of availability, emotional support, and adaptive efforts that extend well beyond contractual obligations. More recent studies confirm that such discretionary behaviors play a key role in sustaining positive work climates and reinforcing professional solidarity within educational institutions (Lapointe & Vandenberghe, 2018).

In universities, OCB also contributes to institutional legitimacy and academic vitality by supporting collective governance, collaborative research, and community engagement (Biron, Brun & Ivers, 2008). However, these behaviors remain fragile and contingent. They are largely driven by intrinsic motivation and are highly sensitive to perceptions of fairness, recognition, and leadership practices (Vigoda-Gadot, 2007). When these conditions deteriorate, faculty members may reduce their discretionary involvement, prioritizing individual strategies over collective interests. Thus, OCB constitutes a relevant indicator of organizational health in higher education, revealing the extent to which faculty members are willing to transcend formal role requirements in favor of the academic common good.

The Role of Leadership in Academic Settings

Leadership is widely recognized as a key driver of engagement and organizational citizenship behaviors (Bass, 1985). In higher education, however, leadership cannot be reduced to hierarchical authority. Universities operate within professional bureaucracies characterized by strong norms of autonomy, peer legitimacy, and plural missions encompassing teaching, research, and service activities.

Research conducted in North American contexts has shown that transformational and distributed leadership styles are particularly effective in fostering OCB in academic environments. Lapointe, Vandenberghe and

Panaccio (2011) demonstrate that faculty members who perceive their leaders as supportive, accessible, and fair are more inclined to cooperate, share knowledge, and engage beyond formal job requirements. Similarly, Bélanger and Paquet (2007) highlight the importance of inclusive leadership practices capable of reinforcing trust and procedural equity, both of which are essential conditions for discretionary behaviors.

In the Moroccan context, academic leadership faces specific structural tensions. University leaders are often former faculty members appointed through competitive or elective procedures, sometimes influenced by political or relational networks. Their role tends to emphasize external representation and institutional visibility, while internal management and human resource regulation receive comparatively less attention. Operational responsibilities are frequently delegated to academic or administrative coordinators drawn from the faculty body, who may lack formal managerial training. This configuration often limits managerial legitimacy and encourages informal authority structures.

More recent reforms have attempted to appoint leaders with managerial backgrounds external to the academic field. While this approach aims to professionalize governance, it may generate legitimacy conflicts when managerial authority clashes with academic status hierarchies. In some cases, this tension leads to resistance, disengagement, or symbolic compliance rather than genuine cooperation. Despite their differences, both configurations may produce similar outcomes: weakened trust, deteriorated work climates, and limited capacity to stimulate OCB. These dynamics underscore the importance of leadership legitimacy and managerial competence in fostering cooperation and discretionary engagement in universities.

Organizational Justice and Its Effects on OCB

Organizational justice represents a central theoretical framework for understanding discretionary behaviors at work. According to Greenberg (1990) and Colquitt (2001), employees' perceptions of distributive, procedural, and interactional justice strongly influence their willingness to invest effort beyond formal role expectations. Numerous studies have established a positive relationship between perceived fairness, organizational commitment, and OCB across sectors, including education (Biron, Brun & Ivers, 2008; Lapointe et al., 2011).

In universities, justice perceptions are closely tied to leadership practices, particularly with regard to evaluation procedures, allocation of responsibilities, and access to career opportunities. Transparent and consistent decision-making processes reinforce trust in leadership and encourage cooperative behaviors among faculty members.

In the Moroccan higher education system, however, organizational justice is often challenged by the fragility of governance structures. Despite the existence of formal regulatory frameworks, the absence of clear and operational evaluation systems leaves room for informal arrangements. Appointments to managerial roles, distribution of teaching loads, and access to resources may be perceived as opaque or influenced by favoritism. Such perceptions undermine trust and weaken the motivational foundations of OCB.

Under these conditions, faculty members may adopt defensive or competitive strategies aimed at protecting individual interests rather than engaging in altruistic and collective behaviors. In line with OCB theory (Organ, 1988), perceived injustice thus constrains discretionary involvement and contributes to organizational fragmentation. Overall, the articulation between leadership and organizational justice appears critical: contested or weak leadership undermines fairness perceptions, which in turn limits the emergence of citizenship behaviors and compromises organizational vitality in universities.

Organizational Commitment among Faculty Members

Organizational commitment remains a foundational concept for analyzing faculty work dynamics. The three-component model developed by Meyer and Allen (1991, 1997) distinguishes affective commitment (emotional attachment), normative commitment (a sense of obligation), and continuance commitment (perceived costs of leaving). This framework has been extensively mobilized in educational research to account for career stability and professional engagement (Firestone & Pennell, 1993; Bélanger, 2007). Earlier sociological perspectives also highlight the multidimensional nature of commitment, emphasizing both individual motivations and structural constraints (Becker, 1960).

In the Moroccan public university system, organizational commitment assumes a distinctive configuration. Academic positions offer high job security and very low turnover, particularly compared to other sectors of the labor market. Faculty members thus often remain in their positions not solely out of affective attachment, but because alternative academic opportunities are scarce and public employment provides stable income and social protection (El Adraoui, 2016).

Many faculty members complement their income through part-time teaching in private institutions while maintaining their public status. Others seek administrative or managerial responsibilities, which may offer additional allowances and symbolic recognition. In this context, continuance commitment tends to dominate, reflecting engagement grounded more in stability and career security than in emotional attachment (El Adraoui, 2025).

This specific pattern of commitment provides a relevant analytical lens for examining organizational citizenship behaviors in Moroccan universities, particularly when considered alongside leadership and justice perceptions. Understanding these dynamics is crucial for designing policies and practices that foster both professional engagement and cooperative behaviors in higher education institutions.

3. Methodology

Hypotheses and Research Model

This study aims to examine how the organizational commitment of Moroccan university faculty shapes the expression of organizational citizenship behaviors (OCB), while accounting for the mediating effects of academic leadership and perceived social justice within institutions. The research model is inspired by Organ's (1988) theoretical framework of OCB, enriched with attributes specific to the academic context identified in Canadian and international literature (Biron, Brun & Ivers, 2008; Lapointe, Vandenberghe & Panaccio, 2011; Bélanger & Paquet, 2007), particularly student assistance, pedagogical availability, and knowledge sharing.

The hypotheses formalize the expected relationships between organizational commitment, OCB, and the two mediating variables—leadership and social justice—while acknowledging that some citizenship behaviors may be more reliably observed by students, which constitutes one of the methodological originalities of this study.

Our research hypotheses are as follows:
H1: The organizational commitment of university faculty is positively associated with organizational citizenship behaviors.
H2: Academic leadership mediates the relationship between organizational commitment and OCB, such that fair and inspiring leadership strengthens the expression of OCB.
H3: Perceived social justice acts as a mediator in the relationship between organizational commitment and OCB, such that higher perceptions of justice increase faculty members' citizenship engagement.
H4: Academic leadership positively influences perceptions of social justice, thus establishing an additional indirect link between commitment and OCB through this dual mechanism.

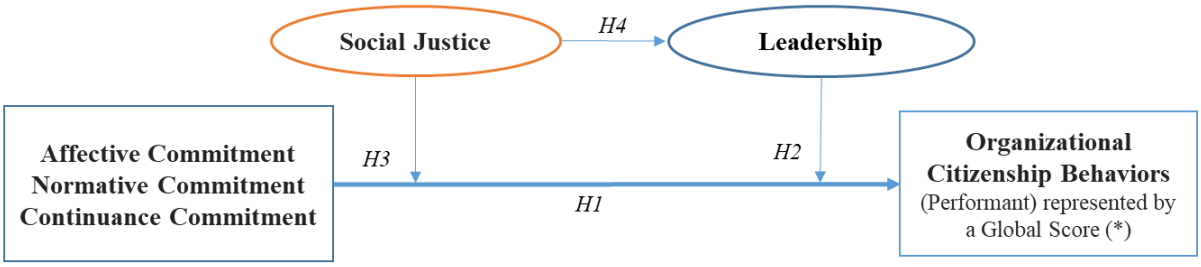
In his foundational model, Organ (1988) identifies five core dimensions: altruism (spontaneous assistance), conscientiousness (adherence to rules and duties), courtesy (conflict prevention and relational harmony), organizational loyalty (promotion and protection of the organization), and civic virtue (active participation in collective life). These attributes constitute a major theoretical foundation widely mobilized in international research and have been adapted to various sectors. In this study, Organ's (1988) model is used as the starting point and expanded to reflect the specificities of the higher education context. Following recommendations from Canadian and international studies (Biron, Brun & Ivers, 2008; Lapointe, Vandenberghe & Panaccio, 2011; Bélanger & Paquet, 2007), we added attributes particularly relevant to academia, such as student collaboration, pedagogical knowledge sharing, and citizenship oriented toward pedagogical innovation. Furthermore, to capture the actual perception of these behaviors, we incorporated an original dimension: behaviors observed by students, enabling a direct evaluation of teacher availability, pedagogical support, and motivational capacity.

The empirical approach is twofold. First, we used an adapted OCB scale administered to faculty members to measure their self-perceived and self-declared citizenship engagement. Second, we collected responses from

100 university students to triangulate these behaviors through external observation, thus enhancing the study's validity. This methodology allows us to move beyond self-reported measures, often criticized for social desirability bias, and to propose a contextualized and robust measure of OCB in higher education.

Accordingly, the final research model integrates Organ's (1988) foundational attributes with contextual extensions for academia, contributing both to the intercultural validation of the construct and to a deeper understanding of faculty citizenship behaviors in Moroccan higher education.

Figure 1: Research Model (Developed by the Author)



(*) The attributes derived from Organ's (1988) model, revised with two attributes from the literature and three additional attributes proposed by the students.

Measurement Instruments and Sample

The study was conducted with 51 faculty members and 100 students from several Moroccan universities. Given the sensitivity of the questions, many colleagues chose not to participate. To ensure anonymity and obtain reliable responses, participants were recruited outside the institution where the author works, thereby guaranteeing confidentiality and meaningful contributions. Among participating faculty, 20% had previously abandoned managerial responsibilities due to tensions with colleagues, while 10 faculty members currently hold managerial roles. The sample also included 15 female faculty members, some of whom avoided both the study and managerial positions due to family responsibilities.

The use of student responses is a methodological originality of this research. Certain organizational citizenship behaviors—such as assistance to students, availability, and resource sharing—are more accurately observable by students themselves. This dual evaluation corrects and complements faculty self-assessments and provides a more comprehensive measure of observable behaviors within the academic environment.

Organizational Commitment

Organizational commitment was assessed according to Meyer and Allen's (1991) three-component model, adapted to the Moroccan academic context:

Affective Commitment: emotional attachment to the university.
Examples:

- "I am proud to be part of this university."
- "I feel deeply attached to my institution."

Continuance Commitment: remaining in the university due to security and costs associated with leaving.
Examples:

- "I would remain in this institution mainly because it would be difficult to find an equivalent position elsewhere."
- "Leaving my institution would mean losing significant advantages or opportunities."

Normative Commitment: moral obligation toward the institution.
Examples:

- "I feel obliged to stay in this institution out of loyalty."
- "I must contribute to the success of my university even if I could work elsewhere."

Organizational Citizenship Behaviors (OCB)
OCB was measured using an adapted version of Organ's (1988) scale, enriched for academia based on Canadian and international studies (Paillé, 2007; Biron, Brun & Ivers, 2008; Lapointe, Vandenberghe & Panaccio, 2011; Bélanger & Paquet, 2007). These adaptations add attributes specific to higher education, such as collaboration with students and knowledge sharing.

Measured attributes and sample items:
Altruism / Assistance to colleagues and students
- "I take time to help colleagues even when not formally required."
- "I support students beyond class hours to facilitate their learning."

Conscientiousness / Compliance with rules
- "I respect departmental and university procedures."
- "I actively participate in meetings and academic obligations even when they are not mandatory."

Civic Virtue / Voluntary Involvement
- "I voluntarily participate in projects or committees that improve university functioning."
- "I propose initiatives to improve teaching quality or academic management."

Courtesy and Collaboration (added based on academic literature)
- "I communicate respectfully and constructively with colleagues and students."
- "I avoid unnecessary conflicts and promote cooperation."

Knowledge-Sharing and Innovation-Oriented Citizenship (academic context adaptation)
- "I share pedagogical knowledge and resources with colleagues."
- "I participate in collective initiatives aimed at improving teaching methods."

Behaviors Observed by Students (original contribution)
Availability:
- "This instructor responds quickly to my questions and requests."
- "He/she is accessible outside class hours to help me."

Pedagogical Support:
- "The instructor provides clear and detailed explanations."
- "He/she offers additional resources to support learning."

Encouragement and Motivation:
- "This instructor encourages me to participate actively in class."
- "He/she values our efforts and ideas."

OCB was measured using two distinct data sources: 51 faculty self-assessments and 100 student evaluations. For analytical purposes and to ensure comparability, a subsample of 51 student responses was randomly selected from the 100 collected. This strategy balances the weight of both groups and reduces the risk of bias from overrepresentation. Based on this, we computed a mean score for each OCB dimension by aggregating faculty and student evaluations. Although exploratory, this approach serves two purposes: (1) combining actor and observer perspectives to strengthen convergent validity, and (2) providing a global indicator usable for SPSS regression analyses. Acknowledging the limitations of this approach, we view it as a pragmatic first step before more sophisticated analyses (CFA, multi-source SEM) in future research.

Academic Leadership
Adapted to the Moroccan academic context, items refer to the institution's director or academic leader:

Vision and Inspiration:
- "The director clearly communicates objectives and inspires academic staff."
- "The director's orientations motivate my professional engagement."

Support and Recognition:
- "The director acknowledges my efforts and supports my professional development."
- "I receive useful guidance and encouragement for my academic progress."

Justice and Fairness:
- "Decisions regarding responsibilities and promotions are fair."
- "The director treats staff with respect and consideration."

Organizational Justice
Evaluated according to Colquitt (2001), with adaptations for universities:

Distributive Justice:
- "Workload and benefits are distributed fairly."
- "Opportunities for advancement are accessible to everyone in a fair manner."

Procedural Justice:
- "Rules for accessing managerial positions are clear and transparent."
- "Important decisions follow coherent and understandable procedures."

Interactional Justice:
- "The director treats me with respect and listens to my concerns."
- "Interactions with the director are constructive and respectful."

Reliability and Analysis
A Cronbach reliability test conducted on all scales yielded α = 0.80, indicating good internal consistency. Statistical analyses were conducted using SPSS and included descriptive statistics, correlations, and mediation tests to examine the role of leadership and social justice in the relationship between continuance commitment and OCB.

4. Results

The data were analyzed using SPSS to examine the relationships between organizational commitment, academic leadership, perceived social justice, and organizational citizenship behaviors (OCB). The reliability of the measurement scales was satisfactory, with a Cronbach's alpha of 0.80, indicating good internal consistency.

Commitment Dimensions as Predictors of Organizational Citizenship Behaviors
Correlation analyses (see Table 1) reveal contrasted relationships between the three dimensions of organizational commitment and organizational citizenship behaviors.

Table 1: Correlation Matrix (SPSS Output)

		Affective Commitment Index	Continuance Commitment Index	Normative Commitment Index	OCB Score
Affective Commitment Index	Pearson Correlation	1	0,078	0,161	0,006
	Sig. (2-tailed)		0,586	0,259	0,967
	N	51	51	51	51
Continuance Commitment Index	Pearson Correlation	0,078	1	,402**	,371**
	Sig. (2-tailed)	0,586		0,003	0,007
	N	51	51	51	51
Normative Commitment Index	Pearson Correlation	0,161	,402**	1	,921**
	Sig. (2-tailed)	0,259	0,003		0,000
	N	51	51	51	51
OCB Score (pour Organizational Citizenship Behavior Score)	Pearson Correlation	0,006	,371**	,921**	1
	Sig. (2-tailed)	0,967	0,007	0,000	
	N	51	51	51	51

**Correlation is significant at the 0.01 level (2-tailed)

Affective commitment is not significantly related to OCB (r = 0.006, p = 0.967). This result indicates that emotional attachment to the institution does not, in itself, translate into discretionary or voluntary behaviors among faculty members in the context studied.

Continuance commitment shows a moderate and statistically significant association with OCB (r = 0.371, p = 0.007). Faculty members whose attachment to the institution is driven by job security and professional stability tend to exhibit certain citizenship behaviors, mainly those related to cooperation and compliance with institutional norms.

Normative commitment displays a very strong and highly significant relationship with OCB (r = 0.921, p < 0.001). Faculty members who feel a moral obligation toward their institution are the most likely to engage in citizenship behaviors, suggesting that perceived duty and adherence to professional norms play a central role in fostering extra-role behaviors.

Qualitative data support these quantitative findings. Faculty responses indicate that, even in situations of dissatisfaction or disagreement with institutional management, they continue to fulfill their responsibilities toward students and colleagues. This commitment is frequently described as a matter of professional conscience rather than personal attachment. Overall, the results show that organizational citizenship behaviors among Moroccan faculty members are primarily associated with normative commitment, followed by continuance commitment, while affective commitment does not exhibit a significant effect.

To deepen these insights, it is necessary to assess the influence of academic leadership and perceived social justice. Regression analyses allow the examination of their potential mediating effects in the relationship between commitment and OCB, thereby offering a more nuanced understanding of the factors that promote—or inhibit—citizenship behaviors in Moroccan universities.

Table 2: Relationship Between Leadership and Social Justice (SPSS Output)

Coefficients[a]

Model				Standardized Coefficients Bêta	t	Sig.
1	(Constant)	1,017	0,360		2,824	0,007
	Leadership Index	0,617	0,126	0,575	4,914	0,000

a. Dependant variable : Social Justice Index

The results (see Table 2) show a positive and significant relationship between academic leadership and perceived social justice (r = 0.617, p < 0.001). This confirms that fair, structured, and inspiring leadership enhances perceptions of justice—consistent with findings on transformational and distributed leadership in Canadian universities (Lapointe, Vandenberghe & Panaccio, 2011; Biron, Brun & Ivers, 2008). In this context, social justice emerges as a direct consequence of legitimate leadership capable of regulating internal rivalries and promoting cooperation, conditions essential for the expression of OCB.

These results also highlight the specificities of Moroccan universities, where faculty are predominantly motivated by stability and job security. The absence of a significant link between affective commitment and OCB diverges from findings in Canadian studies, where emotional engagement typically plays a central role. This underscores a contextual singularity: citizenship behaviors among Moroccan faculty are more strongly influenced by institutional and normative factors than by affective or intrinsic motivations.

Thus, the study underscores the potential mediating role of leadership and social justice in the relationship between organizational commitment and OCB, confirming that equitable management strategies and fair organizational practices can reinforce citizenship behaviors even when commitment is primarily normative or continuity-based.

Mediation Effects of Leadership and Social Justice in the Relationship Between Organizational Commitment and OCB

The results reveal a strong and significant relationship between leadership and perceived social justice ($r = 0.617$, $p < 0.001$), indicating that leadership quality has a direct influence on fairness perceptions within universities. Legitimate, structured, and credible leadership appears essential for regulating internal relations and reinforcing perceptions of equity.

However, mediation analyses (Table 3) indicate that neither leadership nor social justice mediates the relationship between organizational commitment and OCB. For continuance commitment, the direct effect on OCB remains significant ($c' = 0.110$, $p = 0.006$), while indirect effects through leadership or justice are not significant. Similarly, for normative commitment, the direct relationship with OCB remains extremely strong ($c' \approx 0.982–0.996$, $p < 0.001$), without any mediating influence.

Faculty testimonies illustrate this autonomy from managerial processes:

"I focus on my courses and leave the institution without engaging in internal affairs."
"When the academic director invites me for coffee, I know he wants to involve me or make me sign something; I decline and go home."
"I prefer stopping by the cafeteria after class, where I have a better chance of meeting the academic director to discuss concrete issues."
"I do not understand what happens at the administrative level. Invitations to participate in decisions are rare."
"I don't have time; a teacher must teach and publish—the rest is not my responsibility."
"Institutional management does not interest me; I focus on my work and my students."
"Administrative discussions are not part of my role; I prefer focusing on teaching and research."
"I am rarely asked to participate in internal decision-making; I do not feel involved in governance."

These statements confirm that citizenship behaviors are largely disconnected from leadership and governance structures and instead rooted in individual professional norms and continuity-based motivations.

Table 3: Summary of Regression Analyses (SPSS Output)

Variable X	Variable Y	Effet of X on Y	c *(global effect)*	c' *(direct effect)*	Coefficient a (Effect of X on M) M: Social Justice	Coefficient b (Effect of M on Y)	Mediation effect (a*b)
Normative Commitment	CCO (*)	*Confirmed*	c=.990 sig .000	c'=.982 sig .000	a= -.137 sig.509	b=-.058 sig .166	0.008
Continuance Commitment		*Confirmed*	c=.107 sig .007	c'=.110 sig .006	a= .024 sig.000	b=-.139 sig .160	-0.003
Affective Commitment		*Non significant*					

Variable X	Variable Y	Effet of X on Y	c *(global effect)*	c' *(direct effect)*	Coefficient a (Effect of X on M) M : Leadership	Coefficient b (Effect of M on Y)	Mediation effect (a*b)
Normative Commitment	CCO (*)	*Confirmed*	c=.990 sig .000	c'=.996 sig .000	a= .154 sig.426	b=-.044 sig .329	0.007
Continuance Commitment		*Confirmed*	c=.107 sig .007	c'=.110 sig .008	a= .087 sig.089	b=-.033 sig .769	-0.003
Affective Commitment		*Non significant*					

(*) organizational citizenship behaviors

Discussion

The findings reveal a specific configuration within Moroccan higher education that diverges from dominant models in organizational behavior. Contrary to evidence from Western and Canadian contexts, academic leadership and perceived organizational justice do not directly foster organizational citizenship behaviors (OCB). Instead, OCB appears to be primarily driven by normative and continuance forms of organizational commitment.

Although academic leadership significantly shapes perceptions of social justice, this influence does not extend to citizenship behaviors. Faculty members tend to adopt autonomous and task-oriented postures, focusing mainly on teaching and research activities while remaining distanced from administrative and managerial dynamics. This separation between professional practice and institutional governance limits the effectiveness of managerial mechanisms traditionally viewed as central drivers of extra-role behaviors.

These results contribute to the literature by highlighting the contextual boundaries of established models linking leadership, justice, and OCB. In environments characterized by strong employment stability, limited participatory governance, and weak managerial legitimacy, citizenship behaviors may develop independently of leadership practices and fairness perceptions. This finding challenges the assumed universality of leadership- and justice-based explanations of prosocial behavior at work.

Comparatively, Canadian studies emphasize the central role of transformational leadership and organizational justice in promoting cooperation, mutual assistance, and participation among faculty members (Bélanger & Paquet, 2007; Lapointe, Vandenberghe & Panaccio, 2011; Biron, Brun & Ivers, 2008). In these contexts, leadership quality and fairness mechanisms actively structure professional engagement. The Moroccan case, by contrast, reveals a decoupling between managerial action and citizenship behaviors.

As one of the first empirical investigations of these relationships in Moroccan higher education, this study shows that OCB is more strongly rooted in moral obligation and employment continuity than in leadership or justice mechanisms. Faculty testimonies reinforce this pattern, illustrating a professional logic based on duty, stability, and individual responsibility rather than collective governance or managerial involvement.

Overall, the findings point to a structural gap between managerial practices and faculty behaviors. While organizational theory identifies leadership and justice as key levers for encouraging citizenship behaviors (Organ, 1988; Colquitt, 2001), the Moroccan higher education context suggests that these levers remain insufficient in the absence of participatory cultures, transparent evaluation systems, and credible governance structures. This raises important questions about the transferability of mainstream management models and calls for context-sensitive approaches to organizational development in higher education.

5. Practical Implications and Recommendations

Although no mediation effects were observed, the strong and significant relationship between academic leadership and perceived social justice underscores the importance of developing legitimate and competent leadership within Moroccan universities. Leadership quality remains a key lever for improving fairness perceptions, reducing internal tensions, and strengthening institutional cohesion, even if it does not directly translate into higher levels of organizational citizenship behaviors in the present study.

These findings suggest that academic leadership should be strengthened through selection criteria based on managerial competencies, academic legitimacy, and formal leadership training, rather than administrative seniority or political considerations. Such an approach would enhance leadership credibility and contribute to more equitable organizational environments.

In addition, the results highlight the need for structured and professional human resource management systems in Moroccan higher education. Transparent evaluation procedures, objective promotion criteria, and clearer career pathways would help restore trust in institutional processes and support faculty motivation. While these mechanisms may not immediately generate citizenship behaviors, they constitute essential foundations for long-term organizational stability and legitimacy.

From a policy perspective, these recommendations align with national and international guidelines advocating equity, accountability, and professionalism in university governance. Strengthening leadership capacity and institutional justice should therefore be viewed as strategic priorities for higher education reform rather than as short-term behavioral interventions.

Overall, the study emphasizes that leadership and social justice function less as direct drivers of citizenship behaviors and more as structural conditions for improving organizational functioning. Addressing these dimensions is essential for supporting the development, credibility, and sustainability of Moroccan universities, and for creating institutional contexts more conducive to engagement and collective responsibility.

Conclusion

This study contributes to the limited empirical literature on organizational commitment and organizational citizenship behaviors (OCB) in Moroccan higher education by examining the roles of academic leadership and perceived social justice. The findings reveal a distinctive contextual pattern in which OCB is primarily driven by normative and continuance commitment, while academic leadership and social justice do not exert mediating effects in this relationship.

Faculty members demonstrate a strong sense of professional responsibility toward teaching and students yet remain largely detached from managerial and administrative processes. This professional autonomy highlights a structural separation between academic practice and institutional governance, challenging dominant theoretical assumptions that position leadership and justice as universal drivers of citizenship behaviors.

By contrasting these results with findings from Canadian universities and the Moroccan private sector, where leadership and organizational justice play a central role in fostering OCB, the study underscores the importance of contextual and institutional factors. In Moroccan public universities, the limited participatory culture and the weak legitimacy of managerial structures appear to constrain the influence of conventional motivational mechanisms.

From a practical perspective, the findings suggest that strengthening academic leadership, improving perceptions of social justice, and professionalizing human resource management systems are essential conditions for enhancing organizational functioning. While these levers may not immediately translate into higher citizenship behaviors, they constitute critical foundations for restoring trust, legitimacy, and long-term engagement within universities.

Finally, this research opens promising avenues for future studies by emphasizing the need to further investigate institutional, cultural, and governance-related determinants of OCB in Moroccan higher education. Such efforts would contribute to the development of more context-sensitive models of engagement and support the ongoing transformation of higher education systems in similar public-sector environments.

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Journal of Economics and Behavioral Studies (JEBS)
Vol. 17, No. 4, 2025 (ISSN: 2220-6140)

Financial Risk Management and Financial Performance of Construction Companies in Greater Kampala Metropolitan Area

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Abstract: The financial performance of construction companies depends significantly on their ability to manage financial risks. This study examined the effect of financial risk management on the financial performance of construction companies focusing on three dimensions: risk identification, risk assessment and evaluation, and risk management strategy. Guided by Modern Portfolio Theory, the study adopted a cross-sectional survey design and collected data from 191 construction companies selected through proportionate sampling. Structured questionnaires were used for data collection and the validity and reliability of the instruments were confirmed through expert review and Cronbach's Alpha. Data were analyzed using descriptive statistics, correlation analysis, and hierarchical regression. Findings revealed that all three financial risk management components were positively associated with financial performance. Risk identification showed a significant but modest relationship with financial performance ($r = .300$, $p < .01$), while risk assessment and evaluation exhibited the strongest association ($r = .591$, $p < .01$). Risk management strategy also demonstrated a significant positive relationship ($r = .428$, $p < .01$). Hierarchical regression results further indicated that risk assessment and evaluation contributed the largest increase in explained variance (24.9 percent), followed by risk management strategy (7.1 percent), whereas the influence of risk identification diminished after additional predictors were introduced. Overall, the models explained 42.7 percent of the variation in financial performance. The study concludes that financial risk management significantly improves financial performance, particularly when firms invest in thorough assessment and evaluation of risks and implement structured mitigation strategies. It recommends that construction firms adopt comprehensive risk management frameworks, strengthen analytical capacities and integrate proactive financial planning tools to enhance profitability, reduce exposure to uncertainty and improve long-term sustainability.

Keywords: *Financial risk management, financial performance, construction companies, Greater Kampala metropolitan area*

1. Background to the Study

Financial risk management and financial performance are two fundamental variables that determine the growth, sustainability, and competitiveness of construction companies. Financial performance reflects how efficiently a firm utilizes its resources to generate profits, maintain liquidity, and achieve operational stability, which are essential for long-term survival in the construction sector (Alaloul et al., 2022; Hwang, Shan, & Looi, 2023). Financial risk management involves the systematic process of identifying, assessing, mitigating, and monitoring financial risks such as currency volatility, credit risk, liquidity challenges, and cost fluctuations that may hinder firm performance (Shibani et al., 2024; Taroun, 2022). In the construction industry, these risks are particularly prominent due to the dynamic and unpredictable nature of construction projects, where cost escalations, financing difficulties, and delays frequently arise (Ogunnusi et al., 2022). Firms that develop strong risk management capabilities, including early identification of risks, rigorous evaluation, and the formulation of effective mitigation strategies, often achieve better financial outcomes, improved credit access, and overall financial stability (Adu-Gyamfi et al., 2024; Alaloul et al., 2022). In this study, financial risk management is examined through three dimensions, namely risk identification, risk assessment and evaluation, and risk management strategy, all of which influence how resources are allocated and how decisions are made within construction firms (Shibani et al., 2024).

Globally, the construction industry remains one of the largest and most influential sectors, valued at approximately 11.4 trillion US dollars in 2024 and projected to reach nearly 17 trillion US dollars by 2030 (Deloitte, 2024; GlobalData, 2023). The industry contributes significantly to global GDP and employs millions of people worldwide, yet it continues to face persistent financial risks driven by fluctuating material prices, unstable exchange rates, financing constraints, and inflationary pressures (International Labour Organization,

2023; Ogunnusi et al., 2022). The COVID-19 pandemic exposed the vulnerability of firms with weak risk management systems while highlighting the resilience of those that had robust frameworks in place (Ogunnusi et al., 2022). Evidence from developed countries such as China, the United States, and the United Kingdom demonstrates that financial sustainability within the construction sector is closely linked to formalized risk management practices, long-term planning, and strategic financial controls (Alaloul et al., 2022; Hwang et al., 2023). As global markets continue to evolve, effective financial risk management remains central to cost stabilization, access to financing, return on investment, and overall financial performance (Shibani et al., 2024).

Within Africa, the construction sector has expanded rapidly, reaching a market value of approximately 219.66 billion US dollars in 2024 and projected to rise further in 2025 (Next Move Strategy Consulting, 2025). Despite this growth, construction firms across the continent operate under challenging macroeconomic conditions characterized by currency instability, inflation, limited financing options, and inconsistent regulatory environments (African Development Bank, 2023). These conditions have made financial risk management an essential component of firm survival and growth. Studies in countries such as Nigeria, Kenya, and South Africa show that construction companies that adopt structured financial risk management systems achieve better financial performance, operational efficiency, and project success than those that do not (Aghimien et al., 2023; Sanni-Anibire et al., 2022). African firms are increasingly shifting from reactive responses to proactive identification and mitigation of financial risks, supported by institutional reforms and strategic policy interventions (African Development Bank, 2023). This shift has strengthened the ability of firms to maintain stability even in environments marked by uncertainty, thereby enhancing sustainability and investor confidence in the construction sector.

In Uganda, the construction industry is a cornerstone of economic transformation and development, contributing significantly to national GDP and supporting infrastructure development, employment, and urban growth (World Bank, 2023; Tutesigensi et al., 2021). Recent increases in sector output, rising from approximately 2816.14 billion Ugandan shillings in early 2025 to 2959.99 billion in the second quarter, reflect the sector's resilience and continued expansion (Trading Economics, 2026). Nonetheless, construction firms in Uganda experience a variety of financial risks, including cost overruns, delayed payments, currency depreciation, and difficulties in accessing affordable financing (Aguome et al., 2024; Alinaitwe, Apolot, & Tindiwensi, 2013). Although some firms have adopted project control systems, value management practices, and cost estimation models, many continue to operate without well-formalized financial risk management frameworks (Adu-Gyamfi et al., 2024). International contractors, particularly from China, have also introduced advanced financial management techniques, increasing competitive pressure on local firms that lack equivalent risk management capabilities (Mutikanga, Muheirwe, & Tindiwensi, 2023). Strengthening financial risk identification, assessment, and mitigation strategies is therefore essential for improving financial performance and ensuring long-term competitiveness in Uganda's construction industry (Mwelu et al., 2021).

Despite several financial risk management initiatives implemented by construction firms in Uganda, including hedging against currency fluctuations, strict cost controls, and securing favorable project financing, the financial performance of many firms remains weak. Profit margins are estimated at only 3 to 7 percent (Mutikanga et al., 2023), while low returns on equity and high debt ratios place firms in a financially vulnerable position (Bagenda and Ndevu, 2024). The consequences of these weaknesses include liquidity challenges, project delays, poor project quality, and reduced investor confidence, all of which threaten the stability of the sector. Past literature attributes these challenges to financial risk management deficiencies, including ineffective hedging, unstable material costs, and poor debt management practices (Ogwang and Vanclay, 2021; Seninde, 2020). These persistent concerns underscore the need to investigate how financial risk management influences the financial performance of construction companies in Uganda. Such an investigation will provide evidence to support sustainable growth, improve project delivery, and reduce financial vulnerability within the construction industry.

2. Literature Review

Theoretical Review

The theoretical basis for this study is derived from Modern Portfolio Theory (MPT), introduced by Harry Markowitz in 1952, which describes the relationship between financial risk management and financial

performance in construction companies. MPT postulates that firms can realize maximum returns with a minimum of financial risks by diversifying investments and managing exposure to volatile financial elements such as credit risk, liquidity risk, and interest rate fluctuations, among others, coupled with market uncertainties. Several studies based on MPT, such as the one conducted by Berk and Tutarlı (2021), indicate that organizations that have their risk estimated and analyzed systematically are able to take more effective financial decisions for enhancing stability and profitability. Lindquist et al. (2022) emphasized that the very concept of the trade-off between risk and return lies at the heart of portfolio selection, a principle that construction companies can apply in managing project costs and financing uncertainties. Al Janabi (2021) explained how MPT can be applied under illiquid market conditions for the optimization of portfolio outcomes. It was evident that structured assessment and hedging of risks improve resilience against market shocks. Lukomnik and Hawley (2021) reported that diversification and active management of risks, through the guidance of MPT, enable an enterprise to operate in a more efficient manner and protect its financial performance. El Ghmari and Ed-Dahhani (2024) mentioned how MPT works in a practical framework, indicating that continuous monitoring and adjustment of risk exposures are crucial for the firm to maintain its performance despite fluctuations in the cost of projects or macroeconomic conditions. Overall, MPT positions financial risk as a manageable variable and provides tools for systematic evaluation, monitoring, and mitigation, thus supporting profitability and long-term growth in construction firms directly.

Empirical Literature Review

Risk identification and financial performance

Risk identification has been widely recognized as the cornerstone of effective financial risk management in construction projects, directly influencing financial performance outcomes. The process involves the systematic detection of potential threats that could impede project objectives, which usually include cost overruns, delays, credit risks, and operational uncertainties. Shibani et al. (2024) identified that firms adopting structured risk identification frameworks are more capable of proper resource allocation, anticipating financially constraining factors, and sustaining liquidity, hence contributing to improved profitability. According to Yousri et al. (2023), early identification of project-specific risks allows firms to develop mitigation strategies before problems escalate, reducing the possibility of budgetary deviation and schedule disruption. In large-scale construction projects, Nabawy et al. (2021) stressed that risk identification frameworks not only capture individual threats but also map their interconnections, providing a holistic understanding of how one risk can amplify others, thus protecting financial performance. Further, Bahamid and Doh (2017) emphasized that risk identification remains important in developing countries, where construction firms operate in volatile economic environments characterized by fluctuations in material costs and financing terms. Okiye et al. (2022) showed that early identification models improve cost control and schedule performance, thereby directly enhancing financial outcomes. However, limited empirical studies have examined how risk identification practices influence financial performance among construction firms in Uganda.

The adoption of technology-driven approaches in risk identification further enhances financial performance and permits firms to react dynamically to emerging threats. Machine learning and real-time analytics have increasingly been applied to proactively monitor project progress and detect anomalies that may lead to financial losses. Hovhannisyan et al. (2023) showed that data-driven forecasting models can predict schedule risks in mega-projects, enabling managers to take preventive action and maintain cash flow stability. Similarly, Martínez-Aires et al. (2024) found that integrating automated risk assessment tools within operational frameworks significantly reduces incidents that can cause unforeseen financial burdens. Studies from African contexts, including Kenya, demonstrate that early detection of supply chain and construction risks helps avert material shortages, labour disruptions, and contractual penalties, thereby improving financial outcomes (Ji et al., 2022). Li et al. (2024) further showed that industrialized and prefabricated construction benefits from formalized risk assessment systems that enhance both operational reliability and economic efficiency. Collectively, these studies underline that comprehensive identification of risks supports the overall financial performance of construction firms, with proactive identification acting as a key driver of financial stability and profitability. Nevertheless, empirical evidence on technology-driven risk identification and its financial implications remains limited in Sub-Saharan African construction contexts.

Artificial intelligence has become a pivotal tool in risk identification due to its capacity to enhance prediction accuracy and support decision-making processes (Wang, 2024). Salamai et al. (2021) proposed dynamic voting

classifiers in supply chain environments for real-time identification of risks, demonstrating that AI improves detection speed and reduces human error, leading to more reliable financial outcomes. Bahamid et al. (2022) also showed that AI-driven systems integrate historical data, market trends, and operational variables to continuously update risk conditions, enabling managers to readjust resources and project plans to avoid losses. El-Sayegh et al. (2021) identified that combining traditional risk identification approaches with AI analytics strengthens the early detection of threats and improves response effectiveness. Yousri et al. (2023) further highlighted that firms utilizing AI in risk identification outperform competitors in budget control, project completion time, and profitability. These findings demonstrate that risk identification through conventional and AI-enhanced systems remains a key mechanism through which construction companies protect financial performance, reduce exposure to uncertainties, and ensure project sustainability. However, little is known about the adoption and effectiveness of AI-enabled risk identification systems in improving financial performance among construction companies in Uganda.

Risk assessment, evaluation and financial performance

Risk assessment and evaluation are one of the important stages in financial risk management, directly influencing the financial performance of construction firms since identified risks are valued according to their potential impact and likelihood. This stage involves quantitative assessment, prioritization, and evaluation to provide managers with sufficient information for mitigation strategies, resource allocation, and contingency planning (Albasyouni et al., 2025). Chen et al. (2022) showed that technological integrations in construction, such as Building Information Modelling (BIM) and digital project management systems, significantly improve risk assessment accuracy, enabling firms to foresee financial complications and improve budgeting decisions. Antoniou (2021) demonstrated through road project case studies that systematic delay risk assessment helps firms reduce cost overruns and maintain profitability by identifying scheduling bottlenecks early. Similarly, Koulinas et al. (2023) indicated that multi-criteria risk assessment frameworks allow construction companies to weigh operational risks against financial consequences, supporting better investment decisions and enhancing financial performance. Risk assessment is particularly essential in large infrastructure projects such as bridges and highways; Li et al. (2022) and Wu and Lu (2022) found that intelligent algorithm-based safety risk assessment models reduce unforeseen expenses by identifying high-risk activities in advance. Yao et al. (2024) further demonstrated that combining variable-weight theory with cloud models allows firms to evaluate exposure to multiple risk factors simultaneously, improving strategic decision-making and protecting profitability. However, limited empirical evidence exists on how risk assessment and evaluation practices influence the financial performance of construction firms in Uganda.

The systematic assessment of risks also enhances financial performance through evidence-based budgeting, contingency planning, and resource optimization. Studies in Ghana show that firms applying structured risk evaluation frameworks achieve better cost control, timely project delivery, and improved profitability through proactive management of potential disruptions (Boateng, Ameyaw, & Mensah, 2022). In Uganda, research indicates that improved risk assessment in cost estimation enables firms to minimize budget variances and maintain operational liquidity (Draleti et al., 2024). Similarly, studies in Kenya reveal that risk assessment practices significantly influence project performance and financial outcomes by providing managers with accurate information about the probability and severity of project risks (Cherono & Nyang'au, 2024). Evidence from Ethiopia suggests that foreign contractors using systematic cost and schedule risk evaluations are better able to avoid financial losses and optimize resource allocation (Tessema et al., 2022). Oyekunle (2024) further emphasized that Nigerian construction firms employing structured risk assessment frameworks tend to achieve stronger financial performance. Nevertheless, most studies are concentrated in specific national contexts, leaving limited comparative evidence on risk assessment practices and financial performance within construction firms operating in the Greater Kampala Metropolitan Area.

Advanced methodologies and analytical techniques are increasingly being applied to risk assessment to improve predictive accuracy and financial performance. Hassan et al. (2023) demonstrated that risk assessment linked to circular economy practices helps identify financial vulnerabilities associated with resource inefficiencies and sustainability risks. Albasyouni et al. (2025) highlighted how probabilistic models and simulation techniques enhance the quantification of financial exposure. Chen et al. (2022) emphasized the role of integrated digital technologies in enabling real-time risk monitoring and scenario analysis. Antoniou (2021) and Koulinas et al. (2023) applied multi-criteria decision-making tools to balance operational risks and

cost implications, helping projects stay within budget. Evidence from Li et al. (2022), Wu and Lu (2022), and Yao et al. (2024) shows that intelligent algorithms and cloud-based models enable firms to evaluate multiple risk variables concurrently and reduce unexpected costs. Similarly, Boateng et al. (2022) and Draleti et al. (2024) confirmed that integrating structured risk assessment at the planning stage allows firms to align financial performance with operational stability. Overall, these studies show that systematic risk assessment serves not only as a preventive tool but also as a strategic driver that strengthens financial performance by reducing uncertainty and improving resource allocation. However, there is limited empirical evidence on the adoption and financial impact of advanced risk assessment technologies among construction firms in Uganda, which this study seeks to address.

Risk management strategy and financial performance

Risk management strategy is among the most important financial performance determinant factors in construction companies, given that it involves deliberate planning, policy formulation, and implementation of measures to minimize exposure to financial risks. A properly developed strategy empowers firms to anticipate financial threats, allocate resources efficiently, and maintain liquidity under unpredictable project conditions. Toufaili (2021) found that organisations adopting comprehensive risk management strategies achieved higher profitability by incorporating preventive, mitigative, and contingency measures into financial planning. Within the construction sector, Bahamid et al. (2022) emphasized that strategies such as project monitoring, contract evaluation, and financial hedging contribute to better cost control and overall project success. Similarly, studies on small and medium-sized construction enterprises demonstrate that proactive risk management strategies enhance operational efficiency and improve financial performance (Adu-Gyamfi et al., 2024). However, limited empirical research has examined how risk management strategy directly influences financial performance among construction firms in Uganda.

The adoption of advanced financial risk management tools further strengthens a firm's ability to respond to uncertainties and protect financial performance. Studies show that risk transfer mechanisms such as insurance, hedging, and contractual risk-sharing can reduce liquidity and credit risks in construction projects (Srinivasan et al., 2022; Duo et al., 2023). Akomea-Frimpong et al. (2021) observed that integrating risk management strategies within public–private partnership projects improves resource utilization and reduces potential financial losses. In addition, resilience-based strategies and flexible decision-making frameworks assist firms in adapting to changing market conditions, thereby supporting financial performance (Settembre-Blundo et al., 2021). Proactive supply chain risk strategies also help construction firms reduce vulnerabilities associated with material shortages, price fluctuations, and logistics disruptions (Can Saglam et al., 2021; Hohenstein, 2022). Nevertheless, most studies on advanced risk management tools focus on large-scale international projects, leaving a limited understanding of their application and financial benefits for construction firms operating in developing-country contexts such as Uganda.

Emerging technologies and data-driven approaches are increasingly influencing risk management strategies, providing construction companies with competitive advantages through improved financial performance. Medavaka (2024) indicated that the adoption of risk avoidance measures such as insurance coverage and strategic planning enhances the financial stability of firms. Vääräniemi (2021) highlighted that decision-making frameworks based on risk analytics enable firms to maximize returns under uncertain conditions. Evidence from other sectors further demonstrates that structured risk mitigation strategies, including diversification, hedging, and contingency planning, provide protection against economic shocks and improve performance outcomes (Birthal et al., 2021; da Costa, 2024; Anyango, 2022). The literature suggests that well-articulated and systematically implemented risk management strategies are essential for sustaining financial performance, enhancing profitability, and ensuring long-term growth in construction companies. However, there is limited empirical evidence on the adoption of technology-driven and analytics-based risk management strategies among construction firms in Uganda and their effect on financial performance.

3. Research methodology

The study employed a cross-sectional survey design to collect data on respondents' perceptions of financial risk management and financial performance among construction firms. This design was suitable because it allows exposures and outcomes to be assessed simultaneously within a defined period and provides a time-

efficient and cost-effective approach for hypothesis testing (Setia, 2016; Wang & Cheng, 2020). The area of study was the Kampala Metropolitan Region, which included a total population of 380 registered construction companies. Using Krejcie and Morgan's (1970) sample size determination table, a sample of 191 companies was selected, with managers and head accountants serving as respondents. Proportionate sampling was used to ensure fair representation of companies according to their distribution across the metropolitan region, consistent with guidance from Etikan and Bala (2017) and Taherdoost (2017).

Primary data were collected through structured, self-administered questionnaires designed separately for finance managers and field employees to ensure relevance and clarity (Dillman, Smyth, & Christian, 2014). To ensure methodological rigor, the study assessed both the validity and reliability of the instruments. Content validity was evaluated by experts and quantified using the Content Validity Index as recommended by De Vet, Mokkink, Mosmuller, and Terwee (2017), while reliability was measured using Cronbach's Alpha following Mugenda and Mugenda (2003). Data analysis involved quantitative techniques, beginning with coding and cleaning, followed by descriptive statistics such as means, frequencies, and standard deviations. Inferential methods, including correlation and regression analysis were applied to determine relationships between financial risk management practices and financial performance, with statistical software such as SPSS or R ensuring robustness and accuracy in the analytical process (Field, 2018).

4. Study Findings and Analysis

Table 1: Correlation Results

Variables	RI	RAE	RMS	NPM	ROE	FP
Risk Identification (RI)	1					
Risk assessment and evaluation (RAE)	.520**	1				
Risk management strategy (RMS)	.159**	.311**	1			
Net Profit Margin (NPM)	.091	.387**	.344**	1		
Return on Equity (ROE)	.117*	.114*	.210**	.412**	1	
Financial performance (FP)	.300**	.591**	.428**	.797**	.726**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Risk Identification (RI) and Financial Performance (FP)

The correlation results show a positive and statistically significant relationship between risk identification and financial performance ($r = .300$, $p < .01$). This implies that any positive change in risk identification practices is associated with a corresponding positive change in financial performance, suggesting that strengthening early detection mechanisms contributes to enhanced profitability and overall financial success.

Risk Assessment and Evaluation (RAE) and Financial Performance (FP)

The correlation results show a strong and statistically significant relationship between risk assessment and evaluation and financial performance ($r = .591$, $p < .01$). This implies that any positive change in risk assessment and evaluation practices is associated with a corresponding positive change in financial performance, suggesting that firms that thoroughly analyze the likelihood, severity, and potential impact of risks are more likely to achieve higher profitability and improved financial outcomes.

Risk Management Strategy (RMS) and Financial Performance (FP)

The correlation results show a positive and statistically significant relationship between risk management strategy and financial performance ($r = .428$, $p < .01$). This implies that any positive change in risk management strategy is associated with a corresponding positive change in financial performance, suggesting that implementing effective mitigation measures, contingency plans, and strategic responses to risks enhances profitability, strengthens financial stability, and supports better overall firm performance.

Table 2: Hierarchical Regression

Variable	Model 1			Model 2			Model 3			Model 4		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Constant	3.23	0.09		2.06	0.23		1.54	0.2		0.82	0.22	
Type of Commercial Construction Project	0.09	0.04	.117*	0.09	0.04	.112*	0.05	0.04	0.07	0.06	0.03	0.07
Number of Commercial Projects Participated In	0.02	0.03	0.04	0.04	0.03	0.07	0.03	0.03	0.06	0.05	0.03	0.08
Risk Identification				0.31	0.06	.305**	0	0.06	0	0	0.05	0
Risk Assessment and Evaluation							0.49	0.05	.587**	0.41	0.04	.498**
Risk Management Strategy										0.27	0.04	.281**
R		0.12			0.33			0.6			0.65	
R^2		0.02			0.11			0.36			0.43	
Adjusted R^2		0.01			0.1			0.35			0.42	
R^2 Change		0.02			0.09			0.25			0.07	
F Change		2.36			31.2			117			37	
Sig. F Change		0.1			.000			.000			.000	

Results of Model 1 indicate that the control variables (type of commercial construction project and number of commercial projects participated in) explain 1.5% of the variation in financial performance. Of the two variables, only the type of commercial construction project was found to be a significant predictor of financial performance ($\beta = .117$, $p < .05$), suggesting that firms involved in certain commercial project types tend to experience better financial outcomes than others.

Model 2 shows that the addition of risk identification accounts for an extra 9.2% of the variance explained by the model (R^2 change = .092; $F\Delta = 31.203$; $p < .001$). The findings further confirm a positive and significant relationship between risk identification and financial performance ($\beta = .305$; $p < .001$). This suggests that firms that improve their ability to detect risks early tend to perform better financially. However, it is important to note that the predictive power of risk identification does not remain strong once further risk management components are introduced.

The inclusion of risk assessment and evaluation in Model 3 reveals an additional 24.9% increase in the variability explained in financial performance (R^2 change = .249; $F\Delta = 116.612$; $p < .001$). The results also show a strong, positive, and significant relationship between risk assessment and evaluation and financial performance ($\beta = .587$; $p < .001$). This indicates that firms that thoroughly examine the likelihood, severity, and potential impact of risks experience substantially higher levels of financial performance. At this stage, risk identification becomes statistically non-significant, suggesting that its effect is absorbed by the stronger predictive influence of risk assessment and evaluation.

In Model 4, the addition of risk management strategy explains a further 7.1% of the variance in financial performance (R^2 change = .071; $F\Delta = 37.042$; $p < .001$). The findings confirm a positive and significant relationship between risk management strategy and financial performance ($\beta = .281$; $p < .001$). This implies that firms that implement effective mitigation and response strategies experience improved financial outcomes. Additionally, the beta coefficient for risk assessment and evaluation decreases slightly from $\beta = .587$ to $\beta = .498$, indicating partial mediation by risk management strategy.

Overall, the predictive power of the four models explains 42.7% ($R^2 = .427$) of the variation in financial performance. Out of this, the control variables contribute 1.5%, risk identification contributes 9.2%, risk assessment and evaluation contributes 24.9%, and risk management strategy contributes 7.1%. These findings

demonstrate that risk assessment and evaluation are the strongest predictors of financial performance, followed by risk management strategy, while the influence of risk identification diminishes once more advanced risk management practices are introduced.

5. Conclusion and Recommendations

The hierarchical regression results demonstrate that financial risk management significantly influences the financial performance of construction firms in the Kampala Metropolitan Region. Risk assessment and evaluation emerged as the strongest predictor of financial performance, accounting for the largest increase in explained variance when introduced into the model. This finding suggests that firms that thoroughly examine the likelihood, severity, and financial implications of risks are better positioned to achieve improved financial outcomes. Risk management strategy also exhibited a positive and significant effect on financial performance, indicating that proactive mitigation measures contribute meaningfully to profitability and stability. While risk identification initially showed significance, its effect diminished when other risk management components were added, implying that identifying risks alone is insufficient without systematic evaluation and strategic response. Overall, the combined predictors explained 42.7 percent of the variation in financial performance, highlighting the central role of financial risk management in enhancing the financial stability and competitiveness of construction firms.

Recommendations

Given the strong predictive power of financial risk management variables, construction firms should prioritize strengthening their internal risk management frameworks, particularly in the areas of risk assessment and evaluation. Firms are encouraged to invest in training, analytical tools, and financial modelling techniques that enable them to quantify risks accurately and forecast their potential impacts on project outcomes. Additionally, companies should institutionalize structured risk management strategies, including contingency planning, cost-control mechanisms, and diversification approaches, to mitigate the effects of financial shocks. Integrating these practices into organizational decision-making processes will enhance financial performance, reduce exposure to uncertainties, and improve overall project success. Policymakers, industry regulators, and professional bodies should also support construction firms through guidelines, capacity-building initiatives, and incentives that promote the adoption of systematic financial risk management practices across the sector.

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Journal of Economics and Behavioral Studies (JEBS)
Vol. 17, No. 4, 2025 (ISSN: 2220-6140)

Performing without Pressure? The Effect of Ghost Games on Effort-based and Skill-based Tasks in the German Football Bundesliga

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Abstract: This study examines how the absence of crowds affects effort-based and skill-based performance in professional football. Using "ghost games" from the 2019/2020 season of the German football Bundesliga as a natural experiment, the analysis follows a within-subject design. It employs Wilcoxon signed-rank tests and linear regression models, including the interaction between home advantage and ghost games. Previous studies showed a decline in home advantage when matches are played without fans. Distinguishing between effort-based and skill-based performance, we argue that this effect is primarily driven by tasks involving physical effort, whereas the technical precision of home teams rather improves in ghost games. This study advances the behavioral understanding of home advantage and highlights how crowd presence can simultaneously motivate and constrain performance.

Keywords: *Home advantage, crowd effect, natural experiment, ghost games, Bundesliga*

1. Introduction

Home teams consistently outperform away teams, a phenomenon known as home advantage. For instance, Pollard and Gómez (2014) found that in European football, home teams win between 50.6% and 78.5% of matches. Scholars attribute home advantage to travel effects, psychological comfort, and crowd effects on player motivation and referees (Pollard, 2008). Spectators may boost players' motivation and effort, consistent with social facilitation theory (Strauss, 2002), yet their presence can also increase pressure and impair skill-based tasks (Dohmen, 2008). Referees are influenced as well, with discretionary decisions such as fouls, cards, and penalties more likely to favor home teams under vocal crowd conditions (Bilalić, 2021). However, despite extensive research, the mechanisms underlying home advantage remain debated.

We argue that the effects of crowds extend beyond officiating and interact directly with player motivation and execution. The complexity of crowd effects on players' performance requires analyses that distinguish between effort-based and skill-based performance. These analyses should examine whether fans primarily boost physical exertion or increase the pressure that undermines technical performance. Supportive crowds could act as a non-monetary incentive, enhancing effort-based performance (Lazear & Rosen, 1981; Rosen, 1986). At the same time, audiences can increase anxiety, impairing precision in skill-based tasks (Baumeister & Steinhilber, 1984). Performance under pressure may follow an inverted-U pattern, with optimal arousal levels (Yerkes & Dodson, 1908). These dynamics could explain why crowd effects appear contradictory.

This paper leverages German football Bundesliga data during the COVID-19 season to compare effort-based and skill-based performance under conditions with and without spectators. By examining whether the absence of fans differentially affects physical exertion and technical execution, we provide new insights into the psychological and behavioral mechanisms that underlie the home advantage. Beyond theoretical contributions, distinguishing between effort and skill offers guidance for training, tactical preparation, stadium management, and strategies for managing high-pressure situations. The remainder of the paper is structured as follows: Section 2 reviews theoretical foundations as well as previous studies and develops hypotheses; Section 3 presents data and empirical methods; Section 4 reports the results; and Section 5 discusses implications for behavioral economics, sport management, and future research.

2. Theoretical Background and Hypotheses

Social facilitation theory (Triplett, 1898) suggests that the presence of others can enhance performance on simple or well-practiced tasks by increasing physiological arousal and motivation (Zajonc, 1965). Building on this, evaluative pressure (Cottrell, 1972) and heightened attentional focus (Baron, 1986) have been shown to

further strengthen performance in social settings. Together, these mechanisms highlight the generally beneficial impact of social presence on well-learned behaviors.

In contrast, behavioral and sports economics, as well as (sports) psychology, describe performance decrements despite high incentives as 'choking under pressure.' According to Hebb's (1955) theory on the optimal level of arousal, performance may be impaired when the pressure perceived by a person is too high, which corresponds to the Yerkes-Dodson law (Yerkes & Dodson, 1908). Choking under pressure is either explained by the distraction theory (Mullen et al., 2005) or by the self-focus theory (Baumeister, 1984; Masters, 1992; Mesagno et al., 1992). When anxiety levels rise, for example, during crucial penalty kicks (Jordet et al., 2007), players may perform suboptimally either because they are distracted from their task or because they focus too much on executing it. The latter theory finds more support in experimental settings, see e.g., Kent et al. (2018) for an overview. A conscious focus can interfere with the automatic processes that are essential in sports, where deliberate decision-making is typically too time-consuming (Gigerenzer & Todd, 1999). This can lead players to underperform compared to their usual standard of skill.

In a behavioral field experiment conducted in India, Ariely et al. (2009) observe that very high incentives improve performance in effort-based tasks but diminish performance in skill-based tasks. Similarly, in professional biathlon, Harb-Wu and Krumer (2019) find evidence for choking under pressure that results in a home disadvantage: Whereas home biathletes' skiing performance is slightly better on average (effort-based task), their shooting performance is much worse than that of away biathletes (skill-based task). Harb-Wu and Krumer (2019) rule out that these poor shooting results are explained by faster skiing. In line with Wallace et al. (2005), home biathletes appear to underperform because they feel under pressure to perform especially well in front of a supportive audience.

Previous studies on "ghost games" during the COVID-19 pandemic provide mixed evidence regarding the mechanisms behind the decline in home advantage. Systematic reviews (Leitner et al., 2023; Wang & Qin, 2023) conclude that while most leagues experienced a significant reduction in home advantage, the underlying drivers differ across studies. Some studies attribute this decline primarily to the elimination of referee bias under spectator absence (Bryson et al., 2021; Reade et al., 2022), whereas others emphasize changes in player motivation and effort (Santana et al., 2021; Fischer & Haucap, 2021). More recent work suggests that crowd effects may not only influence external factors such as officiating but also directly affect athletes' psychological states, arousal levels, and task performance (Ferraresi & Gucciardi, 2023).

Despite growing empirical evidence, the literature lacks a systematic differentiation between how crowd presence affects various dimensions of player performance. Most of the prior studies measure aggregate outcomes (e.g., goals, points, or win probabilities) without distinguishing between the effort exerted and the precision required for successful execution. Building on insights from behavioral economics and sport psychology (Ariely et al., 2009; Baumeister & Steinhilber, 1984), this study addresses this gap by separating effort-based from skill-based performance indicators. This distinction allows for a more nuanced understanding of the behavioral and psychological mechanisms underlying home advantage and extends existing work on pressure and performance in professional sports.

Whereas social facilitation theory offers arguments for a home advantage in relatively simple effort tasks (Triplett, 1898), experimental evidence from behavioral economics and sport psychology rather suggests a home disadvantage for relatively complex skill tasks (Baumeister & Showers, 1986; Harb-Wu & Krumer, 2019). Based on this literature, we hypothesize that:
H1: For effort-based tasks, the absence of a crowd decreases the home team's performance in professional football.
H2: For skill-based tasks, the absence of a crowd does not decrease the home team's performance in professional football.

3. Method

The German football Bundesliga was the first major European league to resume play under closed-door conditions during the COVID-19 pandemic. To investigate the impact of crowd absence on home advantage, we

employ a within-season matched-pairs design using data from the Bundesliga during the 2019/2020 season. Specifically, we compare performance metrics from ghost games matches – played behind closed doors due to COVID-19 restrictions (matchdays 26–34) – with their corresponding fixtures earlier in the season (matchdays 9–17), which were played under normal conditions with spectators. This within-league design avoids the confounding impact of cross-country heterogeneity on the estimated crowd effects.

This procedure results in a dataset of 81 matched fixtures, where each team pair played once with fans (first half of the season) and once without (second half), albeit at reversed venues. By focusing on the same opponents in the same season, we reduce the risk of confounding factors that often plague between-season comparisons, such as regulatory changes (e.g., the introduction of the Video Assistant Referee) or evolving league-wide tactical trends.

However, a key limitation of this design is that it is not possible to keep the location of the match constant. The corresponding fixtures are played at different stadiums, which introduces a source of variation that may interact with the crowd effect. While this spatial asymmetry is controlled to some extent by including interaction terms in our regressions (see below), balancing internal validity (via within-season control) against potential location-driven confounds remains an inherent trade-off in the design.

Our data is drawn from the F24 event feed provided by Opta, a reputable sports analytics company. This data stream offers highly granular event-level information on professional football matches, including player movements, ball touches, passes, shots, and defensive actions. Open access to such detailed football data is limited, making the use of this dataset a unique strength of our study.
In line with prior research (Hughes et al., 2012; Rampinini et al., 2009), we classify match actions into two main categories:
Effort-based tasks: These are predominantly physiological in nature, involving physical exertion such as speed, stamina, and strength.
Skill-based tasks: These require technical proficiency, precision, and cognitive processing, often under time pressure.

Table 1 summarizes the variables and their classification.

Table 1: Categorization of effort-based vs. skill-based variables

Category	Variables	Description
Effort-based tasks	Sprints	Number of high-intensity runs
	Distance	Kilometers covered
	Clearances	Defensive actions where a player kicks the ball away from his own goal with no intended recipient of the ball
	Tackles[a]	Dispossessing the opponent, whether the tackling player comes away with the ball or not
Skill-based tasks	Ground duels Won[b]	Successful 50-50 contests between two players of opposing sides in the match
	Crosses	Accurate deliveries from a wide position to a central attacking area
	Passes	Successful transfer of the ball between two players
	Shots on target	Attempts to score a goal, made with any (legal) part of the body, which hits the target

Notes: [a]: It can be argued that tackles are not only effort-based but also skill-based. [b]: It can be argued that ground duels are not only skill-based but also effort-based, especially for defenders.

In football, the action variables associated with a successful result are physical activity and greater accuracy in both defense and attack (e.g., Carling, 2013; Hossini et al., 2012; McGarry, 2009). However, a clear distinction between effort-based and skill-based tasks is difficult. Assigning action variables to effort-based and skill-based

tasks, we generally follow Rampinini et al. (2009). We apply their classification of physiological actions to group effort-based tasks and assign technical actions to skill-based tasks. If it is unclear to which category an action variable predominantly belongs, we exclude it from further analysis. As a result, we identify four effort-based and four skill-based tasks out of our dataset (see Table 1).

While physical tasks, such as running (e.g., distance covered and sprints), are inherently effort-based, defensive tasks such as clearances, ground duels, and tackles require both physical strength and skill. Following Hughes et al. (2012), physiological actions are based on height, strength, power, speed, and stamina. Thus, clearances and tackles are considered to be predominantly effort-based. On the other hand, winning ground duels requires technical skills rather than physiological attributes to snatch the ball from the opponent. Finally, the offensive tasks of shooting and passing are based on individual skills.

Our analysis focuses on effort-based vs. skill-based performances of home teams in ghost vs. regular games. Additionally, we compare the results with the same performances of away teams. For better interpretability, we use ratios for all of the skill-based variables. According to one sample Kolmogorov-Smirnov test, we cannot assume that the analyzed performance data of home and away teams in ghost and regular games are normally distributed. Our statistical analysis exploits the within-subject experimental design and uses nonparametric Wilcoxon signed-rank tests. However, we also estimate a set of ordinary least squares (OLS) regression models, one for each performance variable. The following specification is applied:

$$Performance_{ij} = \alpha + \beta_1 Home_{ij} + \beta_2 Ghost_{ij} + \beta_3 (Home\ x\ Ghost)_{ij} + \varepsilon_{ij},$$

where $Performance_{ij}$ Is the performance outcome of team *i* in match *j*, $Home_{ij}$ It is a binary variable indicating whether the team played at home (1) or away (0), $Ghost_{ij}$ It is a binary variable indicating whether the match was a ghost game (1) or a regular game (0), $(Home\ x\ Ghost)_{ij}$ captures the interaction effect – i.e., whether the home advantage changes in the absence of a crowd, and ε_{ij} Is the error term.

This model allows us to isolate the effect of playing at home, the effect of playing without fans, and the differential impact of home advantage in the absence of crowd support. Nonetheless, the non-random assignment of crowd conditions – a limitation of all observational studies – introduces potential bias. Although the COVID-19 pandemic offers a quasi-experimental setup, teams may have adapted their strategies or line-ups in the post-lockdown period for reasons unrelated to crowd effects.

4. Results

This section presents the performance results of the home and away teams in the 2019/20 German football Bundesliga season. We distinguish between regular games (matchdays 9–17 before the COVID-19 pandemic) and ghost games (matchdays 26–34 during the pandemic). Figures 1 to 8 show the team averages for all football-specific action variables to which effort-based and skill-based tasks are assigned.

Figures 1 and 4 present evidence for the effort-based tasks:
Sprints: While home teams run at a higher intensity in regular matches (227 to 222 sprints | p=0.166), away teams cover more ground in high intensity without a crowd (221 to 225 sprints | p=0.517). However, these differences are not statistically significant according to the Wilcoxon signed-rank tests. Comparing home and away teams, home teams outperform away teams in regular games (p=0.094) and are not significantly worse in ghost games (p=0.434).
Distance: Both home and away teams cover more kilometers in front of a crowd than in ghost games (Home: 116.67 to 115.23 | p=0.011; Away: 116.18 to 115.30 | p=0.083). For home teams, this effect is statistically significant at the 5% level. For regular matches, this finding is in line with the existing literature, according to which home teams generally run more kilometers (Lago et al., 2010). However, the differences between home and away teams are not statistically significant (p=0.298 in regular and p=0.863 in ghost games).
Clearances: While the number of clearances by home teams does not statistically significantly increase from regular to ghost matches (17.01 to 17.37 | p=0.889), the number of clearances by away teams decreased significantly by around 20 percent (23.12 to 18.56 | p=0.010). In regular games, the number of clearances by

away teams is significantly higher than by home teams (p=0.003), which is not the case for ghost games (p=0.612)
Tackles: Both home and away teams perform more tackles in front of a crowd than in ghost games. The difference is statistically significant for away but not for home teams. (Home: 16.54 and 15.79 | p=0.249; Away: 17.05 and 15.11| p=0.047). Comparing home vs. away teams' tackles, the number of tackles by home teams is not significantly lower in regular games than by away teams (p=0.453) and not significantly higher in ghost games (p=0.280)

Figures 5 to 8 depict the performance measures in skill-based tasks:
Ground duels won: Home teams win fewer ground duels in front of a crowd compared to ghost games (50 to 56 percent | p=0.054), statistically significant at the 10% level. For away teams, it is the other way around. In ghost games, home teams win significantly more ground duels than away teams (p=0.035).
Crosses: Whereas home teams' crosses are less successful in regular matches (21 to 24 percent | p=0.196), the opposite applies to away teams. They deliver more precise crosses in front of the crowd (24 to 21 percent | p=0.256). However, these differences are not statistically significant, and the precision also does not significantly differ between home and away teams (p=0.193 in regular and p=0.248 in ghost games).
Passes: The passes in front of a crowd are less precise compared to the corresponding ghost games (Home: 77 to 78 percent | p=0.254; Away: 75 to 77 percent p=0.021), statistically significant for away but not for home teams. According to Tucker et al. (2005), high accuracy of passes is associated with a successful outcome. In regular games, home teams significantly outperform away teams in terms of pass accuracy (p=0.048), but not in ghost games (p=0.386).
Shots on target: Both teams show reduced accuracy in shots on target in regular games compared to ghost games (Home: 59 to 61 percent | p=0.495; Away: 58 to 60 percent | p=0.737), but these associations and the differences between home and away teams' shot accuracy are not statistically significant according to Wilcoxon signed-rank tests.

Taken together, the nonparametric tests offer limited support for our two hypotheses. To further analyze whether the absence of the crowd has an impact on the home team's performance, Table 2 presents the results of OLS regressions with each effort-based and skill-based task as one of the dependent variables and Home, Ghost, as well as the interaction between Home and Ghost as the independent variables. A positive coefficient of Home suggests a home advantage. Following H1, the impact of Ghost would be negative for effort-based tasks and, in line with H2, zero or positive for skill-based tasks. A positive coefficient of Home with a negative coefficient of the interaction between Home and Ghost suggests a reduction in home advantage in ghost games.

Concerning effort-based tasks, Table 2 displays a significant negative association of Home and clearances, Ghost and clearances, as well as Ghost and tackles, and a significant positive interaction of Home and Ghost with clearances. According to the regression results, ghost games have, ceteris paribus, a negative impact on the effort-based performances, tackles and clearances, but not on sprints and the distance covered. Furthermore, they suggest a home disadvantage for clearances, which is reduced during ghost games. Looking at skill-based tasks, Table 2 shows null results for Home and Ghost concerning ground duels, crosses and shots, as well as for the interaction of Home and Ghost on passes and shots. Yet it indicates a positive impact of playing at home and ghost games on pass accuracy, as well as positive interaction effects of Home and Ghost on ground duels and the accuracy of crosses. This indicates a home advantage with respect to passing accuracy as well as an increase in this performance metric in ghost games, with no distinction between home and away teams. Moreover, the results suggest that home teams have an advantage in skill-based tasks such as ground duels and crosses only in ghost games.

In sum, the regression results complement the descriptive statistics and nonparametric tests in this section. They offer weak support for H1 and confirm H2.

Table 2: OLS regressions

	Effort-based tasks				Skill-based tasks			
	Sprints	**Distance covered**	**Clearances**	**Tackles**	**Ground duels**	**Crosses**	**Passes**	**Shots on target**
Home	5.79 (4.84)	0.49 (0.73)	-6.11*** (1.43)	-0.51 (0.79)	-0.02 (0.21)	-0.03 (0.02)	0.02** (0.01)	0.01 (0.02)
Ghost	3.35 (4.84)	-0.88 (0.73)	-4.57*** (0.09)	-1.94** (0.79)	-0.08 (0.21)	-0.03 (0.02)	0.02** (0.01)	0.02 (0.02)
Home#Ghost	-8.54 (6.84)	-0.56 (1.03)	4.93** (2.02)	1.19 (1.12)	0.06** (0.00)	0.05* (0.03)	-0.01 (0.01)	0.00 (0.04)
Constant	221.18*** (3.42)	116.18*** (0.51)	23.12*** (1.01)	17.05*** (0.56)	0.52*** (0.01)	0.24*** (0.02)	0.75*** (0.01)	0.58*** (0.02)
N	324	324	324	324	324	323	324	324
R^2	0.0057	0.017	0.0681	0.0211	0.0207	0.0093	0.0351	0.0050
Adj. R^2	-0.0036	0.0078	0.0594	0.0120	0.0115	-0.0001	0.0261	-0.0043
F, Prob>F	0.61 p=0.6094	1.84 p=0.1390	7.79 p<0.0001	2.30 p=0.0768	2.25 p=0.0820	0.99 p=0.3962	3.88 p=0.0095	0.54 p=0.6556

Notes: Standard deviations in parentheses; significance levels * p<0.1, ** p<0.05, *** p<0.01.

Figures 1-8: Effort-based (upper panel) and skill-based (lower panel) performance of home vs. away teams in regular vs. ghost games

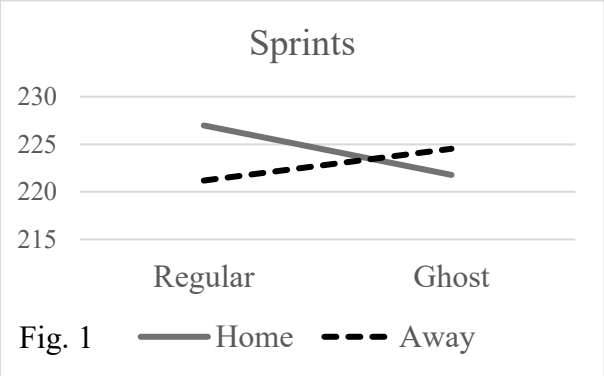

Fig. 1

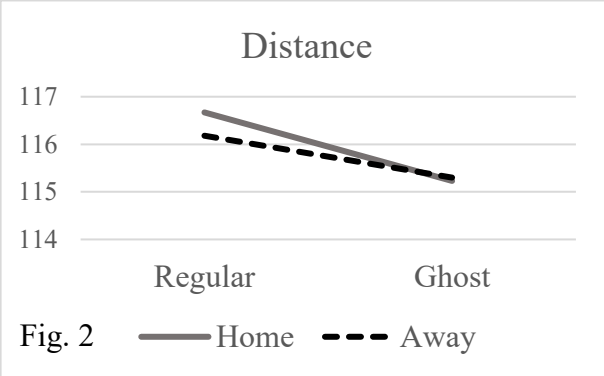

Fig. 2

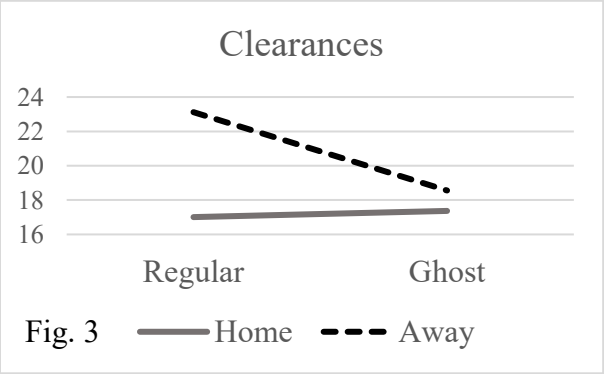

Fig. 3

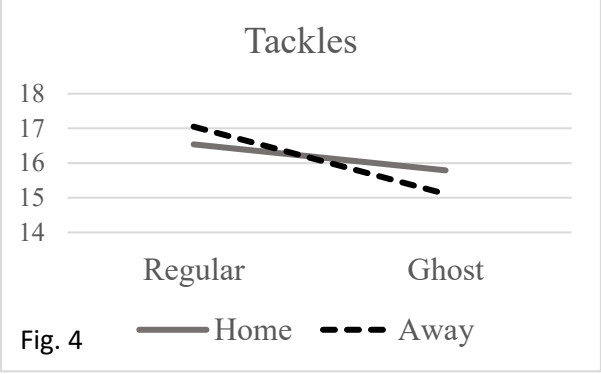

Fig. 4

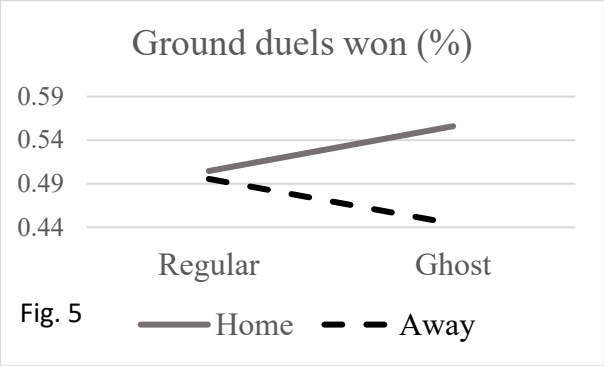

Fig. 5

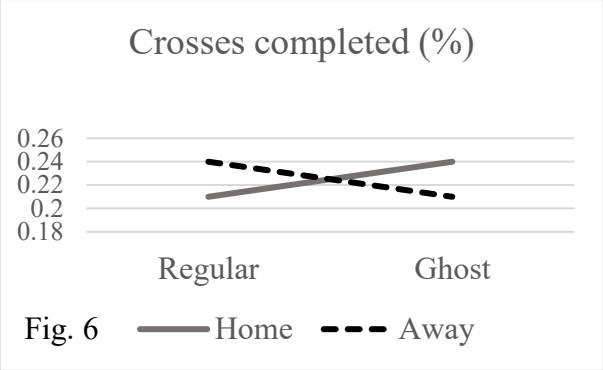

Fig. 6

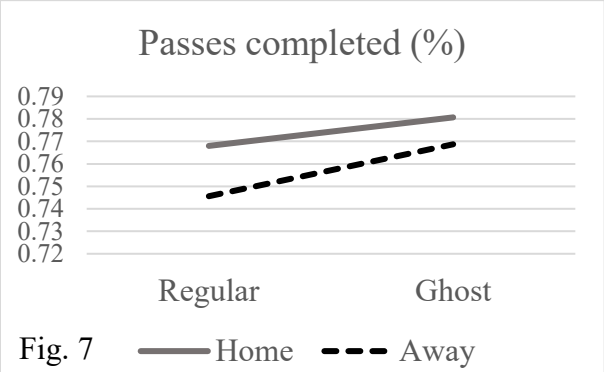

Fig. 7

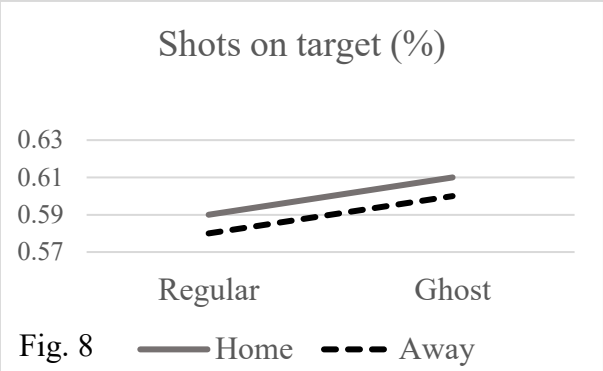

Fig. 8

5. Conclusion and Discussion

This study examines how spectator absence during the German football Bundesliga's 2019/2020 season affected home-team performance. Leveraging this quasi-natural experiment allows us to isolate the causal impact of crowd presence – avoiding biases inherent in studies that rely on endogenous variation in crowd size (Pollard & Armatas, 2017). Contributing to research on the diminished home advantage in ghost games (Leitner et al., 2023; Wang & Qin, 2023), we distinguish between effort-based and skill-based performance indicators. While previous work attributes the diminished home advantage to a reduction in referee bias (Bryson et al., 2021; Cueva, 2020; Reade et al., 2021) and offensive activity (Ferraresi & Gucciardi, 2023; Santana et al., 2021; Scoppa, 2021), our results show that crowd effects are shaped by the type of task.

The results of our nonparametric tests suggest that home teams outperform away teams in the effort-intensive metric sprints during regular games but not during ghost games. Furthermore, home teams cover a greater distance in regular games compared to ghost games. However, these results are not significantly confirmed in our regression analyses, which show a general decline of clearances and tackles in ghost games compared to regular games. While crowds may boost physical exertion (Triplett, 1898; Lazear & Rosen, 1981; Rosen, 1986), their influence is task dependent.

Skill-based performance shows a different pattern: the nonparametric statistics and regression results imply that home teams in fact win more ground duels in ghost games compared to regular games. Moreover, the regression analyses revealed that home teams' accuracy in cross is higher in ghost games than in regular games. However, there were no significant interaction effects of home advantage and crowd attendance on passes and shots on target. This suggests that crowd-induced pressure does not help with skill-based tasks and may even hinder performance (Baumeister & Steinhilber, 1984; Dohmen, 2008).

Our evidence highlights that home advantage is not uniform but varies systematically with the performance dimension. This task-specific perspective challenges simplified models of home advantage and offers practical

implications for coaching, tactical preparation, and stadium design. For instance, club managers could consider how elements like the proximity of fans to the field and the acoustics and atmosphere of standing sections (Edensor, 2015) influence player motivation and pressure. Additionally, sports marketing campaigns could emphasize the impact of fans on effort-based tasks, encouraging attendance to boost team performance. Conversely, situations that require skill – such as penalty kicks or free throws – a quieter or neutral environment may confer an advantage.

As with any empirical analysis, our study has several limitations. Firstly, the dataset is confined to a single season (2019/2020) in the German football Bundesliga, which restricts how widely the findings can be generalized across time, leagues, and sports. For instance, the extraordinary context of the COVID-19 pandemic may have introduced confounding psychological or physiological variables unrelated to crowd effects. Secondly, although we categorize performance tasks as either effort-based or skill-based, many football actions involve both components to varying degrees, making strict classification difficult. Thirdly, our analysis is based on observable match statistics, which may not capture more subtle psychological or tactical dynamics.

The limitations of this study open up several avenues for future research. One promising direction would be to extend this analysis to other major European leagues, such as the Premier League, Serie A, La Liga, and Ligue 1, to examine whether league-specific contexts – such as tactical culture, stadium design, or fan behavior – moderate the relationship between crowd presence and player performance. Another direction for future studies could be to examine subsequent seasons, particularly those in which fans were gradually allowed back into the stadiums. This would allow researchers to assess how quickly players readapt to crowd presence and whether performance patterns observed during ghost games persist or revert. Fischer and Haucap (2021) suggest that adaptation may vary by league level and previous exposure to large crowds, an idea that could be explored in further depth. A third direction would be to test whether the task-specific effects identified also apply to other sports. Jane (2022), for instance, finds that crowd presence negatively impacts batting performance in baseball, a highly skilled task. This lends weight to the notion of a more comprehensive framework in which task type and crowd context interact to influence performance outcomes. Finally, experimental research using biometric data or controlled psychological studies could help to isolate the underlying mechanisms, such as stress, motivation, or attention.

Overall, our findings support a more nuanced understanding of the behavioral mechanisms underlying home advantage and crowd effects, taking into account the nature of the performance task. This refined perspective could inform more targeted fan engagement strategies in professional sports, more effective coaching, and fairer competition design.

Conflict of interest statement: The authors declare no conflict of interest.

Data availability statement: The data can be found here https://doi.org/10.17632/p9mhr9fcxn.1.

Funding statement: The authors did not receive any funding for this study.

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Journal of Economics and Behavioral Studies (JEBS)
Vol. 17, No. 4, 2025 (ISSN: 2220-6140)

Property Rights and Entrepreneurship in the Context of Conflict: Evidence from Amuda, Northeast Syria

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Abstract: This article examines how changes in property rights protection, resulting from the collapse of formal institutions during the Syrian conflict, have influenced entrepreneurial activity. The study draws on qualitative research conducted in 2021 and is based on semi-structured interviews with 46 entrepreneurs in the town of Amuda in northeast Syria, complemented by secondary data from local institutions and media sources. The findings reveal a distinctive pattern of entrepreneurship in a conflict-affected context. Following the Syrian regime's loss of control over much of the region after 2012—previously characterized as a highly predatory state—and the emergence of a weak Autonomous Administration with limited institutional capacity, informal institutions assumed an increasingly important role in regulating economic activity. In this environment, informal social mechanisms, alongside the disruption of traditional supply chains, contributed to improved perceptions of property rights protection. As a result, Amuda witnessed the emergence of a new wave of predominantly productive and non-conflict-related entrepreneurship, rather than entrepreneurship driven solely by necessity or war-related opportunities. These findings challenge the prevailing consensus in the literature that entrepreneurship in conflict settings is primarily necessity-based. Instead, the study highlights the importance of context-specific institutional configurations and calls for a reassessment of dominant assumptions within conflict economics and entrepreneurship research.

Keywords: *Northeastern Syria, Amuda, Institutions, Property Rights, Conflict, Entrepreneurship*

1. Introduction

Traditionally, research on entrepreneurship has concentrated on the characteristics and resources of business owners, as well as their emotional, cognitive and behavioral responses (Eijdenberg et al., 2019; Welter, 2011). However, given increasing awareness of the importance of context, as noted by Ireland et al. (2001), it is inadequate for a comprehensive analysis of entrepreneurship. Studies that adopt an institutional perspective focus on their incentivizing or disincentivizing impact on entrepreneurship (Baumol, 1996). Brück et al., (2016) also highlight that such studies have been primarily undertaken in stable contexts, i.e. post conflict and in peacetime (Aldairany et al., 2018), with scholarly investigation on questions of entrepreneurship in countries experiencing conflict limited (Joseph et al., 2023). Eijdenberg et al. (2019) also point to the fact that most institution-focused research employs large-scale sample surveys and inter-country comparisons to construct a comprehensive understanding of institutions at a macro level but fails to offer a micro-level perspective on property rights, which is highly significant in the context of conflict.

This study adopts a property rights perspective to examine the phenomenon of entrepreneurship in the town of Amuda, located in Northeast Syria (NES). Amidst a prolonged civil war, this underdeveloped and impoverished region has experienced a notable increase in entrepreneurial activity. A recent study revealed that it had undergone a complete transformation and now exhibits highly favorable investment characteristics, including factories, agricultural projects and diverse commercial enterprises (Muhammad, 2021). This raises the question: *How does protecting property rights affect entrepreneurship in times of conflict?*

This study should be of interest to scholars, donors, peacekeepers, development agencies, governments, and entrepreneurs, not only in relation to NES and wider Syria, but also in relation to other conflict-affected regions around the world.

In this paper, we argue that productive (opportunity type), peaceful entrepreneurship, protected by new forms of property rights can emerge within conflict-affected contexts and even flourish when the restrictive elements of predatory formal institutions are removed and those introduced by informal institutions seek to encourage entrepreneurship.

The remainder of this article is structured as follows: The next section presents the theoretical background for our research, followed by an overview of the empirical background and research context. We then outline our methodology, including details of our data collection process. In the findings section, we report the results and discuss their implications in the subsequent section. Finally, we conclude with a summary of our key findings.

2. Theoretical background and limitations

Classical economic analysis begins from the premise that specialization and exchange enhance productivity and drive economic growth, as articulated by Adam Smith, by encouraging the development of new technologies and more efficient forms of production. However, the realization of exchange does not depend on market forces alone; it presupposes an institutional framework that governs economic interactions and reduces uncertainty. Within this framework, property rights play a central role in enabling exchange, as markets cannot function effectively in the absence of legal and social rules that protect ownership and regulate the use of resources. These rules are embedded in both formal and informal institutions, which shape the incentive structure—through rewards and sanctions—that influences the allocation of economic resources, including entrepreneurial activity (North, 1984; Acemoglu, 2005). When institutional arrangements operate effectively, they reduce transaction costs and encourage investment in productive assets.

Building on this institutional and property rights framework, entrepreneurship can take different forms depending on how incentives are structured and perceived by economic actors. When entrepreneurs initiate a business in response to identified opportunities, often categorized as opportunity entrepreneurship, they engage in innovation and contribute to economic growth. In contrast, necessity entrepreneurship is typically driven by survival considerations and may involve rent-seeking activities or forms of wealth redistribution that can impede growth. Opportunity entrepreneurs actively explore and exploit recognized market opportunities, whereas necessity entrepreneurs generally face constrained capacities to identify or seize such opportunities (Morris et al., 2023). The stability and efficiency of institutions play a crucial role in shaping these outcomes, as appropriate institutional environments mitigate risk for entrepreneurs (Sendra-Ponsa et al., 2022) while simultaneously fostering productive entrepreneurship with higher returns (Boettke and Coyne, 2009; Baumol, 1996).

Conflict exerts both direct and indirect impacts on entrepreneurship. The immediate consequences manifest themselves in the impairment of tangible and intangible assets, referred to as the shock component. Indirect consequences are associated with institutional collapse (Justino, 2009). Conflict destroys the social contract and leads to a fragile if not failed state (Penh, 2009). This means a crucial change in both formal and informal institutions (Abedtalas, 2024). Institutional changes also drive changes in property rights and incentive structures, resulting in the transfer of higher returns to rent-seeking entrepreneurs and those involved in the war economy, which can be unproductive and destructive (Naudé, 2007). Conflict alters the relative prices of certain commodities used in war and reduces barriers to entry into the market in general, reducing in turn the cost of finding potentially valuable opportunities (Brück et al., 2011).

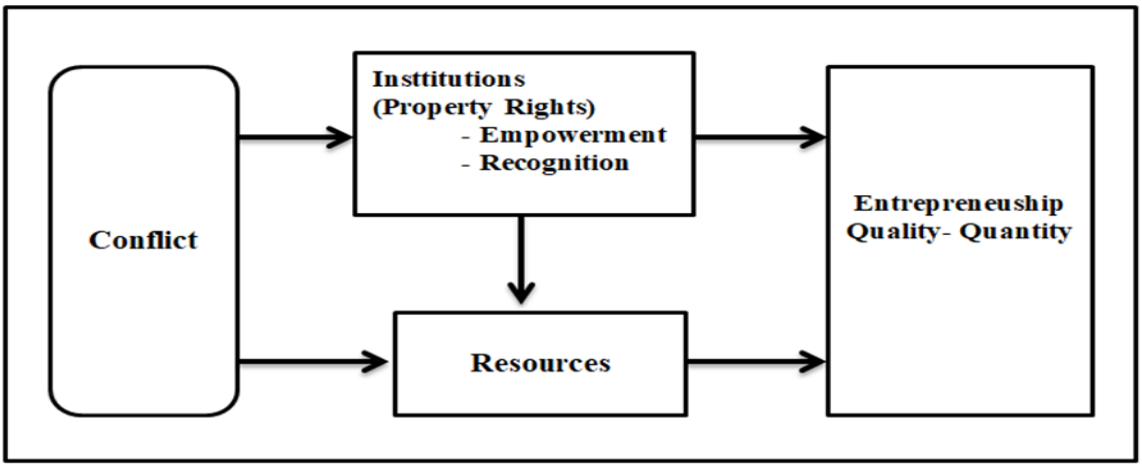
From a property rights perspective, "when a transaction is concluded in the marketplace, two bundles of property rights are exchanged." (Demsetz,1974: 163). "The value of the goods that are traded and, consequently, the terms of trade, depend on the content of property rights in those goods." (Pejovich,1972: 309). Property rights specify which resources can be owned and by whom, and how they can be used (Harris et al., 2020). With the protection of property rights, the cost and benefit to owners of the use of their resources is entirely at their own risk, with strong incentives for efficient use (Xu, 2013). Besley and Ghatak (2010) explain that the efficient allocation of resources is impacted by property rights, limiting expropriation and facilitating market transactions, thereby enhancing investment incentives and improving the collateralizability of assets, and facilitating credit transactions.

The state fails to protect property rights when it is predatory, or ineffective, or lacks power and authority. A predator state cannot protect property rights from its own distorted power of expropriation. An ineffective state will fail to invest sufficiently in public goods and infrastructure, such as courts and property rights registration agencies, without the ability to grant and rescind power is unable to protect property rights (Besley & Ghatak, 2010). By defining property rights as "a socially enforced right(s) to select uses of an economic good" protection depends not only on the state, but also on "informal social actions and prevailing ethical and moral norms … which can be found in abundance in informal institutions and more broadly in civil society" (Alchian, 1989:232). This perspective is important to understanding entrepreneurship in the context of conflict where the risk of state failure and ensuing disorder, leading to property violations and economic instability, is high.

Entrepreneurs' property rights are protected when they are free, beyond compliance with regulations, to make their own choices over their resources (Barzel and Allen, 2023). This requires the existence of resource empowerment and resource recognition. Infrastructure, including water and electricity supply, banking services, and financial assistance, falls under the umbrella of resource empowerment, facilitating entrepreneurial engagement. Resource recognition includes security, contract enforcement, market entry and product quality control, conflict resolution, and licensing, all of which legitimize and legalize the entrepreneur's resources as property rights (Abedtalas, 2024).

Building on the theoretical background outlined above, the framework guiding this research is as follows: In addition to its direct impact on resources, the war alters both formal and informal institutions and their roles in protecting property rights, though not always in the same direction. The effect on entrepreneurship depends on the net change in the level of property rights protection as perceived by entrepreneurs. This shift in protection influences the incentive structure, ultimately determining the quality and quantity of entrepreneurship (see Figure 1).

Figure 1: theoretical framework



Empirical background

A number of studies focusing on specific contexts, explored entrepreneurship from an institutional approach. For example, Valdez and Richardson (2013) and Stenholm et al. (2013) demonstrate that informal institutions are more important in incentivizing entrepreneurial activity than formal institutions, whereas Schüler (2022) argues that formal institutions, in general, play a greater role in entrepreneurial activities. Other researchers have taken cross-sectional samples from developing and developed countries. For example, Chowdhury et al. (2019), in their comprehensive study drawing on secondary data, analyzed the critical role played by both formal and informal institutions relative to the quality and quantity of entrepreneurship in 70 countries, both developed and developing, from 2005 to 2015, as confirmed by Sendra-Ponsa et al. (2022).

Yet others, also using an institutional approach, have examined entrepreneurship in transition economies, moving from planned to market economies. Futo et al. (1997) studied Hungary and concluded that during the first stage of the transition, there was a remarkable expansion of small businesses due to the collapse of large government companies, the removal of stifling regulations, and the existence of a legacy of helpful informal institutions. Aidis et al. (2008) demonstrate how Russia's unfavorable institutional environment contributed to low entrepreneurship rates, while Estrina and Mickiewicz (2010) discuss the challenges associated with inheritance following a prolonged period of communist rule within the framework of a so-called "path dependency."[1].

The institutional approach was also used to investigate the dual transition from central planning to the market economy and from war to peace. Hoxha (2009) investigated the barriers to entrepreneurship in Kosovo and found that even in the absence of an effective formal institutional framework, entrepreneurship expanded due to the presence of informal institutions. Williams and Vorley (2017), who investigated Kosovo seven years later, concluded that it had not faced the same challenges as entrepreneurship in other transition countries that faced challenges in extending inherited path dependency. Kosovo, on the other hand, forged an entirely new path by dissolving Yugoslavia's old state institutions and building new institutions from the ground up, with local support for entrepreneurship. The Williams and Vorley (2017) study also confirmed that institutional harmonization, formal and informal, determined the level of productivity of entrepreneurship. This mismatch between formal and informal institutions was addressed in a study by Muhammad et al. (2016) in a conflict-affected area of Pakistan, which focused on the institutional pressures placed on entrepreneurs in conflict situations, to which they responded by managing to establish their legitimacy across the different parties to the conflict.

As with much of the literature informing the theoretical background, the continued reliance on an institutional approach tends to overlook the specific issue of property rights protection. While the study on Pakistan touches on entrepreneurship in conflict settings, it does so from a limited perspective, and studies on Kosovo largely focus on the post-conflict period. More specifically, limited attention has been paid to how property rights are perceived, enforced, and protected at the micro level during ongoing conflict, rather than in post-conflict contexts.

This study on entrepreneurship in Amuda addresses this gap by examining entrepreneurship through a property rights protection lens in an active conflict setting. Given the particular characteristics of the Amuda context, the following section provides a detailed discussion of the research setting.

Research context

Amuda is a town of 150,000 people in Al-Hasakah, a province in Northeast Syria NES[2], with a Kurdish majority (see Figure 2). Before the commencement of the conflict in 2011, the pro-Arab Syrian government endeavored to assimilate the region (Van Wilgenburg and Fumerton, 2022) through the implementation of discriminatory economic and political legislation. For example, in 1962, the exceptional census[3] resulted in approximately 120,000 Kurds losing their Syrian citizenship and being reclassified as Ajānib (foreigners in Arabic) (Schmidinger, 2020) and stripped of their property rights. What is referred to as the "Arab Belt" initiative[4], implemented in the 1970s and 1980s aimed to eliminate what was referred to as the Kurdish "threat" by relocating Kurds to Arab-dominated areas and colonizing traditional Kurdish areas with Arab settlers (Tejel, 2020). In 2008, the Syrian government issued Decree No. 49, which declared Al-Hasakah Province as a border area enabling the imposition of standard border area restrictions such as prohibiting the trade of real estate and property transfer without prior approval from security and administrative agencies. This not only complicated the process of property trading, but also made it impossible on occasion, violating property rights. In his study, Jongerden (2021) employed the theoretical framework of "the center and the periphery" to

[1] 'Path Dependency' is an economics, social and political science concept proposing that decisions or outcomes at a particular point in time are heavily influenced by historical events, past choices and initial conditions, rather than just current circumstances.
[2] NES includes the governorates of Hasakah, Raqqa, parts of Deir ez-Zor, and parts of Aleppo.
[3] This represented 20% of the overall Syrian Kurdish population in 1962, leaving stateless and unable to claim an alternative nationality. https://www.hrw.org/reports/1996/Syria.htm#:~:text=In%201962%2C%20an%20exceptional%20census,no%20claim%20to%20another%20nationality.
[4] The goal of the 'Arab Belt' initiative was to weaken Kurdish political and cultural influence.

contextualize the prevailing circumstances in the region. He labelled the governmental policies applied to Al-Hasakah, as exhibiting characteristics of intentional "de-development". As a result of constrained industrial and service sector activities, the province was forced to become over-reliant on seasonal agriculture and livestock rearing for its economic survival. From a property rights perspective, the region was subjected to dysfunctional governance and what might be more aptly defined as a "super-predatory" state.

Figure 2: Map of Syria highlighting Amuda.

The conflict forced the government to withdraw almost entirely from Al-Hasakah[5] Leaving the Autonomous Administration of North and East Syria (AANES) to assume power in 2014, following its formation. Although under what is referred to as the AANES "social contract"[6], Private property is protected (Item 70). AANES also wanted to build an alternative to the market economy, which could have negative implications for property rights protection and private investment. According to the social contract Item 105, the Council of Economy and Agriculture:

"…E*stablishes cooperatives that achieve a participatory economy and develops projects in the field of securing sources for imports and investments. It works in coordination with finance commissions and committees to open the way for investing money in the communal economy.*"

The alternative AANES, economic model, referred to as "communal economy", is *"based not on profit but on the fairer redistribution of wealth*" (Knapp, 2015). Such a model does not deny "*private property, but rather has the goal of putting private property in the service of all the people*" (Knapp, 2015). It depends on a cooperative model, but has to date played an insignificant role in the province's economy. "*Strategically important areas of production such as electricity or the fuel supply were taken over by the new [quasi] state authorities. Private enterprises and large-scale landholdings remained*" (Schmidinger, 2018: 121). The result is an "*economy … based on a mixture of war economy, small capitalism, and subsistence production of food within which the cooperatives lead a niche existence instead of representing a new economic system*" (Schmidinger, 2018: 121).

[5] The Syrian regime withdrew from the majority of northeast Syria after 2012, following territorial gains by opposition factions.

[6] The AANES Social Contract serves as the region's constitution. It outlines the theoretical and practical principles, laws, and organizational rules that define the relationship between the administration and the people. https://rojavainformationcenter.org/2023/12/aanes-social-contract-2023-edition/

Against a general background of civil war and an environment where supposedly legal property rights are undermined by the communal economy model, productive investment will be increasingly discouraged (Schmidinger, 2018; 2020). The continued deterioration of infrastructure and poor public services under AANES, as evidenced by frequent power outages, poor fuel and road quality, and deteriorating water and sewage networks, poses evident challenges to businesses. In addition, investment laws are poorly formulated, resulting in constant confusion as to the responsibilities of the different AANES agencies in charge of quality control, business licensing and taxation. This last is further exacerbated by corruption amongst those in charge (Muhammad, 2021) and continued regime influence, due to its ongoing presence in pockets within Al-Hasaka, leading to power conflicts between the two entities.

From the perspective of property rights, the situation is a mix of semi-predatory and ineffective quasi-state influence, with neither having a monopoly of power. All of this could be sufficient reason for a challenging environment for entrepreneurship (Justino, 2009).

3. Methodology

Implementation of the study took place in 2021, with the selection of Amuda as the focus informed by our observations and information gleaned from various media platforms, such as Radio Arta FM and Radio Urkesh FM. These indicated a surprise increase in entrepreneurship in Amuda despite the conflict-affected context. Three of the five research team members also had strong ties to Amuda, simplifying the task of contacting suitable respondents and establishing trust.

Secondary data was gathered from AANES agencies, non-governmental organizations (NGOs), and local radio station websites, to gain initial insights into the context and the seemingly vibrant entrepreneurship in Amuda. Since the goal of this research was to develop our knowledge with regard to the determinants of entrepreneurship in a challenging environment, we used qualitative methods in the form of semi-structured interviews (Creswell et al., 2007).

We used information identified from radio station websites, the researchers' personal connections to implement a snowballing approach identifying a sample set of 46 entrepreneurs for us to interview, who had established their businesses post 2011. The interviewees' businesses were located in areas across the town of Amuda as well as offering a cross-section of business sectors, e.g., services, industry and trade, to ensure the sample was representative.

To allow the study researchers to clarify the potential role of entrepreneurship whether productive or non-productive, the semi-structured interview instrument (see Annex) was designed to enable collection of data to determine the type of entrepreneurship – necessity or opportunity; to establish what the respondent entrepreneurs' resources were that were used to identify and exploit opportunities; and finally, to explore property rights protection. With regard to the question of property rights, respondents were asked to describe the nature of their interactions with formal agencies, such as licensing, control, public services, infrastructure, and tax etc., as well as their experience of societal attitudes in general. The interview instrument also allowed for the initial capture of personal status data, such as education, age, origin, and previous jobs, as well as eliciting information on the factors that had facilitated and/or hindered their entrepreneurship; how the entrepreneur dealt with the contextual conditions; and their longer-term expectations as the Province transitioned hopefully towards peace.

The first interviews were carried out by phone or internet, e.g. WhatsApp and other platforms, but weak responses led a research team member to travel to Amuda to conduct 30 of the 46 interviews in person. Of the 30 in-person interview two were dismissed due to a lack of useful data proffered and apparent bias. Two extra interviews were conducted with AANES representatives. Interviews were coded for analysis using four themes identified from previous studies: 1. Direct Impact of the War on Entrepreneurship; 2. Institutions; 3. Entrepreneurship: Start-up Resources; and 4. Productivity of Entrepreneurship, before refinement across the following sub-themes: i. Entrepreneurship Type: ii. Peace Possibilities; iii. Opportunity Identification; iv. Exploitation Resources; v. Formal Institutions; and vi. Informal Institutions.

Interviewees were fully apprised of the purpose of the study, the intended use of the study data, their opportunity to withdraw before the anonymization of the data, clarification as to data protection and confidentiality, prior to their providing consent orally or in writing. The interview files were uploaded to a secure OneDrive that was only accessible by the study team, with each file assigned a unique code to ensure that personal information remained protected. This qualitative approach is especially appropriate for capturing entrepreneurs' lived experiences and perceptions of property rights protection in a volatile and institutionally fragmented context.

4. Findings

Table 1 shows the demographic characteristics of the entrepreneurs in 2021. The findings are organized around four main themes that capture the impact of conflict, institutional dynamics, entrepreneurial resources, and the productivity of entrepreneurial activity in Amuda. In terms of age range, approximately 63% respondents were 45 or under. We found that there had been a rapid expansion of small projects since 2012, coinciding with the onset of the crisis but before the start of military operations in Al-Hasakah. This expansion came to an abrupt end with the arrival in the Province of military operations, fluctuating in tandem with the proximity of the conflict.

The various businesses were divided into three sectoral categories: service, industry, and trade, with the majority categorized as micro and small industrial enterprises as reflected by employee numbers. Approximately 43% (micro) had five or fewer employees and another 30% (small) had six to ten employees. This finding is hardly surprising given the context of conflict and the underdevelopment of the region pre-2011, as well as scarce financial resources. Given the context, investment of large sums, where these exist, is considered with extreme caution.

Interviewee Profiles: Most entrepreneurs interviewed were Kurds (98%), as would be expected in Amuda, which has a Kurdish majority, with the population of Amuda made up of locals, returnees, and internally displaced persons, with these last representing 18% of study respondents. The limited number of female led-businesses and entrepreneurs in Amuda meant that 95% of interviewees were men who tend to dominate economic activities.

Table 1: Demographic Characteristics of Interview Sample

		Number	%			Number	%
Age range	30 and below	9	20	Sector	Service	10	23
	31-45	19	43		Trading	15	34
	46 and above	12	27		Industry	19	43
	NA	4	9	Employee number	5	19	43
Establishment year	2012	6	14		6_10	13	30
	2013	2	4		11_15	5	11
	2014	1	2		More than 15	6	14
	2015	5	5		NA	1	2
	2016	6	14	Ethnicity	Arabic	1	2
	2017	3	7		Kurdish	43	98
	2018	2	5	Gender	Female	2	5
	2019	5	11		Male	42	95
	2020	8	18	Residency	Displaces	8	18
	2021	6	14		Returnee	5	11
					Local	31	71

Theme 1: Direct impact of the war

None of the businesses involved in the study were conflict-related; however, some of them benefited from the current crisis conditions and resulting market segmentation, as well as the loss of restrictions imposed by the regime on economic activity in the region. Despite consideration having been given to the crisis context before establishing their businesses, the related uncertainties still caused them concern. For example interviewee 3 noted that "*The economy is linked to the political situation. Our political situation is tense and there is no stability*.

Concerns were also expressed in relation to cuts in supply chains, with approximately 50% of the respondents also expressing fear of Turkish military operations and their impact on their businesses: "*For example, the Turkish military operations frighten people, so they reduce buying and selling*" (Interviewer 5). There is also a problem of emigration, including from Al Hasaka due to the war, with resulting labor shortages: "I*n conflict situations…. people flee abroad to Europe, and almost all young people migrate abroad*" (Interview 9). However, a small group of respondents, with negligible levels of capital tied up with their businesses, only expressed indirect concerns relative to the uncertainties of the Syrian situation, "*There is no direct impact, but the conflict affects all businesses and therefore we also lose. But for our work we do not lose much because there is no large capital in our work*" (Interview 14).

Strategies used by respondents to address uncertainties and fluctuations, included the reduced or halted production of certain goods, and the expansion of others. "*If the conflict continues…. the business will fail. For example, we had the same business in Tal Tamr but closed it due to the Turkish military operations.*" (Interview 16). Others simply chose to reduce their investments: "*After the occupation of Afrin, we no longer dared to invest our money*" (Interview 35).

Theme 2: Institutions

Through the interviews, we explored both formal and informal institutions, including the effectiveness of AANES in terms of both empowering and recognizing property rights, through their various related roles including licensing, monitoring, tax collection, and the provision of core public services, such as electricity, water and roads.

Formal institutions

Although a small number of respondents reported AANES as carrying out its responsibilities well, including provision of related services, and without excessive taxation "*They [AANES representatives] approached us to ask us to register our business and pay related taxes annually. The sum is modest so it doesn't impact us negatively. AANES also offered us diesel subsidies following licensing.*" (Interview 2) This reflected low expectations due to the conflict conditions and recognition of AANES' still limited administrative capacities: "*AANES is in the process of establishing itself and needs to invest in capacity building, for example, staff recruitment and training.*" (Interview 2). Nevertheless, the majority of interviewees expressed dissatisfaction: *"AANES visited us to register the business and ask questions…, but has not provided us with any services."* (Interview 44). Some also considered that it had negatively affected their businesses due to inconsistent regulations: "*When we need something, we need to submit a request, but receive no response. … We are supposedly supervised by the AANES Board of Economy although it isn't able to support us as it lacks the necessary power and means."* (Interview 42). Another group complained about mismanagement: *"Businesses are being established in an unregulated and chaotic environment…. Businesses emerging in my field [cleaning products] and neighborhood have become common… They mix all sorts of uncontrolled ingredients to create detergents to sell locally."* (Interview 30). Many businesses have attempted to get licenses from both AANES and the Damascus government, with the conflict of power between them seen as another negative dimension: "*Divided power between the two parties creates problems for us*" (Interview 2). Even in the absence of predatory behaviors, the lack of competencies and effective regulatory bodies, as evidenced above, coupled with the reality of competing powers, has weakened recognition of property rights.

The state of AANES services and infrastructure, such as access to electricity and water, was also frequently criticized: *"They have not provided us with anything yet, although we pay taxes. I have applied for an electricity connection but received no response to date ... We also applied for a license for a generator, which was refused."* (Interview 4). Another entrepreneur also noted issues with the road network: *"We need a road to the factory.... As for diesel, formally we are told that there should be good, cheap industrial diesel, in reality we are forced to buy*

expensive diesel." (Interview 40). Complaints were also made about the lack of an industrial zone "*When I arrived in Amuda, and registered shops and warehouses, there was the idea of establishing an industrial zone, but so far nothing*" (Interview 30).

Entrepreneurs' response to the lack of access to services and poor infrastructure has been to turn to the private sector, to use generators, or to relocate. They also dealt with some of these failures themselves, for example by digging wells or repairing roads. The failure to deliver key services and suitable infrastructure highlights a failure to empower property rights.

Informal institutions
Many of the entrepreneurs interviewed, believed that Amuda offered a safer environment in which to establish businesses with local informal mechanisms supporting the recognition of property rights, including for the resolution of property-related disputes:
"There is something special about Amuda, which is the absence of theft. If our business were in another area, we would need many locks in addition to fencing. We have been in Amuda without a fence for nine years without suffering any thefts." (Interview 19).
"I love Amuda, it is not like other cities. Considering it is purely Kurdish, there are tribal relations… when problems occur, they are quickly resolved" (Interview 2).
Because of this, entrepreneurs established their businesses in Amuda despite a limited availability of skilled labor. *"We recruit from Al-Hasaka city amongst other cities and towns in northeast Syria."* (Interview 30).

Theme 3: Entrepreneurship: Start-up Resources
Since entrepreneurship involves the discovery and exploitation of profit opportunities, the resources utilized in this process underscore the role of formal and informal institutions in empowering and recognizing property rights

Identifying Opportunity Resources
The interviews showed that entrepreneurs adopted different approaches to identifying opportunities. Some did so through friendship or family networks, others by identifying a familiar field or an opportunity that allowed them to draw on experience and expertise.
"We had no experience in this field, but some friends drew our attention to it. We grew up in a business environment….my father was a merchant long ago." (Interview 22).
"I have been working in this field for more than twenty years…in Jordan, Libya, Iraqi Kurdistan, then Germany, and finally I returned to Amuda to stay here and start my business." (Interview 26).
The identification and development of these opportunities relies on human resourcefulness and skills, as well as social capital, which is to say, informal institutions through which property rights can be empowered, regardless of the presence or input of formal institutions.

Exploitation Resources
As discussed earlier, entrepreneurs make use of four primary resources: Human, financial, social, and physical. Most of those interviewed had some previous professional experience and expertise in their fields on which they were able to draw, as in the case of an entrepreneur who was running a battery factory in Amuda:
"*I worked in a battery factory for four years, where I was in charge of around seventy-five percent of the business.... which allowed me to start this business."* (Interview 37).
"*I benefited from my experience, as I owned a factory in Aleppo…in addition to being a graduate of the Faculty of Science."* (Interview 19)

Yet others had benefited from training courses "*I was working in Lebanon… I attended training courses on fashion design …*" (Interview 41). A smaller cohort of entrepreneurs had used their initiative to start a business in a totally new field in which they had no previous experience, *"I used to work as a driver... then I became a baker, as there were few bakeries in Amuda."* (Interview 29)

In the case of obtaining financial resources, most entrepreneurs relied on self-financing or their social networks, such as borrowing from friends: *"I have a friend from Aleppo who helped me with raw materials*" (Interview 30) or from close or more distant relatives, involving, in some cases, the sale of family assets:

"Financing was mainly with the help of my father, family and friends. It is debts that I will repay.... even my wife sold her jewelry to help me finance the business." (Interview 18). Only four of the forty-six interviewees secured grants, two from AANES and two from international donors.

With regard to physical capital, such as land, real estate, machinery etc. before the crisis, entrepreneurs wanting to open a new business, were constrained by seemingly insurmountable regime regulations linked to the licensing or disposal of property. Due to the conflict, these have since disappeared from non-regime-controlled areas, simplifying property exchange procedures, however, fears were also voiced as to how their new businesses would be affected by the end of the conflict. Some considered the conflict had been beneficial in that respect:
"We had a small business started in 2000… but were unable to expand it before 2011 due to the impact of Legislative Decree No. 49[7]. However, after 2011 we were able to start a new business, without those restrictions." (Interview 31)
"The longer the conflict continues, the more Rojava will improve and progress. Currently, the situation is better than before 2011, when we were oppressed by the regime." (Interview 32).

Theme 4: Productivity
Entrepreneurship Type
As noted in the literature, there are two broad types of entrepreneurships: 'opportunity' and 'necessity'. However, the literature fails to explore in any depth a third 'mixed' type combining both 'opportunity' and 'necessity', all three of which were evident in the case of Amuda, where the majority of entrepreneurs were motivated by both the need to work and the identification of an investment opportunity. 'Opportunity' entrepreneurs were fewer in number, with the smallest group, those who had become entrepreneurs out of necessity.

With regard to the largest 'mixed' entrepreneurship group, one of those interviewed spoke for many others when he described what had driven him to start his business: *"Because of the war, there were no opportunities relevant to my degree, so ...we established a small lab linked to cleaning products … where previously there were none."* (Interview 30)

In terms of 'opportunity' entrepreneurs, one of those interviewed had based his business on an identified demand for consumption commodities. *"Our understanding of the region and its situation, led us to do something industrial and productive … the industries that succeed in the region are light industries, so we focused on consumption commodities."* (Interview 42)

In respect of those whose entrepreneurship was borne out of necessity, this included people with limited skills and resources: *"I set up this business because I worked in this field since my childhood and only know this work."* (Interview 25)

The Possibility and Perceived Impact of Peace
Although entrepreneurs' views on the possibility of peace varied, the majority (60%) believed that it would have a positive impact on their lives and businesses:
"*We are optimistic about peace in Syria, which will enable the set-up of many new businesses.*" (Interview 12)
"*Its impact not only on my business but on society as a whole will be positive*" (interview 36).

Discussion
The discussion interprets the findings through an institutional and property rights lens, emphasizing the interaction between formal and informal institutions in shaping entrepreneurial incentives. In general, our findings concur with those of other studies carried out in different contexts. For instance, Schüler (2022) confirms that institutions (formal and informal) can play both a positive and negative role in entrepreneurship.

[7] Legislative Decree No. 49 (2008) imposes strict regulations on property transactions in border areas. The decree requires individuals to obtain prior authorization from the relevant authorities before creating, transferring, modifying, or acquiring any real property rights in these regions.

Valdez & Richardson (2013) and Stenholm et al. (2013) also highlight the effective role of informal institutions relative to that of formal institutions.

When compared to other conflict-affected areas, the Amuda experience shows some similarities to those of Kosovo (Hoxha, 2009; Williams & Vorley, 2017) and Pakistan (Muhammad et al. 2016). As in Kosovo, many of Amuda's established formal institutions did not survive the conflict. With new formal institutions slow to replace them, existing informal institutions came to the fore and played a crucial role in supporting entrepreneurship. However, in Kosovo, both informal institutions and new formal institutions supported entrepreneurship, which was not the case in Amuda.

In the case of the Swat Valley in Pakistan, despite the conflict between the Taliban and the central government, government institutions remained active in the area, forcing entrepreneurs as in Amuda to navigate between two sets of authorities (Martens et al., 2007), although unlike in Amuda no alternative economy emerged.

Quite a number of studies consider all entrepreneurship in transitional countries and conflict areas as being driven by necessity (Cañares, 2011; Ciarli et al., 2010; Ciarli et al., 2015); however, our findings show that the majority of entrepreneurship in Amuda fell predominantly within the 'mixed' and 'opportunity' types. We suggest this is due to the following three factors: the first being the restricted influence of the Syrian regime following its defeat in the area; the second, the overall weakness of AANES; and the third, the segmentation of the Syrian market as a result of the conflict.

Prior to its defeat, in an attempt to pacify the population in NE Syria, the regime had begun to reduce its discriminatory development economic policies in the area, increasing property rights protection from its predatory behavior, opening up a considerable number of new investment opportunities for entrepreneurs. In April 2011, the authorization of building permits was "*transferred to Al-Hasakah Governorate instead of Damascus to enable the Kurds to use lands and real estate in their place of residence*" (Fawaz, 2018:25). Restoration of citizenship stripped from Kurds as part of the 1961 census and the suspension of Decree 49 in 2012, also had a major impact. A large number of the entrepreneurs interviewed pointed to those as enablers, removing prior restrictions on their ability to buy and sell real estate:
"*The war benefited me in general…. helping me open my factory which at the time of the regime's control, was not possible.*" (Interview 22).
Welter and Smallbone (2011) confirm that institutional change can positively affect the development of entrepreneurship when it removes or reduces barriers to entry and/or exit from the market opening up new opportunities.

Without ignoring its negative impact, ironically AANES' weaknesses also played a positive role, given its limited authority, regulatory ambiguities and confusions, and lack of experience and expertise, opening the ways for informal institutions. Our interviews with two AANES officials, in an attempt to clarify their position on entrepreneurship, demonstrated the absence of a clear vision and ambiguity in terms of procedures. This explains AANES's failure to establish an alternative economy aligned with its ideology, and its *de facto* acceptance of a market economy.

We observed that the reduction in administrative and regulatory restrictions linked to economic activities, triggered widespread resolve to establish new businesses. However, the minimal nature of AANES' administrative services also resulted in increasing corruption and tensions between the various regulatory agencies, posing new challenges. Some interviewees were clearly able to run their businesses without any engagement with AANES *"The business is free, there are no subsidies, taxes, or licenses, they did not provide any services and did not ask for anything either."* (Interview 39).

Previous discriminatory de-development economic policies had forced NES to become dependent on other areas for the majority of its needs, whereas the conflict, the region's relative isolation, and reduced outside competition, offered a new and attractive investment environment. "*After the closure of the road to Aleppo in 2013, I took advantage of the opportunity and new demand to open my business*" (Interview 4). International aid in the form of cash programs and new employment opportunities, and the flow of displaced people to the area, were evident factors influencing and facilitating growing demand. This marries with the finding of Bruck et al.

(2011) that some entrepreneurs benefited from increasing local demand due to migration and international aid.

5. Conclusion

This study contributes to the literature on entrepreneurship in conflict-affected contexts by demonstrating that productive and opportunity-driven entrepreneurship can emerge when property rights are perceived as protected, even in the absence of strong formal institutions. To this end, the study examines the phenomenon of entrepreneurship in Amuda through an institutional approach grounded in a property rights perspective.

However, our data analysis revealed that most new enterprises in Amuda were of the 'mixed' and 'opportunity' type of entrepreneurship, challenging the views of many scholars who would expect entrepreneurship in relatively poor and conflict-affected contexts, such as Amuda, to be driven by necessity, i.e. of the 'necessity' type, and linked to conflict-related activities.

Despite its inherent dangers, the Syrian conflict has had a positive impact on entrepreneurship in Amuda, improving the property rights protection as a result of the decreased influence of the predatory state institutions, regulations and policies, the emergence of a less predatory and ineffective state, and an increasing role for informal community-based institutions, all of which have been shown to increase property rights protection and incentivize productive entrepreneurship.

This study provided a unique opportunity to enhance our understanding of the roles of formal and informal institutions in changing levels of property rights protection and how that in turn shapes and influences both the level and types of entrepreneurship, emphasizing the importance of context-specific characteristics.

Given that the dominant forms of entrepreneurship identified in Amuda are predominantly productive, they have the potential to contribute significantly to the broader economic development of Northeast Syria and to support the prospects for sustainable peace. In light of this potential, the Autonomous Administration of North and East Syria (AANES) needs to move beyond the discourse of the alternative or communal economy and articulate a clear economic vision that upholds private property rights while prioritizing a market-oriented approach.

More broadly, the findings indicate that policymakers in fragile and conflict-affected contexts should focus on reducing regulatory ambiguity, improving coordination among governing bodies, and constructively engaging with informal institutions that play a role in protecting property rights. These efforts should be complemented by measures to streamline and unify government agencies responsible for supporting entrepreneurship, enhance administrative efficiency, and strengthen bureaucratic capacity. In addition, establishing regular channels for dialogue and consultation with entrepreneurs is essential to ensure that policies are responsive to the needs of the business community. Finally, targeted investments in public services and infrastructure, alongside the development of business incubators, advisory bodies, and training and community education programs, are likely to be crucial in fostering a more supportive and sustainable entrepreneurial environment. The study's narrow geographic focus on Amuda and its relatively small sample of entrepreneurs, limit our ability to generalize its findings, encouraging further studies on other parts of NES.

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Journal of Economics and Behavioral Studies (JEBS)
Vol. 17, No. 4, 2025 (ISSN: 2220-6140)

Human Capital and Graduate Employability in Public Universities in South- Western Uganda

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Abstract: This study investigates the relationship between human capital and graduate employability in public universities in South-Western Uganda. It aims to provide empirical evidence on how university human capital influences graduates' labor-market readiness. Guided by a positivist paradigm, a cross-sectional design was employed. Data were collected from 377 graduates and 122 academic and administrative staff across three public universities. Structural Equation Modelling (SEM) was used to test the hypothesized relationship between human capital and graduate employability. Results indicate a significant positive relationship between human capital and graduate employability. Universities with skilled, motivated, and professionally competent staff enhance graduates' employability by developing relevant skills and supporting processes that ensure these skills are effectively acquired. Deficiencies in human capital constrain the development of employability outcomes. University leaders should strategically invest in human capital through targeted recruitment, continuous professional development, and performance management linked to employability outcomes. Curricula should embed employer-valued skills such as critical thinking, communication, adaptability, and problem-solving. Strengthening institutional employability support, including career services and industry engagement, is critical for translating staff capacity into labor-market-ready graduates. The study contributes to the literature by highlighting the central role of academic and administrative staff in shaping graduate employability in resource-constrained public universities. It provides context-specific evidence from Uganda, clarifying how staff competence, motivation, and leadership collectively influence labor-market outcomes.

Keywords: *South-western Uganda, Human capital, Employability skills, Public universities, Graduate employability*

1. Introduction

Graduate employability has emerged as a critical concern for policymakers, employers, and higher education institutions worldwide, driven by persistent mismatches between graduate capabilities and labor market requirements. Rapid technological change, globalization, and evolving work structures have fundamentally altered skill demands, placing increasing pressure on universities to produce graduates who are adaptable, productive, and employment-ready (Winterton & Turner, 2019; Mainga et al., 2022). Despite expanding access to higher education, many graduates struggle to secure suitable employment, particularly in developing and emerging economies, where labor markets are less absorptive and institutional capacity is constrained (El Baradei & Kadry, 2022; OECD, 2022). Globally, graduate employment challenges cut across both developed and developing contexts. Evidence from countries such as India, China, the United States, and several European economies shows that significant proportions of graduates experience unemployment or underemployment despite holding formal qualifications (Nghia, 2019; Kang & Mok, 2022; Calvo & García, 2021; Sharma & Ahlawat, 2024). These patterns underscore the systemic nature of graduate employability challenges, suggesting that formal educational attainment alone is insufficient to guarantee successful labor market transitions. The situation is particularly acute in Sub-Saharan Africa, where rapid expansion in higher education enrolment has not been matched by commensurate growth in graduate-level employment opportunities. Approximately half of graduates in the region encounter difficulties securing employment annually, largely due to skill mismatches, limited practical competencies, and weak alignment between university training and employer needs (ILO, 2021; Zeleza, 2021; Asumadu et al., 2022). Although graduates possess academic credentials, employers frequently report deficiencies in job-relevant skills, resulting in persistent unemployment, underemployment, and occupational mismatch (Morsy & Mukasa, 2019). In Uganda, graduate employability challenges are especially pronounced. Recent statistics indicate that only about 12.86% of annual graduates—approximately 90,000 out of 700,000—access viable formal employment opportunities (Mastercard Foundation, 2025).

Furthermore, over 30% of individuals with a university degree remain unemployed, with female graduates disproportionately affected (UBOS, 2023). These challenges persist despite extensive public investments in

higher education and the implementation of multiple national programs aimed at enhancing youth skills development and labor market participation. The continued prevalence of graduate unemployment suggests that deeper institutional factors within universities may be constraining graduates' employability outcomes. From a theoretical perspective, Human Capital Theory provides a foundational framework for understanding graduate employability by emphasizing the role of education, skills, and competencies in enhancing individual productivity and labor market value (Becker, 1993). Universities are therefore expected to function as key sites for human capital development, equipping graduates with knowledge, skills, and attributes that improve their employment prospects. Complementing this view, Signaling Theory suggests that educational qualifications signal graduates' capabilities to employers, influencing hiring decisions and labor market outcomes (Spence, 1974). Together, these theories underscore the centrality of human capital in shaping graduate employability.

Applying Human Capital and Signaling theories to Uganda's higher education landscape highlights how deficiencies in institutional human capital may directly impede graduate labor market success. Empirical evidence consistently demonstrates a positive relationship between human capital and graduate employability, with studies highlighting the importance of knowledge, competencies, and transferable skills in facilitating successful school-to-work transitions (Clarke, 2018; Römgens et al., 2020; Abelha et al., 2020; Donald et al., 2024). However, much of the existing literature focuses on students in developed economies or examines employability at the individual level, offering limited insight into how institutional human capital within universities contributes to graduate employability in developing contexts. Notably, in Sub-Saharan Africa—and Uganda in particular—empirical research examining the role of university human capital in shaping graduate employability remains scarce. Existing studies often emphasize curriculum content or student competencies while overlooking the broader institutional human capital embedded in academic and administrative staff responsible for designing, delivering, and assessing learning outcomes. This gap limits understanding of how universities' internal human capital capacity influences graduates' readiness for the labor market. Against this backdrop, this study investigates the effect of human capital on graduate employability in public universities in Southwestern Uganda. By focusing on institutional human capital as a critical determinant of employability outcomes, the study contributes to the literature by extending human capital theory to a developing-country higher education context. Empirically, it provides context-specific evidence on how universities' human capital influences graduate employability, while practically, it offers insights for policymakers and university managers seeking to enhance graduate employment outcomes through targeted investments in academic capacity development.

2. Literature Review

Theory

Human Capital Theory, introduced by Schultz (1972) and developed by Becker (1993), emphasizes the role of education and training in enhancing individuals' productivity, competitiveness, and employability. It views human capital as the combination of knowledge, skills, and experiences that increase one's value in the labor market (Tomlinson, 2017; Mgaiwa, 2021). The theory posits that investment in education leads to higher productivity and economic growth, with the labor market rewarding individuals based on their human capital attributes such as qualifications and skills (Nwajiuba et al., 2020). In relation to this study, the theory is relevant because public universities are expected to equip graduates with knowledge and competencies that enhance their employability and readiness for the labor market (Pitan & Muller, 2019). However, the theory has been criticized for assuming that education automatically translates into employment and for overlooking factors such as labor market conditions, creativity, and informal learning opportunities (Tholen, 2023). Despite these limitations, Human Capital Theory remains a useful framework for examining how investments in higher education and skills development influence graduate employability, especially in the context of public universities in South-Western Uganda.

Signaling Theory

Signaling Theory, introduced by Spence (1974), explains how in labor markets with asymmetric information, employers rely on signals such as educational qualifications, certifications, and other observable attributes to assess a graduate's potential productivity (Tomlinson, 2021; Huntington-Klein, 2020). These signals act as proxies, helping employers interpret candidates' abilities, while graduates use their degrees and skills to demonstrate employability. Signaling is also a two-way process, as employers send signals about job

requirements and organizational culture, which influence graduates' career choices (Rodrigues et al., 2020). In relation to this study, the theory is relevant because it highlights how graduates' academic credentials and acquired skills are interpreted by employers in determining employability and organizational fit (Saini & Jawahar, 2019). However, it has been criticized for oversimplifying education as merely a signal rather than a source of real skills, and for neglecting broader contextual factors such as organizational culture and labor market conditions (Akkermans et al., 2024). Despite these limitations, signaling theory remains a useful framework for analyzing how educational outcomes in public universities influence employer perceptions and graduate employability in South-Western Uganda.

Empirical literature

Universities are under increasing pressure to enhance the employability of their graduates, ensuring that they succeed in an increasingly competitive job market. Graduate employability has emerged as a pivotal concern in higher education, as highlighted by Cheng et al. (2022). This emphasis is driven by concerns that graduates lack the requisite skills for successful professional careers, thereby shifting the responsibility toward universities (Small et al., 2018; Mainga et al., 2022). The development of human capital, encompassing the knowledge and skills possessed by individuals, plays a crucial role in improving graduate employability (Römgens et al., 2020; Clarke, 2018; Donald et al., 2024; Abelha et al., 2020). Existing research often focuses on essential individual graduate competencies for employability in Western contexts, Donald et al. (2024) (North America, Europe, Australia); Healy et al. (2022) (Ireland); Tomlinson & Jackson (2021) (UK); Caballero et al. (2020) (Spain). However, a gap exists in understanding the role of university- based human capital itself (Tomlinson, 2017; Clarke, 2018; Donald et al., 2024).

Although the importance of human capital in shaping graduate employability is well-established (Mokhtar et al., 2022)the specific mechanisms through which human capital influences graduate employability outcomes in the Ugandan context remain understudied and require further investigation. Universities act as hubs of human capital, developing graduates through teaching, research, and management activities (Berchin et al., 2021). Research consistently highlights the critical role of higher education in equipping graduates with employability skills (Behle, 2020). This aligns with Awan and Saeed's (2015) a framework which emphasizes knowledge development, utilization, and application as key drivers of graduate employability (Ng et al., 2022). The expertise of faculty, researchers, and managers constitutes a unique university resource, fostering a valuable environment for student learning and development (Quintero-Quintero et al., 2021).

The teaching and learning approaches employed by lecturers have a profound impact on the development of graduates' competencies (Borah & Malik, 2021). Lecturer's cultural backgrounds and teaching methodologies significantly shape the learning experience, ultimately influencing the knowledge and skills acquired by graduates (Rajaram, 2023; Heng & Song, 2020). Fostering proactive, socially oriented, and autonomous learning environments is critical in this regard (Borah & Malik, 2021). This perspective emphasizes the importance of educators expanding their scope beyond mere academic achievement (Feraco et al., 2023; Sahudin, 2022). By instilling essential skills and promoting self-directed learning, educators can significantly enhance graduates' employability prospects (Al Asefer & Abidin, 2021; Calvo & García, 2021).

Moreover, research highlights that the quality of university personnel, including both faculty and administrative staff, significantly plays a crucial role in shaping graduates' job opportunities and overall employability (Siivonen et ai., 2023). Succi & Canovi (2020) and Byrne, (2022) highlight a shift in the literature, where supporting student employability is seen as an academic responsibility. This is achieved through curriculum design aligned with industry skills and knowledge needs. Towers et al., (2020) build on this, emphasizing the importance of fostering entrepreneurial capacity in undergraduates. They argue that the current dynamic competitive job market necessitates graduates with entrepreneurial acumen across disciplines (social sciences: e.g., retail, business; natural sciences: e.g., pharmacy, engineering), highlighting the need for universities to prepare graduates not just for employment, but also for initiating their own ventures, demanding constant, structured, and unstructured learning. Hassock & Hill (2022) found that graduates taught by academics with industry experience have higher employment rates. Their research highlights the importance of industry experience in enhancing graduate employability, noting that academics with practical experience can impart valuable, employer-desired skills and knowledge to students. These findings align with Sultanova et al.'s (2018) study on competency transmission within Kazakhstan's universities, which revealed

that institutions' competitiveness in the knowledge economy depends on their faculty's ability to effectively teach market-relevant skills.

Similarly, Chigbu & Nekhwevha (2022) found that a university's human capital plays a pivotal role in preparing graduates for the workforce, emphasizing that well-developed academic staff are crucial for enhancing graduates' labor market readiness. Further exploring the significance of human capital, Cricelli et al. (2018) conducted a study examining the interplay between intellectual capital and university performance, specifically targeting public universities in Colombia within the context of emerging economies. Their study suggests that universities with high-quality human capital, characterized by strong faculty and administrative staff development, are more likely to produce graduates with industry-valued skills and improved employability outcomes. However, Okolie et al. (2020) highlight challenges faced by Nigerian universities in enhancing graduate employability. While their study confirms a positive correlation between human capital and graduate employability, it also identifies a shortage of trained academics and industry professionals. Their findings suggest that this shortfall limits Nigerian universities' capacity to equip graduates with relevant skills for the contemporary workforce, thereby creating a disconnect between the theoretical advantages of robust human capital and its practical application. Furthermore, developing strong university human capital can be particularly challenging in the developing world. Research by Fomba et al. (2023) and Ogunode & Okechukwu Ezema (2022) draws attention to the problem of political interference in university governance within developing countries, which can have a ripple effect on faculty recruitment. Furthermore, the rapid growth of higher education in these regions has strained resources, potentially leading to a shortage of qualified instructors (Arnhold & Bassett, 2021). Moreover, limited access to professional development opportunities for instructors further compounds this issue, hindering the development of effective teaching skills and potentially leading to rote learning approaches based on memorization (Uzorka et al., 2023). The preceding discussion highlights the importance of the link between human capital and graduate employability, with extensive research demonstrating a strong positive correlation between the quality of university-based human capital and graduates' employability prospects.

Although the significance of human capital is increasingly recognized, the existing literature presents a complex and sometimes contradictory picture. Some studies highlight a robust connection between human capital and graduate employability (Lundgren-Resenterra, 2023; Pangidoan & Nawangsari, 2022; Strazzullo et al., 2022), while other studies advocate for a more nuanced perspective, emphasizing the role of supplementary factors within higher education that extend beyond human capital (Abelha et al., 2020; Clarke, 2018; Robson, 2023). Abelha et al. (2020) highlight the limitations of solely focusing on human capital. They argue that institutions need to consider additional factors beyond traditional human capital development, such as curriculum design and employer engagement. Clarke (2018) and Robson (2023) supports this view, finding that human capital alone does not guarantee graduate employability. Tamrat (2022) further argues that graduate employability outcomes are significantly shaped by government policies, labor market structures, and social contexts, and advocates for a comprehensive strategy that aligns national policies with labor market requirements, acknowledging that university-level human capital alone is insufficient to address the complex issues surrounding graduate employability. Furthermore, limited research has focused specifically on the Ugandan context. In light of these inconsistencies and the research gap within Uganda's context, the following was hypothesized: There is a relationship between human capital and graduate employability.

3. Methodology

The study employed a positivist paradigm with a quantitative approach, anchored in the assumption that human capital and graduate employability can be objectively measured and analyzed. A cross-sectional research design was adopted, allowing for the collection of data at a single point in time to identify patterns and relationships between the study variables. The target population comprised 8,696 graduates from Kabale University, Mountains of the Moon University, and Mbarara University of Science and Technology (MUST) who graduated in 2019, 2022, and 2023, as well as 145 academic and administrative staff members across these institutions. From this population, a sample of 383 graduates was determined using Yamen's (1973) formula , while all 145 staff members were included in the study to ensure comprehensive coverage of those directly involved in planning, supervision, and quality assurance. Graduates were selected through simple random sampling, while staff were chosen purposively given their strategic roles and expertise.

Data were collected using a self-administered questionnaire, adapted from validated instruments by previous scholars and modified to suit the Ugandan higher education context. Constructs were measured on a five-point Likert scale, capturing perceptions of human capital and graduate employability. To ensure validity and reliability, the instruments were pre-tested, and statistical checks such as confirmatory factor analysis, Cronbach's alpha, and tests for common method bias, tests for parametric assumptions were undertaken. Data were managed and analyzed using SPSS version 26 and Structural Equation Modelling (SEM) to test direct, indirect, and interaction effects among variables, with bootstrapping applied for mediation analysis. Ethical clearance was obtained from the un, and measures such as informed consent, confidentiality, and fair compensation were implemented to safeguard participants' rights.

4. Results

Sample Characteristics

The study drew responses from 377 graduates and 122 university staff from three public universities in South-Western Uganda. Graduates were predominantly recent completers (2019–2023), with the majority holding bachelor's degrees, while staff respondents largely occupied academic leadership and management positions and possessed postgraduate qualifications. This composition ensured that the data reflected informed perspectives on institutional human capital and graduate employability.

Descriptive Statistics

Analysis of the study variables showed that human capital had a relatively high mean score ($M = 4.071$, $SD = 0.457$), reflecting strong respondent agreement on the presence and relevance of academic and administrative competencies in public universities. In comparison, graduate employability registered a moderately high mean ($M = 3.966$, $SD = 0.380$), indicating that although employability outcomes exist, they remain below the perceived level of institutional human capital.

Measurement Model Assessment

Confirmatory Factor Analysis (CFA) was conducted to assess the validity and reliability of the measurement models for human capital and graduate employability before hypothesis testing. The refined human capital model retained six indicators with standardized factor loadings ranging from 0.658 to 0.774 ($p < .001$), demonstrating strong construct representation. Model fit indices indicated excellent fit (CFI = 0.988; TLI = 0.974; RMSEA = 0.059), with composite reliability (CR = 0.81) and average variance extracted (AVE = 0.63) exceeding recommended thresholds. Similarly, the graduate employability measurement model demonstrated satisfactory fit (CFI = 0.952; TLI = 0.931; RMSEA = 0.058), with all indicators loading significantly on their respective dimensions. Composite reliability values ranged from 0.82 to 0.88, confirming internal consistency and convergent validity. These results confirm that the constructs were measured reliably and were suitable for subsequent analysis.

Relationship between Human Capital and Graduate Employability

Pearson correlation analysis revealed a strong and statistically significant positive relationship between human capital and graduate employability ($r = 0.551$, $p < .01$). This indicates that higher levels of institutional human capital are associated with higher levels of graduate employability in public universities in South-Western Uganda.

Predictive effect of Human Capital on Graduate Employability

To test the predictive influence of human capital on graduate employability, hierarchical regression analysis was conducted while controlling for respondents' age and level of education. The control variables explained a minimal proportion of variance in graduate employability ($R^2 = 0.015$). When human capital was introduced into the model, it accounted for an additional 29.8% of the variance in graduate employability ($\Delta R^2 = 0.298$, $p < .001$). Human capital emerged as a strong and positive predictor of graduate employability ($\beta = 0.547$, $p < .001$), providing empirical support for Hypothesis 1. This finding indicates that universities with higher levels of academic competence, professional expertise, and staff capability are more likely to produce graduates who are better positioned for labor market participation.

Discussion of results

The study found a significant positive relationship between human capital and graduate employability in public universities in South-Western Uganda ($\beta = 0.547$, $p < .001$). This indicates that universities with higher-quality human capital—comprising professional competence, motivation, and leadership capacity of staff—are more effective in producing employable graduates.

This finding aligns with Human Capital Theory (Becker, 1993), which posits that investment in knowledge and skills enhances productivity and labor market outcomes. In the Ugandan context, where public universities face infrastructural deficits and bureaucratic constraints (Ndibuuza et al., 2021; Kibuuka, 2025), human capital functions as the critical adaptive resource that sustains employability outcomes. Unlike physical infrastructure, skilled staff provide interpretive flexibility, adapt curricula responsively, and creatively leverage limited resources and industry linkages to enhance student learning (Annala et al., 2023).

The results are consistent with international studies demonstrating that faculty quality directly influences graduate outcomes. Phusavat et al. (2025) and Asiedu et al. (2023) found that faculty involvement in curriculum design and industry engagement is vital for embedding market-relevant skills. Similarly, Cricelli et al. (2018) showed that universities with high-quality human capital produce graduates with stronger industry-valued competencies. In Africa , Okolie et al. (2020) confirmed this positive correlation in Nigerian universities, while noting that shortages of trained academics constrain institutional capacity—a challenge equally relevant to Uganda.

Within Uganda, Mbabazi et al. (2020) demonstrated that improvements in staff quality enhance graduates' practical skills and workplace confidence. The current study extends this by quantifying the predictive strength of human capital on employability outcomes in public universities. The finding that human capital explains 29.8% of the variance in graduate employability underscores its central role. Crucially, human capital must operate cohesively across teaching, mentoring, and program support functions to maximize employability outcomes (Valero et al., 2020; Päivi Siivonen et al., 2023). Skilled academic staff transmits disciplinary knowledge while modeling critical thinking and problem-solving. Administrative staff ensure supportive institutional processes, including career services and internship coordination. When these functions align, universities create an ecosystem where student capabilities are systematically developed and translated into labor-market readiness.

The practical implication is clear: in resource-constrained settings like Uganda, human capital is not merely additive but transformative. Strategic investments in recruitment, professional development, and performance management linked to employability outcomes are essential. Initiatives empowering staff to innovate pedagogically and deepen industry partnerships directly enhance graduate outcomes.

In summary, this study demonstrates that human capital is the central driver of graduate employability in Ugandan public universities. Its coordinated deployment across institutional functions bridges the gap between educational inputs and labor market outcomes, reinforcing the critical role of skilled staff in sustaining institutional resilience and graduate readiness.

5. Conclusion and Recommendations

This study examined the role of human capital in shaping graduate employability in public universities in South-Western Uganda and found that human capital is a strong and significant predictor of graduate employability. Skilled, motivated, and professionally competent academic and administrative staff directly enhance graduates' labor-market readiness by developing employability skills and supporting processes that ensure these skills are effectively acquired, while deficiencies in human capital constrain the development of employability outcomes.

The study contributes to the literature by providing empirical evidence that human capital is the central driver of graduate employability in resource-constrained university settings, clarifying how staff competence, motivation, and leadership collectively shape graduate outcomes, and highlighting the mediating role of employability skills in translating human capital into labor-market success. Based on these findings, university

leaders should prioritize strategic investment in human capital through targeted recruitment, continuous professional development, and performance management tied to employability outcomes; embed employer-valued skills such as critical thinking, communication, adaptability, and problem-solving into curricula and pedagogy; and strengthen institutional employability support structures, including career services, internships, and industry engagement, to translate staff capacity into market-ready graduates. Policymakers should implement outcome-oriented quality assurance and funding mechanisms that incentivize universities to enhance human capital and employability skills development. In conclusion, human capital is the primary driver of graduate employability, and deliberate investment in staff competence, motivation, and leadership, coupled with institutional support, is essential for producing graduates equipped for the labor market and advancing national human capital development.

Acknowledgement: The author acknowledges the support of the MUST-IUC UCoBs Partnership for the PhD scholarship. It is this scholarship that made this research possible.

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Journal of Economics and Behavioral Studies (JEBS)
Vol. 17, No. 4, 2025 (ISSN: 2220-6140)

Premature Mortality From Non-Communicable Diseases in Latin America and The Caribbean: A Time-Series Analysis of Progress Toward SDG 3.4

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Abstract: Premature mortality from non-communicable diseases (NCDs) remains a major public health challenge in Latin America and the Caribbean, threatening progress toward Sustainable Development Goal (SDG) 3.4, which calls for a one-third reduction in premature NCD mortality. We examine trends and future trajectories of mortality from cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases among adults aged 30–70 years using monthly World Bank data from 2000 to 2024. The ARIMA modeling framework is employed to capture both long-run persistence and short-run fluctuations in mortality dynamics. Estimation results reveal strong persistence in premature NCD mortality, as evidenced by a positive and statistically significant autoregressive coefficient, alongside a negative and significant moving-average component indicating partial shock correction. Model diagnostics confirm stationarity and invertibility, supporting the reliability of forecasts. Projections indicate a gradual decline in premature NCD mortality, converging toward approximately 13.32% by 2046. While this trend reflects continued improvement, the projected level remains unacceptably high and insufficient to fully achieve SDG 3.4 targets. The findings underscore the urgency of strengthening NCD prevention, early diagnosis, and health-system capacity to accelerate mortality reductions in the region.

Keywords: *ARIMA, premature adult mortality, non-communicable diseases, Latin America, the Caribbean*

1. Introduction

Non-communicable diseases (NCDs), principally cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases have emerged as the leading cause of premature mortality globally, accounting for more than 70 percent of all deaths worldwide (WHO, 2023). The burden of NCDs is particularly acute in low- and middle-income regions, where demographic transitions, urbanization, lifestyle changes, and unequal access to quality healthcare interact to elevate mortality risks among working-age adults. In response to this growing challenge, Sustainable Development Goal (SDG) 3.4 commits countries to reducing premature mortality from NCDs by one-third by 2030 through prevention, treatment, and the promotion of mental health and well-being (United Nations, 2015).

Latin America and the Caribbean (LAC) have made notable progress in reducing communicable disease mortality; however, this success has been accompanied by a rapid epidemiological transition toward NCDs (PAHO, 2022). Despite improvements in life expectancy and health system coverage, premature mortality from NCDs among adults aged 30–70 years remains persistently high in the region. Cardiovascular diseases and cancers alone account for the majority of these deaths, often occurring during individuals' most productive years, thereby imposing substantial social and economic costs on households and national economies (Bloom et al., 2011; Nugent, 2016). The COVID-19 pandemic further disrupted NCD prevention, diagnosis, and management services, raising concerns about the sustainability of recent mortality gains (WHO, 2022).

While numerous studies have examined the determinants of NCD mortality in LAC using cross-sectional or panel data approaches (Barreto et al., 2012; Miranda et al., 2019), comparatively limited attention has been paid to the time-series dynamics of premature NCD mortality at the regional level. Existing research often emphasizes structural risk factors such as income inequality, behavioral risks, or health expenditure without adequately modeling the persistence, inertia, and shock responses inherent in mortality trends. This represents an important gap, as mortality outcomes typically evolve gradually and exhibit strong temporal dependence, implying that short-run interventions may have delayed or muted effects unless sustained over time (Box et al., 2015; Nahabwe & Maniple, 2025). Moreover, few studies explicitly link mortality forecasts to the feasibility of achieving SDG 3.4, limiting their direct relevance for medium- and long-term policy planning.

Against this backdrop, we address the research problem of persistently high premature mortality from NCDs in Latin America and the Caribbean by modeling its temporal behavior using a time-series framework. By applying an autoregressive integrated moving average (ARIMA) approach to World Bank data spanning 2000 to 2024, our study captures both long-run persistence and short-run fluctuations in mortality from cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases among adults aged 30–70 years. Unlike static or purely explanatory models, this approach enables robust forecasting of mortality trajectories and provides empirical evidence on whether current trends are consistent with the pace required to achieve SDG 3.4.

The rationale for this study is threefold. Firstly, understanding the dynamic properties of premature NCD mortality is essential for designing effective and sustained public health interventions. Secondly, credible long-term projections offer policymakers a benchmark against which to assess progress toward SDG 3.4 and identify potential shortfalls. Thirdly, by focusing on the LAC region as a whole, our study provides regionally relevant insights that complement country-specific analyses and support coordinated policy responses. In doing so, our research contributes to both the empirical literature on NCD mortality dynamics and the policy discourse on achieving global health targets in Latin America and the Caribbean.

2. Literature Review

Non-communicable diseases (NCDs) have dominated global mortality patterns over the past three decades, contributing to a significant share of premature deaths among adults aged 30–70 years (WHO, 2023).

Globally, cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases are estimated to account for more than 70% of all deaths, with a disproportionate burden afflicting low- and middle-income countries (LMICs) due to structural vulnerabilities, behavioral risk exposures, and limited access to early diagnosis and treatment (Zavalis et al., 2017; Naghavi et al., 2017; Nahabwe & Maniple, 2025). These mortality trends directly inform Sustainable Development Goal (SDG) 3.4, which mandates a one-third reduction in premature NCD mortality by 2030 relative to 2015 baselines (United Nations, 2015).

Empirical studies highlight that while high-income countries have made notable gains through comprehensive prevention and treatment strategies, many LMICs lag due to persistent health system bottlenecks and socio-economic inequities (Gakidou et al., 2017; Collaborators & Ärnlöv, 2020). This global evidence underscores the urgency of time-sensitive action and robust monitoring to achieve SDG 3.4.

Within Latin America and the Caribbean (LAC), the NCD burden has escalated alongside economic development and demographic transitions. Regional mortality patterns reveal high levels of premature deaths attributable primarily to cardiovascular diseases and cancers, with diabetes and chronic respiratory diseases also contributing substantially (PAHO, 2022; Martinez et al., 2020). These patterns are compounded by the high prevalence of modifiable risk factors including tobacco use, unhealthy diets, physical inactivity, and obesity (Gómez et al., 2019).

Although national health policies and surveillance systems have improved in many LAC countries, significant disparities persist between urban and rural populations as well as across socio-economic strata (Oliveira et al., 2020). Cross-country comparative studies suggest that variations in health system capacity, expenditure levels, and policy implementation influence the pace of NCD mortality decline, pointing to the need for coordinated regional policy frameworks that align with SDG priorities (Beaglehole et al., 2011; Miranda et al., 2019).

Despite growing awareness of the NCD crisis in the region, much of the existing research on LAC mortality trends has emphasized cross-sectional or explanatory risk factor analyses rather than longitudinal time-series perspectives. Where longitudinal studies exist, they often focus on country-specific trajectories (e.g., Brazil: Machado et al., 2020; Mexico: Barquera et al., 2016), leaving a gap in understanding regional temporal dynamics that integrate persistence and shock responses crucial to effective forecasting and policy evaluation.

At the national and sub-national levels, research has documented spatial and socio-economic inequalities in premature NCD mortality, often linked to disparities in health service access and prevention program coverage

(Oliveira et al., 2020; Robinson et al., 2012). For example, studies in Central American settings indicate that rural and lower-income populations experience elevated NCD mortality, reflecting barriers to early detection and ongoing management of chronic conditions (Garduño-Alanis et al., 2024). These local analyses enrich global and regional evidence by revealing the contextual and health system determinants of mortality patterns. However, few of these studies apply formal time-series methods to examine temporal dependencies and the trajectory of mortality trends limiting their utility for forecasting progress toward SDG targets.

The theoretical foundation for analyzing premature NCD mortality draws from the epidemiologic transition theory, which posits that societies undergoing economic development gradually shift from infectious to chronic disease dominance due to changes in lifestyle, aging, and environmental exposures (Omran, 1971; Frenk et al., 1991). In later stages of the transition, mortality improvements are influenced less by infectious disease control and more by prevention, early diagnosis, and effective long-term management of chronic conditions. Complementing this is the health systems theory, which emphasizes that sustained reductions in NCD mortality depend on comprehensive service delivery, financing, and governance arrangements that can adapt to changing disease burdens (Saltman et al., 2006). These theories collectively inform the expectation that mortality dynamics will exhibit persistence and respond to policy shocks over extended periods, thereby necessitating models such as ARIMA that explicitly account for temporal correlations in the data (Box et al., 2015; Nahabwe & Kagarura, 2025).

Conceptually, premature adult mortality from non-communicable diseases (NCDs) is specified as the dependent variable and measured as the probability (percentage) of death between ages 30 and 70 from cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases. This outcome reflects the combined and lagged effects of behavioral risks, socioeconomic conditions, health system performance, and demographic change in Latin America and the Caribbean. Rather than modeling these determinants explicitly, their influence is assumed to be embedded in the historical evolution of the mortality series. Autoregressive and moving-average components, therefore, capture persistence and short-term shocks, making the ARIMA framework appropriate for analyzing trends and forecasting progress toward SDG 3.4 (Box & Jenkins, 1976; Nahabwe & Maniple, 2025).

The cumulative review reveals three key gaps: Firstly, a scarcity of comprehensive time-series analyses of premature NCD mortality at the regional level; Secondly, limited integration of temporal dynamics in assessing SDG 3.4 progress; and thirdly, inadequate use of forecasting methodologies to guide long-term planning. Our study responds directly to these gaps by employing ARIMA modeling to capture the temporal structure of mortality trends and generate forecasts extending to 2046, thereby providing empirically grounded insights for regional policy agendas aligned with SDG targets.

3. Data and Method

We adopt a quantitative time-series research design to examine the dynamics and future trajectory of premature adult mortality from non-communicable diseases (NCDs) in Latin America and the Caribbean. A time-series approach is particularly appropriate given the study's objective of modeling temporal persistence, short-run shocks, and long-run trends in mortality outcomes, as well as assessing progress toward Sustainable Development Goal (SDG) 3.4. Unlike cross-sectional or panel designs, time-series analysis enables explicit modeling of inertia and innovation effects inherent in health outcomes that evolve gradually over time (Box et al., 2015; Enders, 2015; Nahabwe & Kagarura, 2025).

We utilize secondary monthly time-series data obtained from the World Bank's World Development Indicators (WDI) database (World Bank, 2024). The primary variable of interest is Mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases between exact ages 30 and 70 (%), a core indicator used globally to monitor progress toward SDG 3.4 (United Nations, 2015; WHO, 2023).

The sample covers the period January 2000 to December 2024, yielding a total of 300 monthly observations. The shift from annual to monthly frequency enhances the statistical power of the analysis, improves the detection of short-run fluctuations, and allows for more precise estimation of dynamic adjustment processes in mortality trends (Harvey, 1990; Kagarura & Nahabwe, 2025). Our study focuses on Latin America and the

Caribbean region as an aggregate, reflecting the regional policy orientation of SDG monitoring and facilitating comparability with regional health assessments by the Pan American Health Organization (PAHO, 2022).

Given the complete availability of data for the study period, a census sampling approach is employed rather than probabilistic sampling. All observed monthly values within the specified timeframe are included, eliminating sampling bias and ensuring that the estimated dynamics fully reflect the historical mortality trajectory of the region (Kagarura et al., 2025).

Empirical analysis proceeds in several stages. Firstly, descriptive analysis is conducted to examine the level, trend, and variability of premature NCD mortality over time. Visual inspection and summary statistics are used to identify structural shifts and potential periods of increased volatility, such as during global health shocks.

Secondly, the stationarity properties of the series are assessed using standard unit root tests to determine the appropriate order of differencing. Consistent with time-series best practices, non-stationary behavior in levels necessitates differencing to achieve stationarity before model estimation (Dickey & Fuller, 1979; Enders, 2015; Nahabwe & Kagarura, 2025).

Thirdly, an autoregressive integrated moving average (ARIMA) framework is specified to capture both persistence (autoregressive effects) and transitory shocks (moving-average effects) in premature mortality dynamics. Model identification follows the Box–Jenkins methodology, guided by autocorrelation and partial autocorrelation diagnostics (Box et al., 2015; Kagarura & Nahabwe, 2025).

ARIMA (p, d, q) model specification is as follows:

$Y_t = \mu + \varepsilon_t + \boldsymbol{\phi}_1 Y_{t-1} + \boldsymbol{\phi}_2 Y_{t-2} + \ldots + \boldsymbol{\phi}_p Y_{t-p} + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \ldots + \theta_q \varepsilon_{t-q}$ …… (1)
Where;
Y_t is the value of the series at time t
μ is the mean of the series
ε_t is white noise
$\boldsymbol{\phi}_1, \boldsymbol{\phi}_2, \ldots \boldsymbol{\phi}_p$ are the coefficients of the AR (p) component
$\theta_1, \theta_2, \ldots \theta_q$ are the coefficients of the MA (q) component
p is the order of the autoregressive part, representing the number of past values considered
q is the order of the moving average part, indicating the number of past errors considered
d is the number of differences required to make the series stationary (Box & Jenkins, 1976; Nahabwe & Kagarura, 2025)

Parameter estimation is conducted using Generalized Least Squares (GLS). GLS is preferred over ordinary least squares (OLS) because time-series data on mortality frequently exhibit serial correlation and heteroskedasticity, which violate classical OLS assumptions and lead to inefficient or biased inference (Greene, 2018; Nahabwe & Kagarura, 2025). By explicitly accounting for the error covariance structure, GLS yields more efficient and reliable parameter estimates, particularly in the presence of autoregressive and moving-average disturbances (Wooldridge, 2016; Nahabwe & Maniple, 2025).

Generalized least squares (GLS) estimation is selected for its ability to effectively handle time-series data that exhibits serial correlation and heteroscedasticity, thus providing more reliable and efficient parameter estimates compared to Ordinary Least Squares (OLS) in this context. The GLS procedure adjusts for potential correlations and non-constant variances in the error terms, which are common in time-series data (Greene 2018; Wooldridge 2016; Nahabwe & Kagarura, 2025). The GLS estimator for the regression coefficients is given by the following formula:
$\hat{\beta} = (X'\Omega^{-1}X)^{-1}X'\Omega^{-1}y$
Where:
$\hat{\beta}$ is a column matrix of coefficients
X is the matrix of independent variables
y is the column vector of the dependent variable

Ω is the variance-covariance matrix of the error terms, accounting for both heteroscedasticity and autocorrelation in the residuals (Greene 2018; Hayashi 2000; Nahabwe & Maniple, 2025).

The robustness of the estimated model is evaluated through diagnostic tests for residual autocorrelation, stationarity, and invertibility. Once validated, the model is used to generate out-of-sample forecasts up to 2046, enabling an assessment of whether projected mortality trajectories are consistent with the pace required to achieve SDG 3.4.

4. Results and Discussion

Appendix 1 presents descriptive statistics for premature mortality from cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases among adults aged 30–70 years in Latin America and the Caribbean over the period January 2000 to December 2024. The mean mortality rate of 15.89% indicates a substantial burden of premature NCD mortality in the region, while the median value of 15.59% suggests that more than half of the observed months recorded mortality rates close to this high average level. The observed maximum (18.54%) and minimum (13.58%) values reveal a marked but gradual decline over time, consistent with long-term epidemiological transition dynamics reported in the region (PAHO, 2022; WHO, 2023).

The standard deviation of 1.23 indicates moderate variability in mortality rates, reflecting slow-moving structural changes rather than abrupt fluctuations, an expected feature of population-level health outcomes. The positive skewness value (0.32) suggests a longer right tail, implying that higher mortality episodes occurred more frequently in earlier periods of the sample. The kurtosis value (2.19) is below the Gaussian benchmark of 3, indicating a flatter distribution in levels. However, the Jarque–Bera statistic (13.17, $p = 0.0014$) rejects the null hypothesis of normality, reinforcing the need for robust time-series techniques that do not rely on strict normality assumptions (Enders, 2015; Wooldridge, 2016; Munyambonera et al., 2025).

Stationarity tests (Appendices 2 & 3) are conducted using the Augmented Dickey-Fuller (ADF) test to check for stationarity. Results indicate that the original series was non-stationary in level ($p > 0.05$). After first difference, the series achieved stationarity ($p < 0.05$), justifying the use of the ARIMA model ($d = 1$) (Kagarura & Nahabwe, 2025). ARIMA(1,1,1) model is identified as the best, based on Akaike Information Criterion (AIC = -5.276310) and Schwarz Criterion (SC = -5.239181), Hannan-Quinn Criterion (H-QC) -5.261449.

Results are summarized as follows:

Results of the ARIMA(1,1,1) model (Appendix 4)

$$\widehat{Mortality\ from\ CVD, cancer, diabetes\ or\ CRD}_t = -0.017524 + 0.909354AR(1) - 0.614833MA(1) \quad \ldots\ldots (3)$$

Hence,

$$\hat{\beta} = \begin{bmatrix} -0.017524 \\ 0.909354 \\ -0.614833 \end{bmatrix}$$

The estimated ARIMA(1,1,1) model provides important insights into the temporal dynamics of premature NCD mortality. The constant term is negative and statistically significant (−0.017524), indicating an underlying downward drift in mortality over time. This finding reflects gradual improvements in prevention, treatment, and health system capacity in the region, albeit at a modest pace (Beaglehole et al., 2011; Miranda et al., 2019).

AR(1) coefficient (0.909354) is positive and statistically significant, implying strong persistence in premature mortality dynamics. This result indicates that current mortality levels are heavily influenced by past outcomes, such that shocks or policy interventions exert effects that unfold slowly over time. High persistence is characteristic of chronic disease mortality and aligns with epidemiological evidence that NCD outcomes respond gradually to sustained policy and behavioral changes rather than short-term interventions (Box et al., 2015; WHO, 2022).

Conversely, the MA(1) coefficient (−0.614833) is negative and statistically significant, suggesting that short-term innovations or shocks—such as temporary policy disruptions or health system stressors—are partially corrected in subsequent periods. This dynamic implies that while mortality trends are highly persistent, transitory deviations tend to dissipate rather than permanently alter the trajectory. Similar corrective patterns have been observed in time-series analyses of mortality and health expenditure dynamics (Akaike, 1974; Harvey, 1990; Kagarura & Nahabwe, 2025).

The adjusted R-squared value of 0.3171 indicates that approximately 32% of the variation in the differenced mortality series is explained by its own past values and error structure. Although modest, this explanatory power is consistent with univariate time-series models applied to complex health outcomes, where a large share of variation is driven by long-run structural determinants not explicitly modeled (Enders, 2015; Kagarura & Nahabwe, 2025; Nahabwe, 2025).

The Durbin–Watson statistic of 2.06 suggests the absence of first-order autocorrelation in the residuals, confirming that the ARIMA specification adequately captures the serial dependence in the data (Nahabwe & Kagarura, 2025; Kagarura et al., 2025).

Model diagnostics further validate the robustness of the estimated results. The histogram of residuals (Appendix 7) reports an exceptionally high kurtosis value (47.5, p = 0.0000), indicating leptokurtic residuals and the presence of extreme observations. While this departs from normality, such behavior is not uncommon in long health time-series and does not invalidate inference under GLS estimation, which remains consistent in the presence of non-normal disturbances (Greene, 2018; Wooldridge, 2016; Nahabwe & Kagarura, 2025).

Ljung–Box Q-statistic test (Appendix 5) yields a p-value of 0.511, leading to a failure to reject the null hypothesis of no residual autocorrelation. This result confirms that the model residuals resemble white noise, satisfying a key requirement for reliable forecasting (Box et al., 2015; Nahabwe & Kagarura, 2025; Kagarura et al., 2025).

Similarly, Breusch–Godfrey serial correlation LM test (Appendix 8) reports Prob. F(2,294) = 0.3679 and Prob. Chi-square(2) = 0.3630, indicating no evidence of higher-order serial correlation. AR and MA roots (Appendix 6) lie within the unit circle, confirming that the ARIMA(1,1,1) model is both covariance stationary and invertible, thereby reinforcing its suitability for inference and forecasting (Nahabwe & Kagarura, 2025; Nahabwe, 2025).

Model-based projections indicate a gradual decline in premature NCD mortality, converging toward approximately 13.32% by 2046. This projected trajectory suggests continued progress but at a decelerating pace. While the downward trend is consistent with regional improvements documented by PAHO (2022) and WHO (2023), the forecasted level remains substantially high, particularly given the SDG 3.4 target of a one-third reduction in premature mortality.

Compared with previous studies that report declining but uneven NCD mortality trends in Latin America and the Caribbean (Martinez et al., 2020; Oliveira et al., 2020), this study uniquely demonstrates that strong temporal persistence may constrain the speed of future mortality reductions. Unlike cross-sectional or panel analyses, the time-series approach highlights that without intensified and sustained interventions, existing trends alone may be insufficient to meet SDG 3.4 within the desired timeframe.

Our study makes three key contributions to the literature. Firstly, it provides one of the few monthly time-series analyses of premature NCD mortality at the regional level, offering a high-resolution view of mortality dynamics. Secondly, it empirically demonstrates the high persistence embedded in NCD mortality trends, underscoring the importance of long-term policy commitment. Thirdly, by linking forecasts directly to SDG 3.4, the study bridges the gap between econometric modeling and policy-relevant health planning, offering actionable insights for regional and global stakeholders.

Limitations

Despite its contributions, our study has several limitations that should be considered when interpreting the findings. Firstly, our research adopts a univariate time-series design, which focuses on the internal dynamics

of premature mortality from non-communicable diseases (NCDs) rather than explicitly modeling their socioeconomic, behavioral, and health-system determinants. While this approach is appropriate for assessing temporal persistence and forecasting progress toward SDG 3.4, it limits causal inference regarding the drivers of observed mortality trends (Enders, 2015; Wooldridge, 2016; Nahabwe & Kagarura, 2025). Consequently, the results should be interpreted as describing patterns and trajectories rather than identifying policy mechanisms.

Secondly, our study relies on aggregated regional data for Latin America and the Caribbean, which may mask substantial cross-country heterogeneity in NCD mortality profiles, health system capacity, and policy implementation. Countries in the region differ markedly in income levels, epidemiological transitions, and exposure to NCD risk factors, and these differences cannot be disentangled within a regional time-series framework (PAHO, 2022; WHO, 2023). As a result, the findings may not fully reflect country-specific progress or setbacks in achieving SDG 3.4.

Thirdly, the conversion of annual mortality estimates into monthly series, although methodologically justified to enhance temporal resolution and forecasting precision, may introduce measurement smoothing and interpolation bias. Monthly disaggregation assumes gradual intra-year variation in mortality, which may understate short-term shocks associated with epidemics, health system disruptions, or policy changes (Harvey, 1990; Box et al., 2015; Nahabwe & Kagarura, 2025). This limitation could affect the magnitude, though not the direction, of estimated dynamics.

Fourthly, although the Generalized Least Squares (GLS) based ARIMA framework is robust to autocorrelation and heteroskedasticity, it assumes parameter stability over time. Structural breaks such as major health reforms, economic crises, or the COVID-19 pandemic may alter mortality dynamics in ways not fully captured by the model (Greene, 2018; Nahabwe & Kagarura, 2025). Future research incorporating regime-switching or multivariate models could address this limitation.

5. Conclusion and Recommendations

Conclusion

Our study provides a rigorous time-series assessment of premature mortality from non-communicable diseases (NCDs) in Latin America and the Caribbean, offering critical insights into the region's trajectory toward achieving Sustainable Development Goal (SDG) 3.4. By modeling the internal dynamics of mortality over a long monthly horizon, the analysis demonstrates that progress toward reducing premature NCD mortality has been gradual and path-dependent, reflecting deep structural persistence in population health outcomes. Such persistence underscores the reality that NCD mortality responds slowly to interventions and remains strongly influenced by long-run demographic, behavioral, and health-system factors (WHO, 2023; PAHO, 2022).

Although the downward trajectory observed is encouraging, the projected stabilization of mortality at a level that remains epidemiologically significant suggests that current policy momentum may be insufficient to achieve the ambitious pace of reduction envisioned under SDG 3.4. This finding reinforces global evidence that incremental improvements, without sustained and coordinated prevention strategies, are unlikely to deliver transformative reductions in premature NCD deaths (Beaglehole et al., 2011; United Nations, 2015). The study thus highlights the importance of early, continuous, and system-wide policy action, particularly in addressing modifiable risk factors and strengthening primary health care systems.

Overall, our research contributes methodologically by demonstrating the value of high-frequency time-series modeling for monitoring SDG health targets and substantively by providing forward-looking evidence to inform regional health planning. Continued progress toward SDG 3.4 in Latin America and the Caribbean will require not only maintaining existing gains but also accelerating policy responses capable of disrupting entrenched mortality dynamics.

Recommendations

In light of the persistent and slowly declining trajectory of premature mortality from non-communicable diseases (NCDs) observed in this study, governments in Latin America and the Caribbean should intensify and recalibrate national NCD policies to accelerate progress toward SDG 3.4. The strong temporal persistence identified in mortality dynamics suggests that incremental policy adjustments are insufficient to disrupt entrenched health outcomes. Policymakers should therefore prioritize population-wide prevention strategies, including fiscal and regulatory measures targeting tobacco use, harmful alcohol consumption, unhealthy diets, and physical inactivity interventions consistently shown to yield the largest and most sustained mortality reductions (Beaglehole et al., 2011; WHO, 2023).

In addition, the projected stabilization of premature mortality at relatively high levels underscores the need to strengthen primary health care systems as the foundation of NCD prevention, early detection, and long-term management. Expanding universal health coverage with a focus on affordable access to essential NCD services is critical to preventing avoidable deaths among working-age adults (PAHO, 2022; United Nations, 2015).

At the program level, the findings point to the importance of long-term, continuous NCD interventions rather than short-lived or fragmented initiatives. Ministries of health should scale up integrated NCD programs that combine risk-factor reduction, routine screening, and sustained treatment adherence, particularly for cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases. Given the inertia revealed by the time-series analysis, programs should be designed with multi-year horizons and protected financing to ensure durability and effectiveness (Bloom et al., 2011).

Furthermore, regional health institutions should enhance routine monitoring and evaluation systems, incorporating high-frequency mortality and morbidity indicators to track progress toward SDG 3.4 in near real time. Improved surveillance would enable earlier detection of deviations from desired trajectories and facilitate timely policy and program adjustments (WHO, 2023).

From a research perspective, our study highlights the need for complementary multivariate and country-specific analyses to unpack the structural drivers underlying persistent NCD mortality trends. Future studies could integrate socioeconomic, behavioral, environmental, and health-system variables to move beyond trajectory analysis toward causal explanation (Wooldridge, 2016; Enders, 2015; Nahabwe & Maniple, 2025). Such research would provide policymakers with clearer guidance on which levers are most effective in accelerating mortality reductions.

Additionally, further work could explore structural breaks and regime changes, including the long-term impacts of major shocks such as economic crises and pandemics, on NCD mortality dynamics. Expanding the use of high-frequency data and advanced time-series methods will strengthen evidence-based monitoring of SDG 3.4 and enhance accountability for health outcomes in the region (Nahabwe & Maniple, 2025).

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APPENDICES

Appendix 1: Descriptive statistics

	Mortality from CVD, cancer, diabetes or CRD between exact ages 30 and 70 (%)
Mean	15.89381
Median	15.58579
Maximum	18.54026
Minimum	13.57888
Std. Dev.	1.230697
Skewness	0.316421
Kurtosis	2.19182

Jarque-Bera	13.17054
Probability	0.001381
Sum	4768.143
Sum Sq. Dev.	452.8696
Observations	300

Appendix 2: Unit root test, Mortality from CVD, cancer, diabetes or CRD between exact ages 30 and 70 (%) **(in Level)**

Null Hypothesis: MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 14 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.965039	0.6174
Test critical values:	1% level	-3.990585	
	5% level	-3.425671	
	10% level	-3.135994	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD)
Method: Least Squares
Date: 01/03/26 Time: 11:45
Sample (adjusted): 2001M04 2024M12
Included observations: 285 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-1)	-0.008263	0.004205	-1.965039	0.0504
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-1))	0.295895	0.060031	4.928996	0.0000
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-2))	0.230894	0.061671	3.743953	0.0002
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-3))	0.108555	0.053742	2.019914	0.0444
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-4))	0.081349	0.054145	1.502433	0.1342
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-5))	0.060937	0.054366	1.120864	0.2633
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-6))	0.045841	0.054485	0.841359	0.4009
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-7))	0.034928	0.054541	0.640394	0.5225
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-8))	0.027342	0.054553	0.501191	0.6166
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-9))	0.022452	0.054522	0.411803	0.6808

D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-10))	0.019815	0.054429	0.364048	0.7161
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-11))	0.019141	0.054233	0.352935	0.7244
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-12))	-0.543042	0.053851	-10.08418	0.0000
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-13))	0.185231	0.061656	3.004258	0.0029
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-14))	0.153421	0.059949	2.559180	0.0110
C	0.143973	0.075674	1.902545	0.0582
@TREND("2000M01")	-0.000112	5.82E-05	-1.924773	0.0553

R-squared	0.509591	Mean dependent var	-0.015652
Adjusted R-squared	0.480312	S.D. dependent var	0.020849
S.E. of regression	0.015030	Akaike info criterion	-5.499763
Sum squared resid	0.060540	Schwarz criterion	-5.281895
Log likelihood	800.7162	Hannan-Quinn criterion.	-5.412425
F-statistic	17.40514	Durbin-Watson stat	2.029431
Prob(F-statistic)	0.000000		

Appendix 3: Unit root test, Mortality from CVD, cancer, diabetes or CRD between exact ages 30 and 70 (%) (in First difference)

Null Hypothesis: D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 13 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.805272	0.0176
Test critical values:	1% level	-3.990585	
	5% level	-3.425671	
	10% level	-3.135994	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD,2)
Method: Least Squares
Date: 01/03/26 Time: 11:46
Sample (adjusted): 2001M04 2024M12
Included observations: 285 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-1))	-0.294173	0.077307	-3.805272	0.0002
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-1),2)	-0.404553	0.084284	-4.799898	0.0000
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-2),2)	-0.173326	0.079098	-2.191264	0.0293
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-3),2)	-0.064209	0.079633	-0.806305	0.4208

D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-4),2)	0.016106	0.079513	0.202559	0.8396
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-5),2)	0.074799	0.079242	0.943937	0.3460
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-6),2)	0.117466	0.079007	1.486782	0.1382
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-7),2)	0.148482	0.078827	1.883640	0.0607
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-8),2)	0.171295	0.078614	2.178920	0.0302
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-9),2)	0.188659	0.078185	2.412993	0.0165
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-10),2)	0.202829	0.077216	2.626753	0.0091
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-11),2)	0.215713	0.075133	2.871067	0.0044
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-12),2)	-0.334306	0.070817	-4.720693	0.0000
D(MORTALITY_FROM_CVD__CANCER__DIABETES_OR_CRD(-13),2)	-0.149258	0.060229	-2.478160	0.0138
C	-0.004652	0.002444	-1.903759	0.0580
@TREND("2000M01")	2.78E-07	1.11E-05	0.025140	0.9800

R-squared	0.544804	Mean dependent var	6.84E-06
Adjusted R-squared	0.519422	S.D. dependent var	0.021796
S.E. of regression	0.015110	Akaike info criterion	-5.492475
Sum squared resid	0.061412	Schwarz criterion	-5.287423
Log likelihood	798.6777	Hannan-Quinn criterion.	-5.410275
F-statistic	21.46363	Durbin-Watson stat	2.026913
Prob(F-statistic)	0.000000		

Appendix 4: Results of the ARIMA(1,1,1) model

Dependent Variable: D(MORTALITY_FROM_CVD__CANCER__DIABETES_ OR_CRD)
Method: ARMA Generalized Least Squares (Gauss-Newton)
Date: 01/03/26 Time: 11:51
Sample: 2000M02 2024M12
Included observations: 299
Convergence achieved after 19 iterations
Coefficient covariance computed using the outer product of gradients
d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.017524	0.004115	-4.258191	0.0000
AR(1)	0.909354	0.036463	24.93890	0.0000
MA(1)	-0.614833	0.068823	-8.933573	0.0000

R-squared	0.321647	Mean dependent var	-0.016593
Adjusted R-squared	0.317064	S.D. dependent var	0.020808
S.E. of regression	0.017196	Akaike info criterion	-5.276310
Sum squared resid	0.087529	Schwarz criterion	-5.239181
Log likelihood	791.8083	Hannan-Quinn criterion.	-5.261449
F-statistic	70.17554	Durbin-Watson stat	2.060306
Prob(F-statistic)	0.000000		

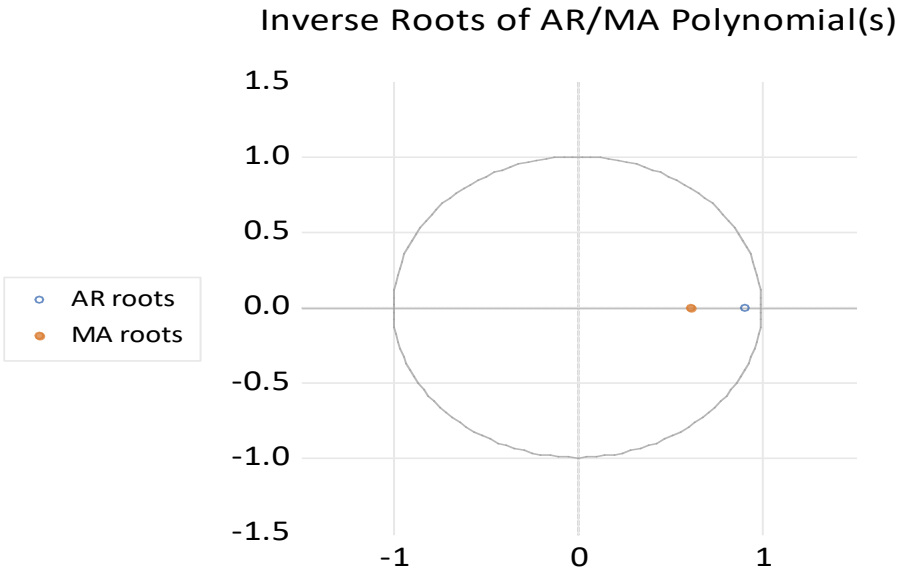
Inverted AR Roots	.91
Inverted MA Roots	.61

Appendix 5: Ljung-Box Q statistic/ test

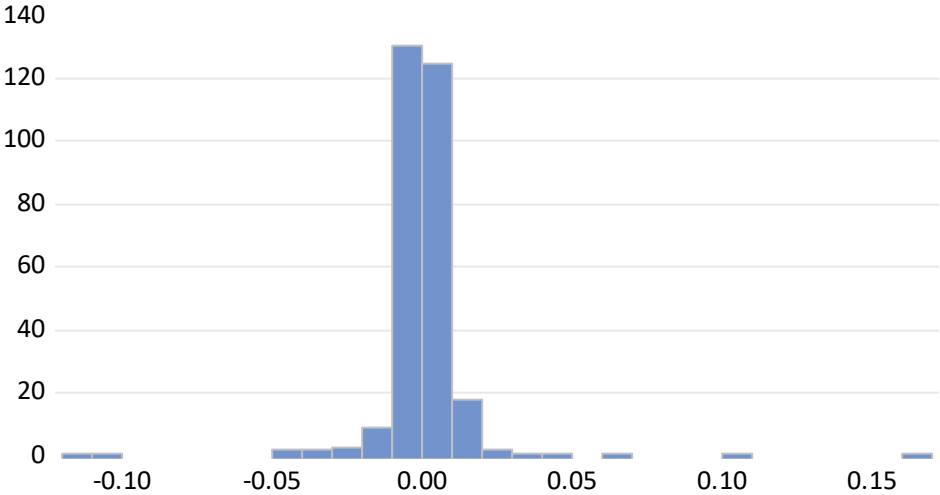
Date: 01/03/26 Time: 12:01
Sample (adjusted): 2000M02 2024M12
Q-statistic probabilities adjusted for 2 ARMA terms

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	-0.033	-0.033	0.3221	
.|. |	.|. |	2	0.001	-0.000	0.3222	
.|. |	.|. |	3	0.019	0.019	0.4321	0.511
.|. |	.|. |	4	0.028	0.029	0.6718	0.715
.|. |	.|. |	5	0.032	0.034	0.9774	0.807
.|. |	.|. |	6	0.032	0.034	1.2969	0.862
.|. |	.|. |	7	0.032	0.033	1.6099	0.900
.|. |	.|. |	8	0.032	0.033	1.9288	0.926
.|. |	.|. |	9	0.035	0.034	2.3048	0.941
.|. |	.|. |	10	0.042	0.041	2.8644	0.943
.|. |	.|. |	11	0.058	0.057	3.9327	0.916
****|. |	****|. |	12	-0.525	-0.533	90.452	0.000
.|. |	.|. |	13	0.051	0.022	91.271	0.000
.|. |	.|. |	14	0.028	0.033	91.512	0.000
.|. |	.|. |	15	0.013	0.037	91.565	0.000
.|. |	.|. |	16	0.004	0.037	91.570	0.000
.|. |	.|. |	17	-0.002	0.033	91.571	0.000
.|. |	.|. |	18	-0.006	0.028	91.583	0.000
.|. |	.|. |	19	-0.009	0.023	91.610	0.000
.|. |	.|. |	20	-0.012	0.018	91.655	0.000
.|. |	.|. |	21	-0.015	0.015	91.725	0.000
.|. |	.|. |	22	-0.018	0.014	91.836	0.000
.|. |	.|. |	23	-0.024	0.019	92.023	0.000
.|* |	**|. |	24	0.120	-0.245	96.763	0.000
.|. |	.|. |	25	-0.027	0.003	96.997	0.000
.|. |	.|. |	26	-0.022	0.005	97.157	0.000
.|. |	.|. |	27	-0.019	0.004	97.282	0.000
.|. |	.|. |	28	-0.018	0.003	97.389	0.000
.|. |	.|. |	29	-0.017	0.001	97.485	0.000
.|. |	.|. |	30	-0.016	-0.001	97.571	0.000
.|. |	.|. |	31	-0.015	-0.002	97.643	0.000
.|. |	.|. |	32	-0.012	-0.001	97.694	0.000
.|. |	.|. |	33	-0.008	0.003	97.717	0.000
.|. |	.|. |	34	-0.002	0.012	97.717	0.000
.|. |	.|. |	35	0.007	0.026	97.735	0.000
**|. |	****|. |	36	-0.326	-0.555	134.14	0.000

Appendix 6: ARIMA(1,1,1) structure



Appendix 7: Histogram of residuals



Series: Residuals
Sample 2000M02 2024M12
Observations 299

Mean	0.000221
Median	7.22e-05
Maximum	0.166774
Minimum	-0.114478
Std. Dev.	0.017137
Skewness	2.041881
Kurtosis	47.46298
Jarque-Bera	24837.36
Probability	0.000000

Appendix 8: Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

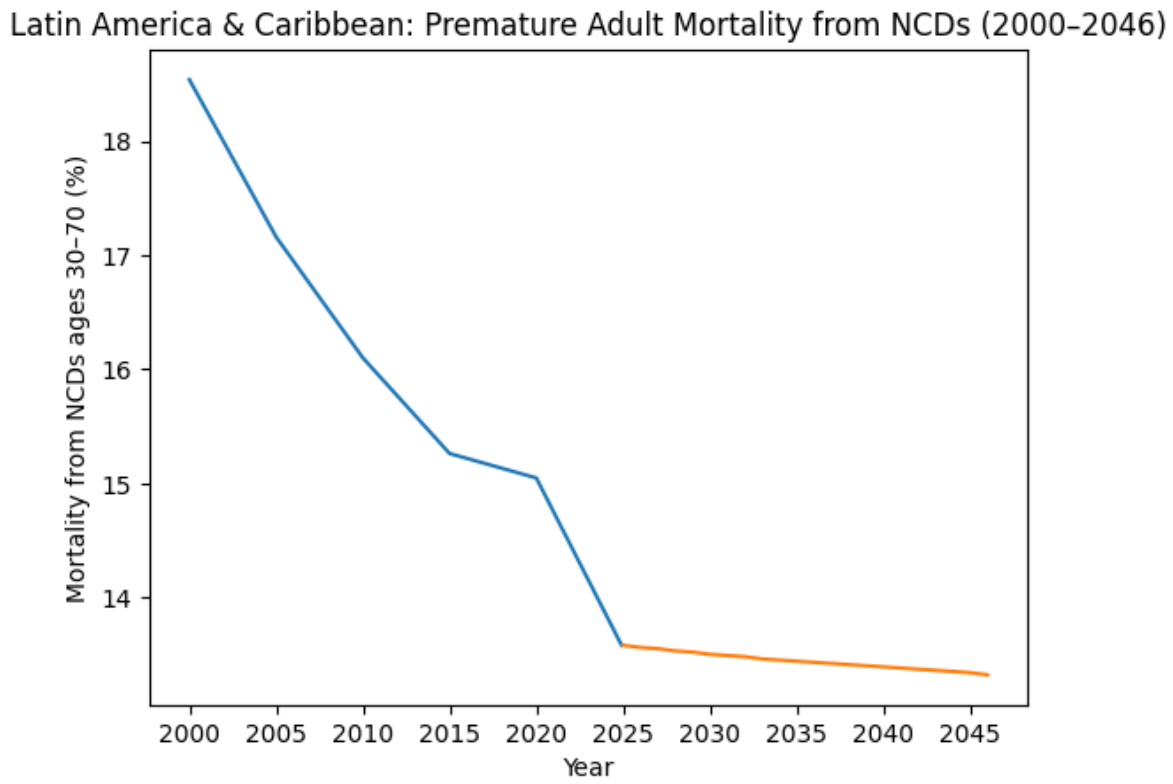
F-statistic	1.003246	Prob. F(2,294)	0.3679
Obs*R-squared	2.026783	Prob. Chi-Square(2)	0.3630

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 01/03/26 Time: 12:03
Sample: 2000M02 2024M12
Included observations: 299
Coefficient covariance computed using the outer product of gradients
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.06E-06	7.04E-05	-0.043481	0.9653
AR(1)	0.000653	0.000758	0.862026	0.3894
MA(1)	-0.004024	0.003115	-1.292072	0.1973
RESID(-1)	-0.233174	0.165163	-1.411782	0.1591
RESID(-2)	-0.110182	0.103915	-1.060316	0.2899

R-squared	0.006613	Mean dependent var	0.000221
Adjusted R-squared	-0.006903	S.D. dependent var	0.017137
S.E. of regression	0.017196	Akaike info criterion	-5.271710
Sum squared resid	0.086936	Schwarz criterion	-5.209829
Log likelihood	793.1206	Hannan-Quinn criterion.	-5.246942
F-statistic	0.489257	Durbin-Watson stat	2.003044
Prob(F-statistic)	0.743638		

Appendix 9: Graph showing Mortality from CVD, cancer, diabetes or CRD between exact ages 30 and 70 (%) ARIMA(1,1,1) Model Simulation



Journal of Economics and Behavioral Studies (JEBS)
Vol. 17, No. 4, 2025 (ISSN: 2220-6140)

Foreign Direct Investment and Exports as A Capacity to Import Vis-À-Vis Trade Balance in Sub-Saharan Africa

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Abstract: We examine the interaction effect of foreign direct investment (FDI) and exports as a capacity to import (ECI) on trade balance in Sub-Saharan Africa (SSA). We utilize balanced annual panel data for 20 SSA countries from 2005 to 2024, obtained from the World Development Indicators. The Generalized Method of Moments (GMM) methodology is used to address endogeneity and unobserved heterogeneity. Empirical findings reveal a positive and statistically significant interaction between FDI and ECI. Specifically, the coefficient of the interaction term (FDI*ECI) is 0.217378, indicating that a simultaneous 10 percent increase in FDI inflows and ECI improves trade balance by approximately 2.2 percent. We recommend that SSA economies adopt integrated strategies that attract export-oriented FDI while promoting export diversification, industrial upgrading, and productive capacity development to achieve sustainable trade balance improvements.

Keywords: *GMM, Foreign direct investment, Exports as a capacity to import, Trade Balance, SSA*

1. Introduction

The external sector remains a critical pillar of macroeconomic stability and sustainable development in Sub-Saharan Africa (SSA). For several decades, the region has been deeply integrated into the global economy primarily as an exporter of primary commodities and an importer of manufactured and capital goods. While this integration has expanded trade volumes, it has also exposed SSA economies to persistent trade imbalances, foreign exchange constraints, and vulnerability to external shocks. Evidence from the World Development Indicators (WDI) shows that most SSA countries have recorded chronic trade deficits continuously from the mid-1970s through 2024, reflecting a structural mismatch between export capacity and import demand (World Bank, 2024).

Foreign direct investment (FDI) has long been promoted as a key mechanism for addressing these external sector challenges. In theory, FDI can enhance productive capacity, facilitate technology transfer, improve export competitiveness, and ultimately strengthen the ability of economies to finance imports without destabilizing the balance of payments (Borensztein et al., 1998; UNCTAD, 2023). However, the SSA experience suggests that rising FDI inflows have not consistently translated into improved trade balances. In many countries, FDI has been concentrated in extractive and enclave sectors with weak domestic linkages, high import dependence, and limited export diversification effects (Asiedu, 2006; UNCTAD, 2022).

At the same time, the structure and sophistication of exports matter critically for external sector sustainability. Exports as a capacity to import (ECI), beyond mere export volumes determines the extent to which exports generate stable foreign exchange earnings capable of financing imports and reducing trade deficits. Economies with more diversified and complex export baskets tend to experience stronger and more resilient trade performance than those dependent on a narrow range of primary commodities (Hausmann et al., 2007; Hidalgo & Hausmann, 2009). In SSA, weak export complexity has constrained the region's capacity to leverage trade as a driver of structural transformation and balance-of-payments stability.

Despite the centrality of these issues, empirical evidence on how FDI interacts with ECI in influencing trade balance outcomes in SSA remains limited. Much of the existing empirical work examines the independent effects of FDI or exports on trade balance, often neglecting the possibility that FDI's impact depends on the nature and sophistication of the export structure. This gap is particularly significant for SSA, where the effectiveness of FDI in improving external balances may hinge on its complementarity with export upgrading and industrial development.

We address this gap by examining the joint role of foreign direct investment and ECI in shaping trade balance performance in SSA. Using annual panel data for 20 SSA countries over the period 2005 to 2024 and employing the dynamic panel Generalized Method of Moments (GMM) technique, we provide robust empirical evidence on whether FDI enhances the export capacity to finance imports. By explicitly focusing on the interaction effect, we offer policy-relevant insights into how SSA economies can realign FDI strategies with export transformation objectives to address persistent trade deficits and strengthen external sector resilience.

2. Literature Review

The relationship between FDI and ECI vis-à-vis trade balance is anchored in classical and modern theories of international trade and investment. Classical trade theories, notably the theory of comparative advantage, posit that countries improve their trade balance by specializing in goods where they have relative efficiency (Ricardo, 1817). However, for many SSA economies, static comparative advantages rooted in primary commodities have constrained export diversification and limited foreign exchange earnings.

The Heckscher–Ohlin model further links trade outcomes to factor endowments, suggesting that capital-scarce SSA economies can benefit from FDI as a vehicle for capital accumulation and technology transfer (Heckscher & Ohlin, 1933). Modern endogenous growth and new trade theories extend this argument by emphasizing scale effects, learning-by-doing, and export sophistication as critical determinants of sustained trade balance improvements (Grossman & Helpman, 1993; Melitz, 2003). From this perspective, FDI enhances trade performance not merely through volume expansion but by upgrading export structures and increasing economic complexity.

Empirical evidence from developed and emerging economies largely supports the export-enhancing role of FDI. A number of studies find that export-oriented FDI improves trade balances by expanding productive capacity, integrating host economies into global value chains, and reducing import dependence (Balasubramanyam et al., 1996; Alfaro et al., 2010). However, the impact is conditional on absorptive capacity, institutional quality, and the nature of FDI inflows.

In developing regions, results are mixed. While FDI has been shown to stimulate exports in East Asia and Latin America, its effect on trade balance is often weakened when FDI is concentrated in enclave sectors or relies heavily on imported intermediate inputs (Aitken et al., 1997). This has led to growing emphasis on interaction effects between FDI and export capability, rather than treating them as independent drivers of external performance.

In SSA, the literature consistently documents persistent trade deficits and limited export diversification despite rising FDI inflows since the early 2000s (UNCTAD, 2023). Several studies argue that resource-seeking and market-seeking FDI have had weak spillovers to export capacity, thereby constraining their impact on trade balance (Asiedu, 2006; Ndikumana & Verick, 2008). Others find that FDI contributes positively to exports only when accompanied by structural transformation and industrial upgrading (World Bank, 2014; Zahonogo, 2016).

Recent studies incorporating export sophistication indicators, such as the Economic Complexity Index, highlight that SSA countries with higher export complexity experience more resilient trade balances and improved import-financing capacity (Hausmann et al., 2014). However, empirical work explicitly examining the interactive role of FDI and ECI on trade balance in SSA remains limited, particularly using dynamic panel techniques that address endogeneity.

Conceptually, our study posits that FDI influences trade balance both directly and indirectly through ECI. FDI enhances production efficiency, technology transfer, and market access, while ECI determines the ability to generate stable foreign exchange earnings. The interaction between FDI and ECI is therefore expected to strengthen the capacity to finance imports and improve the trade balance. The limited SSA-focused empirical evidence on this interaction, especially using dynamic GMM approaches over extended periods, constitutes a critical gap that this study seeks to fill.

3. Data and Method

We adopt a quantitative, explanatory research design based on panel data econometric analysis to examine the relationship between FDI and ECI vis-à-vis trade balance in SSA. A panel framework is appropriate given the cross-country heterogeneity and time-varying macroeconomic dynamics characterizing SSA economies. The design allows for controlling unobserved country-specific effects while capturing both short-run adjustments and long-run structural relationships in external sector performance (Baltagi, 2021; Wooldridge, 2010).

Empirical analysis utilizes balanced annual panel data for 20 SSA countries (Appendix 12), covering the period 2005–2024. The sample selection is guided by data availability and consistency across key variables. All data are sourced from the WDI database of the World Bank, ensuring comparability and reliability across countries and over time (World Bank, 2024).

The dependent variable is the trade balance (TB), measured as exports minus imports in absolute terms (TB = |X - M|), reflects the difference between a country's exports (X) and imports (M) and is a key indicator of a nation's economic health and external sector performance (Krugman et al., 2018; Salvatore, 2016). The core explanatory variable is the interaction of foreign direct investment inflows times export as a capacity to import (FDI*ECI), which reflects the sophistication and diversification of a country's export structure (Hidalgo & Hausmann, 2009).

All study variables, namely TB, FDI and ECI are first transformed using natural logarithms to enhance econometric reliability and interpretability. Logarithmic transformation compresses large numerical scales and reduces the influence of extreme values, which are common in cross-country macroeconomic data. For instance, while the absolute distance between 10 and 10^{10} is enormous, their logarithmic values differ modestly (from 1 to 10), making relationships more stable and comparable. This transformation also helps linearize potentially nonlinear relationships, mitigate heteroskedasticity, and allows estimated coefficients to be interpreted as elasticities, which is particularly useful for policy analysis in international trade and investment studies (Wooldridge, 2010; Baltagi, 2021).

Given the dynamic nature of trade balance adjustment and the potential endogeneity between FDI, exports, and external sector outcomes, we employ the GMM estimation technique. Specifically, Arellano–Bond and Blundell–Bond system GMM estimators are applied to address simultaneity bias, reverse causality, and unobserved heterogeneity (Arellano & Bond, 1991; Blundell & Bond, 1998).

The baseline dynamic specification includes a lagged dependent variable to capture persistence in trade balance performance, alongside the interaction effect of FDI and ECI. The interaction term (FDI*ECI) tests the hypothesis that the impact of FDI on trade balance is conditional on the level of export sophistication, reflecting the complementarity between foreign investment and productive export structures.

The core equation for trade balance is specified as:

$$TB_{it} = \alpha_0 + \alpha_1 TB_{it-1} + \beta_1 FDI_{it} * ECI_{it} + \varepsilon_{it} \quad \ldots\ldots(1)$$

Where:
TB_{it} : Trade balance in country *i* at time *t*
TB_{it-1} : Lagged dependent variable capturing trade balance persistence
FDI_{it} : Foreign direct investment in country *i* at time *t*
ECI_{it} : Exports as a capacity to import in country *i* at time *t*
ε_{it} : Error term.

To address endogeneity, lagged values of the endogenous regressor (FDI*ECI) are used as the instrument. The instrument is valid under the assumption that lagged levels of the endogenous variable are uncorrelated with the contemporaneous error term (Arellano & Bover, 1995). Furthermore, the instrument satisfies the orthogonality condition required by GMM, ensuring identification of structural parameters (Bowsher, 2002). Validity is tested using the Hansen J-statistic, which assesses over-identifying restrictions.

Estimation is conducted using a two-step system GMM with robust standard errors to correct for heteroskedasticity and autocorrelation. Instrument validity is assessed using the Hansen test of over-identifying restrictions. Arellano–Bond serial correlation tests are also employed to confirm model consistency. The number of instruments is carefully controlled to avoid instrument proliferation, in line with best econometric practice (Roodman, 2009).

GMM estimator is expressed as:

$\hat{\theta}_{GMM} = \underset{\theta}{\operatorname{argmin}}[\frac{1}{n}\sum_{i=1}^{n} g(X_i,\theta)]' W_n [\frac{1}{n}\sum_{i=1}^{n} g(X_i,\theta)]$ …….…… (2)

Where:

$g(X_i,\theta) = \frac{1}{n}\sum_{i=1}^{n} Z_i' \varepsilon_i(\theta)$ is the vector of moment conditions,

W_n : A consistent estimate of the weighting matrix,

θ: Vector of structural parameters (Arellano & Bond 1991; Blundell & Bond 1998).

The GMM framework is preferred due to its capacity in handling potential bias from endogenous regressors while accounting for heteroskedasticity and autocorrelation of unknown form (Baltagi, 2021).

4. Results and Discussion

Appendix 1 presents descriptive statistics of the variables, namely foreign direct investment (LNFDI) and exports as a capacity to import (LNECI), expressed in natural logarithms. The mean values of LNFDI (19.74) and LNECI (26.70) suggest moderate but heterogeneous levels of foreign investment inflows and export capacity across SSA countries over the period 2005 to 2024. Relatively wide ranges, LNFDI varying from 14.39 to 24.43 and LNECI from 20.42 to 30.87, reflect substantial cross-country disparities in investment attractiveness and export sophistication within the region.

The standard deviations indicate greater variability in ECI than in FDI inflows, underscoring structural differences in production and export capabilities across SSA economies. Both variables exhibit mild negative skewness, suggesting a concentration of observations above the mean, particularly for ECI. Jarque–Bera statistics reject the null hypotheses of normality, which is common in macro-panel data and justifies the use of robust econometric techniques such as the GMM (Arellano & Bond, 1991; Roodman, 2009).

Stationarity of trade balance (LNTB), foreign direct investment (LNFDI), and exports as a capacity to import (LNECI) is examined using the Augmented Dickey–Fuller (ADF) unit root test (Appendices 2–7). Results indicate that all variables are non-stationary in levels ($p > 0.05$), confirming the presence of unit roots. However, after first differencing, the null hypothesis of a unit root is rejected for each variable ($p < 0.05$), implying that they become stationary. Consequently, they are integrated of order one, I(1), a condition that further justifies the application of dynamic panel estimation GMM, which is well-suited for handling non-stationary variables, endogeneity, and dynamic adjustments in macroeconomic panel data (Dickey & Fuller, 1979; Baltagi, 2021; Arellano & Bond, 1991).

Generalized Method of Moments (GMM) model results (Appendix 8)

$\widehat{\text{LNTB}} = 0.275386 LNTB_{it-1} + 0.217378\text{LNFDI*LNECI}$ ……. (3)

Hence,

$$\hat{\theta}_{GMM} = \begin{bmatrix} 0.275386 \\ 0.217378 \end{bmatrix}$$

Specification of the trade balance model reveals that the lagged dependent variable, $LNTB_{it-1}$, is positive and statistically significant, with a coefficient of 0.275386. This implies that approximately 27.5 percent of past trade balance performance persists into the current period, confirming the presence of trade balance inertia in SSA. The result suggests that improvements or deteriorations in the trade balance tend to be gradual rather than instantaneous, reflecting structural rigidities such as production constraints, import dependence, and adjustment costs in external trade (Pesaran et al., 2001; Arellano & Bond, 1991).

The significance of the lagged trade balance validates the choice of a dynamic panel GMM estimator, as static models would yield biased and inconsistent estimates in the presence of persistence and endogeneity. This finding aligns with earlier studies that document strong path dependence in external sector outcomes among developing economies (Frankel & Rose, 2002; Calderon & Chong, 2001).

The core finding of the study is the positive and statistically significant interaction effect between foreign direct investment and exports as a capacity import (FDI*ECI). The estimated coefficient of 0.217378 implies that a 10 percent simultaneous increase in FDI inflows and ECI, improves the trade balance by approximately 2.2 percent, ceteris paribus. This result highlights the complementarity hypothesis, whereby FDI enhances trade balance only when it is embedded within an export-oriented and structurally diversified economy.

Unlike enclave-type FDI, which often exacerbates import dependence, export-linked FDI strengthens foreign exchange earnings, improves the capacity to finance imports, and reduces chronic trade deficits (Borensztein et al., 1998; Alfaro et al., 2004). This interaction-based evidence represents a unique contribution, as most SSA-focused studies examine the direct effects of FDI or exports independently, rather than their joint impact on trade balance dynamics.

Robustness diagnostics indicate that the residuals deviate from normality, as evidenced by a kurtosis value of 5.71 and a Jarque–Bera probability of 0.00 (Appendix 9), leading to rejection of the null hypothesis of normality. The residual plots further show that some observations fall outside the confidence bands (Appendix 10), suggesting leptokurtic behavior. Such non-normality is common in macro-panel data for developing economies, where structural breaks, external shocks, and cross-country heterogeneity are prevalent (Baltagi, 2021). Crucially, this does not compromise the validity of the GMM estimates, since the estimator does not require normally distributed errors but relies on orthogonality and moment conditions for consistency and efficiency (Arellano & Bond, 1991; Roodman, 2009).

Robustness of the model is further confirmed by the Hansen J-statistic, whose probability value of 0.37 implies a failure to reject the null hypothesis that the instruments are valid. This confirms that the instruments used in the GMM estimation are exogenous and correctly excluded from the estimated equation. Consequently, the model does not suffer from instrument proliferation or over-identification bias, reinforcing the reliability of the estimated coefficients (Roodman, 2009).

Arellano–Bond serial correlation test (Appendix 11) indicates the presence of first-order autocorrelation and absence of second-order autocorrelation in the residuals. Specifically, AR(1) is negative and statistically significant ($m = -3.82$, $p < 0.01$), which is expected in first-differenced dynamic panel models and does not signal model misspecification. In contrast, AR(2) is statistically insignificant ($m = -1.51$, $p = 0.13$), implying no evidence of second-order serial correlation. The absence of AR(2) correlation confirms the validity of the moment conditions and supports the consistency of the GMM estimator employed in the analysis (Arellano & Bond, 1991; Roodman, 2009).

Limitations

Despite its methodological rigor and contribution to understanding the role of FDI and ECI in shaping trade balance outcomes in SSA, our study is subject to several limitations that warrant cautious interpretation of the findings. First, with respect to research design, the study adopts a macro-level panel framework, which while appropriate for capturing cross-country dynamics inevitably abstracts from firm-level, sectoral, and micro-institutional heterogeneity that may influence the effectiveness of FDI and ECI (Helpman et al., 2004; Alfaro et al., 2010). Consequently, the results may not fully capture within-country structural differences, particularly between resource-based and manufacturing-oriented economies.

Secondly, regarding sample and data coverage, the study relies on annual secondary data for 20 SSA countries over the period 2005 to 2024, sourced from the World Development Indicators. Although the panel is balanced, data availability constraints limit the inclusion of all SSA countries and may introduce selection bias toward economies with relatively better statistical reporting systems (Baltagi, 2021). In addition, ECI and aggregate FDI inflows may mask qualitative differences in export sophistication and the sectoral composition of FDI, which are critical for trade balance outcomes (Hausmann et al., 2007).

Lastly, in terms of data analytical procedures, while the GMM estimator is well-suited for addressing endogeneity, simultaneity, and dynamic persistence, it is not without limitations. GMM estimates can be sensitive to instrument proliferation and potential weak instruments, which may bias coefficients if not carefully controlled (Roodman, 2009). Although diagnostic tests, including the J-statistic support instrument validity, the reliance on internal instruments may not fully eliminate all sources of endogeneity, particularly those arising from omitted institutional or geopolitical factors affecting trade balance performance in SSA (Acemoglu et al., 2001).

5. Conclusion and Recommendations

Conclusion

We set out to examine whether foreign direct investment and exports, as a capacity to import jointly, enhance the ability of SSA economies to improve their trade balance. Anchored in dynamic panel econometric analysis and guided by structural trade and development theory, we provided a coherent explanation of how external capital inflows and export sophistication interact to shape external sector outcomes in developing economies. Our findings collectively affirm that trade balance performance in SSA cannot be adequately explained by isolated policy instruments; rather, it emerges from the complementarities between productive FDI and ECI upgrading.

Our study contributes to the broader development economics discourse by demonstrating that the effectiveness of FDI in addressing persistent trade imbalances depends critically on the nature of export structures and productive capabilities within host economies. This insight aligns with structuralist and endogenous growth perspectives, which emphasize the role of industrial upgrading, learning-by-doing, and export diversification in sustaining external balance and long-run growth (Prebisch, 1950; Hausmann et al., 2007; Rodrik, 2018). By integrating ECI into the analysis, the study moves beyond conventional trade balance determinants and highlights the importance of export quality and complexity in shaping Africa's external sustainability.

From a policy standpoint, our study underscores the need for integrated strategies that align FDI attraction with export-oriented industrialization, regional value-chain development, and technological upgrading. Such alignment is particularly critical for SSA economies that continue to experience structural trade deficits, vulnerability to external shocks, and limited domestic productive capacity (UNCTAD, 2023; African Development Bank, 2022). Overall, we reinforce the argument that sustainable improvements in trade balance outcomes in SSA require a shift from volume-based export expansion toward capability-driven, investment-linked export transformation.

Recommendations

Our findings underscore the need for SSA economies to adopt integrated trade–investment policies that deliberately align foreign direct investment inflows with export capacity development. Governments should prioritize attracting export-oriented and productivity-enhancing FDI, particularly into manufacturing, agro-processing, and knowledge-intensive sectors that enhance economic complexity and strengthen the capacity to finance imports. This approach moves beyond volume-based export promotion toward structural transformation of export baskets, which is critical for improving trade balance sustainability (Hausmann et al., 2014; UNCTAD, 2023).

Additionally, macroeconomic and trade policies should emphasize regional value chain participation, especially under the African Continental Free Trade Area (AfCFTA), to enable FDI spillovers across borders and deepen export sophistication. Stable exchange rate management, investment-friendly regulatory frameworks, and targeted fiscal incentives tied to export performance are essential for ensuring that FDI contributes meaningfully to external sector resilience rather than reinforcing import dependence (Rodrik, 2018; IMF, 2022).

SSA governments and development partners should strengthen export capacity-building initiatives, including industrial upgrading programs, skills development, and technology diffusion mechanisms that enhance absorptive capacity for FDI spillovers. Investment promotion agencies should shift from passive FDI attraction

to strategic investment targeting, linking multinational enterprises to domestic suppliers and export markets through local content and supplier development programs (OECD, 2019).

Furthermore, national trade and industrial institutions should invest in export intelligence systems, quality infrastructure, and standards compliance to support firms' integration into global markets. Such programs enhance the effectiveness of FDI–export complementarities, thereby reinforcing countries' ability to finance imports and stabilize trade balances over time (World Bank, 2020).

Future research could extend this analysis by exploring sector-specific dynamics of FDI and ECI, as aggregate measures may conceal important heterogeneities across industries. Further studies could also incorporate firm-level or value-added trade data to better capture micro-level transmission channels through which FDI influences export sophistication and trade balance outcomes.

Methodologically, future work may employ alternative dynamic estimators or non-linear frameworks to assess threshold effects in the FDI–ECI–trade balance nexus, particularly in low-income and fragile SSA economies. Such extensions would enrich the empirical literature on external sector sustainability and inform more nuanced policy design (Aghion et al., 2021).

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APPENDICES

Appendix 1: Descriptive statistics

	LNFDI	LNECI
Mean	19.74268	26.69535
Median	19.73548	27.42601
Maximum	24.42848	30.86505
Minimum	14.39035	20.42241
Std. Dev.	1.427882	2.417976
Skewness	-0.138906	-0.502396
Kurtosis	3.826509	2.482399
Jarque-Bera	12.67161	21.29199
Probability	0.001772	0.000024
Sum	7897.07	10678.14
Sum Sq. Dev.	813.5001	2332.796
Observations	400	400

Appendix 2: Unit root test, LNTB (in Level)

Panel unit root test: Summary
Series: LNTB
Date: 12/23/25 Time: 03:14
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.36325	0.0004	20	360
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.78989	0.2148	20	360
ADF - Fisher Chi-square	50.4277	0.1249	20	360
PP - Fisher Chi-square	58.0121	0.0326	20	380

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 3: Unit root test, LNTB (in first difference)

Panel unit root test: Summary
Series: D(LNTB)
Date: 12/23/25 Time: 03:13
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.17086	0.0000	20	340
Null: Unit root (assumes individual unit root process)				

Im, Pesaran and Shin W-stat	-6.35184	0.0000	20	340
ADF - Fisher Chi-square	112.028	0.0000	20	340
PP - Fisher Chi-square	146.681	0.0000	20	360

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 4: Unit root test, LNFDI (in Level)

Panel unit root test: Summary
Series: LNFDI
Date: 12/23/25 Time: 03:18
Sample: 2005 2024
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.76983	0.7793	20	360
Breitung t-stat	2.63865	0.9958	20	340
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.09157	0.5365	20	360
ADF - Fisher Chi-square	46.4050	0.2252	20	360
PP - Fisher Chi-square	69.1620	0.0028	20	380

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 5: Unit root test, LNFDI (in first difference)

Panel unit root test: Summary
Series: D(LNFDI)
Date: 12/23/25 Time: 03:17
Sample: 2005 2024
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.09259	0.0010	20	340
Breitung t-stat	-2.63172	0.0042	20	320
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.40848	0.0000	20	340
ADF - Fisher Chi-square	100.621	0.0000	20	340
PP - Fisher Chi-square	286.935	0.0000	20	360

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 6: Unit root test, LNECI (in Level)

Panel unit root test: Summary
Series: LNECI
Date: 12/23/25 Time: 03:21
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.75552	0.2250	20	360
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.52326	0.9942	20	360
ADF - Fisher Chi-square	30.9319	0.8476	20	360
PP - Fisher Chi-square	97.3108	0.0000	20	380

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 7: Unit root test, LNECI (in first difference)

Panel unit root test: Summary
Series: D(LNECI)
Date: 12/23/25 Time: 03:20
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-6.04949	0.0000	20	340
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.79369	0.0000	20	340
ADF - Fisher Chi-square	119.668	0.0000	20	340
PP - Fisher Chi-square	232.243	0.0000	20	360

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 8: Generalized Method of Moments (GMM) model results

Dependent Variable: D(LNTB)
Method: Panel Generalized Method of Moments
Transformation: First Differences
Date: 12/23/25 Time: 03:39
Sample (adjusted): 2008 2024
Periods included: 17
Cross-sections included: 20
Total panel (balanced) observations: 340
White period (period correlation) instrument weighting matrix
White period (cross-section cluster) standard errors & covariance (d.f. corrected)
Standard error and t-statistic probabilities adjusted for clustering
Instrument specification: @DYN(D(LNTB),-2) D(LNFDI)*D(LNECI) (-1)

Constant added to instrument list

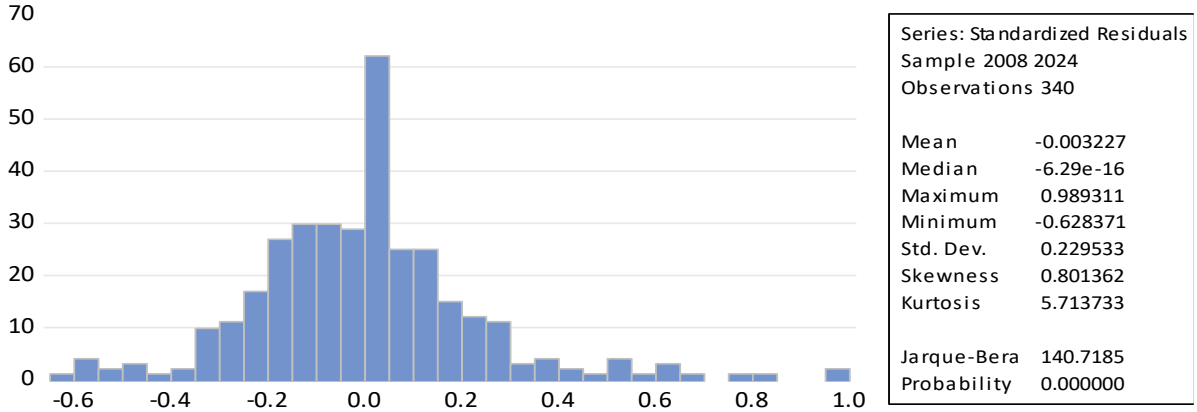
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNTB(-1))	0.275386	0.003985	69.10623	0.0000
D(LNFDI)*D(LNECI)	0.217378	0.003123	69.60932	0.0000

Effects Specification

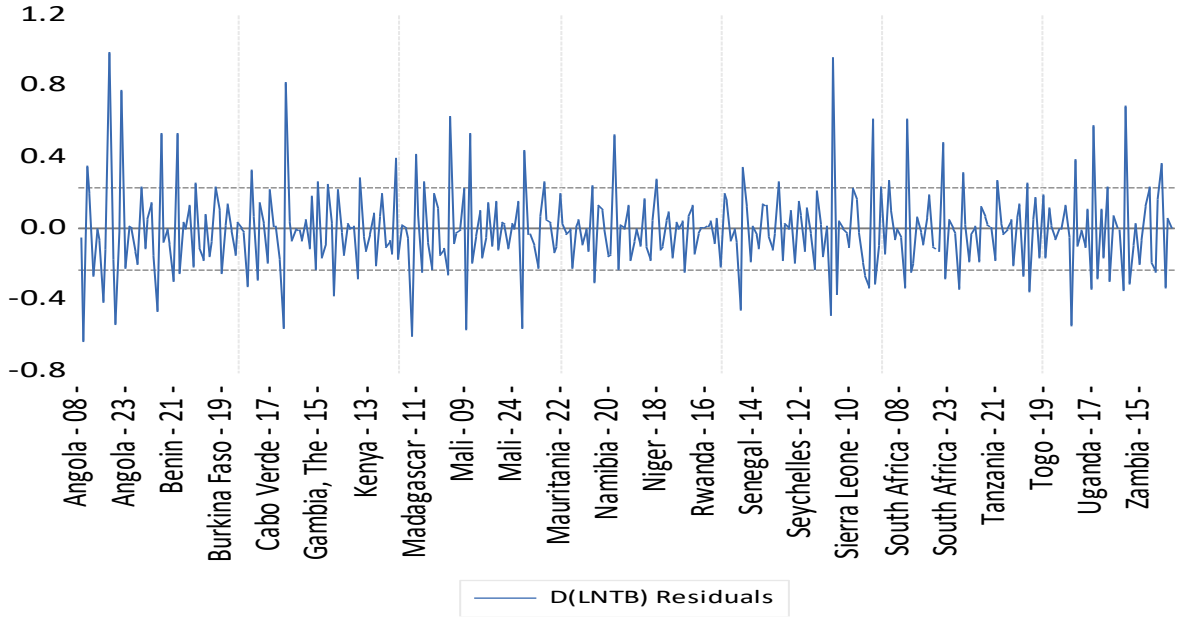
Cross-section fixed (first differences)

Mean dependent var	-0.003348	S.D. dependent var	0.206568
S.E. of regression	0.229895	Sum squared resid	17.86383
J-statistic	19.33955	Instrument rank	20
Prob(J-statistic)	0.371200		

Appendix 9: Normality test



Appendix 10: Graph of residuals



Appendix 11: Serial Correlation Test

Arellano-Bond Serial Correlation Test

Equation: Untitled

Date: 12/23/25 Time: 06:55

Sample: 2005 2024

Included observations: 340

Test order	m-Statistic	rho	SE(rho)	Prob.
AR(1)	-3.819584	-7.670544	2.008215	0.0001
AR(2)	-1.508448	-2.603544	1.725976	0.1314

Appendix 12: List of Sub-Saharan Africa countries in the study

Angola	Gambia, The	Mauritania	Senegal	Tanzania
Benin	Kenya	Namibia	Seychelles	Togo
Burkina Faso	Madagascar	Niger	Sierra Leone	Uganda
Cabo Verde	Mali	Rwanda	South Africa	Zambia