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Economic growth through gender parity: Evidence from education, labour, and governance in Uganda

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ABSTRACT

This study examines the extent to which gender parity in education, labour force participation, and governance influences Uganda's economic growth. It investigates whether progress in these dimensions of gender equality leads to sustained economic benefits by analysing both short- and long-run effects using an Autoregressive Distributed Lag (ARDL) model and annual data from 1997 to 2023. The results reveal contrasting effects: while educational parity has a positive but statistically insignificant long-run impact, suggesting that increased female enrolment alone is insufficient for economic transformation, labour force parity exerts a significant negative long-run effect due to structural inefficiencies, such as occupational segregation and under-employment. By contrast, governance parity, measured by female representation in parliament, demonstrates a significant short-run positive effect, indicating that inclusive decision-making can yield immediate economic gains, although its long-run effect remains statistically insignificant due to institutional constraints. These findings highlight the need for structural reforms to enhance the quality of female employment, institutional governance effectiveness, and the alignment between education and labour market demands. Policymakers should prioritize gender-sensitive policies that foster productive employment, strengthen governance reforms, and improve economic returns on educational parity to maximize the contribution of gender equality to economic growth. This study provides empirical evidence supporting gender-inclusive economic strategies, offering valuable insights for Uganda and similar economies in sub-Saharan Africa.

1. Introduction

Gender inequality remains a persistent barrier to inclusive economic growth in many developing nations, particularly in sub-Saharan Africa. Historical disparities in educational access, labour force participation, and political representation have constrained women's economic potential and, consequently, limited overall national productivity (Alwago, 2023; Wang et al., 2023). In Uganda, these disparities can be traced back to colonial structures that relegated women to subsistence and unpaid domestic work, restricting their access to education, formal employment, and decision making (Baten et al., 2021). Although Uganda has made strides in closing the gender gap with notable improvements in female educational attainment and representation in governance, the economic outcomes of these advancements remain unclear (Mukasa et al., 2024).

Uganda is an ideal case study because of its unique gender equality policies, economic structure, and regional economic performance. Unlike some industrialized African economies, Uganda remains predominantly agrarian, with over 70 % of its workforce engaged in agriculture

(Spence et al., 2023). Additionally, Uganda has implemented several gender-inclusive policies such as the National Gender Policy (2007) and affirmative action in governance (Kangave & Rukundo, 2024). However, despite these measures, Uganda's Gross Domestic Product (GDP) per capita growth lags behind that of its regional peers such as Kenya and Rwanda (Julien et al., 2023). Examining Uganda provides valuable insights into whether gender-parity interventions have translated into measurable economic gains and whether these findings can inform similar economies in sub-Saharan Africa.

While Uganda has made considerable progress toward gender parity, it remains essential to compare its performance with countries that have excelled or struggled to achieve gender equality. According to the World Economic Forum's Global Gender Gap Report (2024), Iceland remains the world leader, closing over 90 % of its gender gap owing to well-designed policies promoting equal pay, comprehensive parental leave, and a gender-balanced workforce. This has translated into sustained economic growth and improved social welfare (Faugoo, 2024). Conversely, Afghanistan and Yemen continue to rank among the lowest globally, where restrictive sociocultural norms severely limit women's

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access to education, employment, and political representation, leading to lower economic participation and stagnated GDP growth (Soetan & Nguyen, 2023). Uganda's progress in gender parity lies between these extremes, presenting an opportunity to learn from best practices while avoiding the systemic challenges of lagging nations (Mukasa et al., 2024; Sedlander et al., 2024).

Uganda's economic growth has been influenced by a complex interplay of factors, including political instability, infrastructure deficiencies, high population growth, low industrialization, and dependence on agriculture (Rumanzi et al., 2021; Sendi et al., 2021). Despite significant policy interventions aimed at enhancing gender equality, Uganda's GDP per capita growth remains volatile (Altuzarra et al., 2021). While external economic shocks and governance inefficiencies contribute to this stagnation (Sendi et al., 2021), few studies have examined the role of gender parity in education, labour force participation, and governance as potential accelerators of economic growth (Altuzarra et al., 2021). This study aims to bridge this gap by assessing whether gender parity fosters economic expansion and sustainable development in these key dimensions. For instance, gender equality in education has been shown to contribute to economic growth, particularly in sub-Saharan Africa, including Uganda (Altuzarra et al., 2021).

Moreover, initiatives such as the Uganda Women Entrepreneurship Program (UWEP) have been instrumental in empowering women economically, thereby challenging gender inequality and enhancing their role within communities (Abal et al., 2024). Additionally, the presence of women in parliament has been linked to more gender-sensitive policies, although their impact on economic growth in sub-Saharan Africa remains complex (Altuzarra et al., 2021; Kangave & Rukundo, 2024). Furthermore, policies such as Universal Primary Education (UPE) have aimed to bridge the gender gap in education, which is crucial for long-term economic growth (Mukasa et al., 2024). Therefore, understanding and enhancing gender parity in these areas could lead to more stable and sustainable economic growth in Uganda.

This study aimed to evaluate the role of gender parity in fostering economic growth in Uganda from 1997 to 2023. Specifically, it seeks the following.

1. To investigate the impact of gender parity in primary education on Uganda's economic growth in a predominantly agrarian economy.
2. Examine the relationship between gender parity in labour force participation and GDP per capita growth in Uganda
3. Assess the influence of gender parity in public governance, as measured by the proportion of seats held by women in Uganda's parliament, on economic growth

Through these objectives, this study elucidates the complex interplay between gender parity and economic growth in Uganda, providing a framework for targeted and effective gender policies within the National Development Plan and for broader economic strategies. Ultimately, this study aims to bridge a critical gap in the gender-economic literature by positioning Uganda's experience as a reference point for low-income countries to navigate gender parity development challenges.

2. Literature review

While substantial research explores the impact of gender equality on economic growth, most studies focus on high-income or industrialized economies, where gender parity in education, labour force participation, and governance are closely aligned with productivity gains (Gdakowicz et al., 2023; Pervaiz et al., 2023). However, few studies have examined these dynamics within low-income, agriculturally driven economies such as Uganda, where the structure and context of female participation differ markedly (Apire et al., 2023). Countries such

as Iceland, Sweden, and Norway have leveraged gender-inclusive policies, leading to higher female labor force participation, enhanced productivity, and equitable economic outcomes (Faugoo, 2024; Liu, 2024). Studies indicate that closing gender gaps in education and employment contributed to a 12–16 % increase in GDP per capita in Scandinavian countries over the past three decades (Xu, 2025; Yeboah & Mogre, 2024).

On the other hand, in countries like Afghanistan and Yemen, where women face severe restrictions in labor participation and governance, economic growth has remained stagnant, with GDP per capita growing at an average annual rate of less than 1 % over the past two decades (Sharipova & Akhmedova, 2024). This contrast underscores the economic benefits of gender parity policies and provides a framework for Uganda to adopt proven strategies while addressing local constraints (Gugan et al., 2024). This study addresses a critical gap by exploring how gender parity in education, labour, and governance influences economic growth in a setting where female labour is predominantly low-skilled and concentrated in agriculture and where governance structures are still evolving to accommodate gender diversity (Alwago, 2023; Apire et al., 2023).

Unlike previous studies that predominantly focused on secondary and tertiary education (Acheampong et al., 2024; Condrion et al., 2023; Otieno et al., 2024; Oudanou et al., 2024; Singha, 2025; Tsourouffi & Rédei, 2021, pp. 231–248), this study uniquely examined the impact of gender parity in primary education on economic growth, reflecting the realities of limited educational attainment levels in Uganda (Mukasa et al., 2024; Sakaue et al., 2024). By addressing these underexplored dimensions, this study contributes a novel perspective to the economic implications of gender parity in Uganda, offering insights that can extend to similar economies in sub-Saharan Africa (Altuzarra et al., 2021; Wang et al., 2023).

While the economic effects of gender parity in secondary and tertiary education have received substantial attention in global literature (Acheampong et al., 2024; Otieno et al., 2024), the specific role of gender parity in primary education remains comparatively underexplored, particularly in low-income, agrarian contexts such as Uganda. Primary education represents the foundational stage of human capital development and plays a pivotal role in enhancing basic literacy, cognitive skills, and productivity in rural economies (Dube, 2015; Mukasa et al., 2024). In Uganda, where the majority of the population relies on subsistence agriculture and where access to higher education remains limited, investments in primary education can yield significant multiplier effects for household incomes, gender empowerment, and macroeconomic growth (Mukasa et al., 2024; Obwona & Ssewanyana, 2007). Despite its strategic importance, few studies have assessed the macroeconomic impacts of achieving gender parity specifically at the primary education level (Canagarajah, 2012). This study, therefore, fills a crucial empirical gap by evaluating how gender-balanced access to basic education contributes to Uganda's GDP per capita growth, providing a policy-relevant evidence base for education sector prioritization under Uganda's National Development Plan III (Kyohairwe, 2016; Yawe, 2014).

2.1. Theoretical framework

2.1.1. Endogenous Growth Theory

Endogenous growth theory is highly relevant for understanding how gender parity in education contributes to economic growth. By promoting equal access to education, Uganda can expand its human capital base, increasing both the skill level and productivity of its labour force (Nnyanzi & Kilimani, 2018). Gender parity in education ensures that women, who make up a substantial portion of Uganda's population, are equally empowered with skills and knowledge that enhance labour productivity (Hong et al., 2019; Wodon & Onagoruwa, 2019). This, in turn, fosters innovation and increases the overall economic output (Devadas

& Kim, 2020; Raifu, 2019). In developing economies such as Uganda, where the agricultural sector dominates employment, improving education for women could have transformative effects, enabling them to adopt more efficient practices, engage in higher-value economic activities, and reduce reliance on low-productivity labour (Kondo, 2018; Wang et al., 2023).

2.1.2. Human capital theory

The relevance of human capital theory in this study is two-fold. First, it underscores the economic returns on educational investment for women, which is critical in countries where high levels of informal and low-skilled labour prevail (Buscha & Dickson, 2023). Second, it highlights the role of education as a means of breaking the cycle of poverty, as educated women are more likely to make productive contributions to the economy, invest in their children's education, and reduce fertility rates, all of which collectively boost economic growth (Bekele et al., 2024; Wirajing et al., 2023). Therefore, the human capital theory provides additional support for this study's focus on gender parity in education as an essential component of economic development in Uganda (de Albuquerque Junior et al., 2024; Dzadzua, 2023).

2.1.3. Feminist Development Theory (Women in Development - WID)

Feminist Development Theory, specifically the Women in Development (WID) approach, brings a critical perspective to understanding the role of gender in economic growth. Originating from critiques of traditional development models, WID's focus on women's economic inclusion supports this study's investigation of gender parity in labour force participation as a driver of growth (Balasubramanian et al., 2024). In Uganda, where a large proportion of women are engaged in low-skilled agricultural work, gender parity in labour participation could lead to significant economic gains if coupled with policies that provide women with access to higher-skilled, higher-paying jobs (Apire et al., 2023).

Women in Development (WID) emphasizes not only the need for equal labour participation but also structural changes that enable women to access opportunities for skill development, career advancement, and financial independence (Mukasa Bbaale, 2022). By advocating for the reallocation of resources and the removal of institutional barriers, WID aligns with the objective of examining how increased labour force participation among women may enhance Uganda's economic growth potential (Lawin et al., 2022; Quraishi et al., 2021).

2.2. Empirical review

2.2.1. Gender parity in education and economic growth

Gender parity in education is widely acknowledged as a cornerstone for economic growth, enhancing the quality of human capital, increasing labour productivity, and fostering a more innovative workforce (Gdakowicz et al., 2023). Across countries with different income levels, studies have consistently emphasized that educational equality brings about transformative economic benefits (Gdakowicz et al., 2023; Zeng, 2023). However, the mechanisms through which gender parity in education translates into economic outcomes vary considerably, and are often influenced by a country's level of development, sectoral composition, and cultural context (Limaj, 2022).

The pathways linking gender parity in education to growth in middle- and low-income countries, particularly in agrarian economies, are often more complex. While gender parity in primary education can improve basic literacy and productivity, its effects on economic growth are frequently constrained by factors such as limited industrialization, labour market segmentation, and restricted access to high-productivity sectors (Aggarwal et al., 2023; Wang et al., 2023). In these settings, even if gender parity is achieved at the primary level, structural economic constraints and social norms may prevent women from fully realizing the potential economic benefits of their education (Karimah & Susanti, 2022). Thus, while gender parity in education yields measur-

able gains in human capital, these gains do not always translate into proportional economic outcomes in countries where female labour is largely concentrated in low-skill, low-wage jobs (Altuzarra et al., 2021; Quraishi et al., 2021).

In sub-Saharan Africa, where gender disparities in education are pronounced and often compounded by structural challenges, the impact of educational parity on growth is complex. Achieving parity in primary and secondary education levels has been shown to foster economic resilience, as it not only boosts female productivity, but also drives important social changes, such as reduced fertility rates and improved health outcomes for future generations (Alwago, 2023; Wang et al., 2023). In agrarian and rural economies, achieving gender parity in primary education may serve as an essential foundation for growth even if the direct economic impact is limited in the short term (Baten et al., 2021). When coupled with supportive labour policies, this foundational education parity can pave the way for broader economic and social benefits, empowering women to participate more fully in the workforce, and setting the stage for greater economic inclusivity over time (Altuzarra et al., 2021; Oudanou et al., 2024).

2.2.2. Gender parity in labour force participation and economic growth

Gender parity in labour force participation is widely regarded as a catalyst for economic growth, contributing to a more productive and diverse workforce, increasing household income, and driving economic resilience. Empirical studies consistently highlight that when women participate in the labour market on an equal footing with men, economies experience enhanced productivity, greater economic stability, and more balanced growth (Buterin et al., 2023; Mose, 2024). However, the relationship between gender parity in labour and economic performance is not uniform across regions or income levels. Factors such as the nature of female employment, sectoral composition, and societal norms significantly influence the economic outcomes of gender-inclusive labour markets (Chopra, 2024; Ibouk & Elouaouiti, 2023).

Low- and middle-income countries face unique challenges that can limit the economic benefits of gender parity in labour. In many developing regions, female labour force participation is concentrated in low-wage, low-skill, or informal sectors such as agriculture, domestic work, and small-scale trade (Obodoechine, 2019; Osabohien et al., 2021). While increased labour force participation among women can increase overall economic productivity in these countries, the gains are often modest and may not immediately translate into significant growth (Balasubramanian et al., 2024; Quraishi et al., 2021). This is largely due to structural constraints, such as limited access to education and skill development, restricted opportunities in high-productivity sectors, and prevailing social norms that reinforce traditional gender roles (Bussolo et al., 2024; Jayachandran, 2020). In these contexts, gender parity in labour force participation may lead to economic stability and poverty reduction but may require additional policy support to unlock broader growth potential (Altat, 2019; Sobhee, 2020).

Agrarian economies, in particular, provide examples of the complex dynamics at play. In many of these settings, women make up a significant portion of the agricultural workforce, often as small-scale farmers or informal labourers (Arintyas, 2024; Pradhan et al., 2024). While their contributions are essential to food security and rural economies, they are typically characterized by low wages, high vulnerability to economic shocks, and limited access to productivity-enhancing resources such as credit, training, and technology (Nazir et al., 2023; Singh et al., 2023). Achieving gender parity in labour participation in such economies may improve household welfare and rural resilience but does not always yield significant Gross Domestic Product (GDP) growth unless coupled with structural reforms that enable women to access higher-value roles or more stable income sources (Kegnide et al., 2024). Therefore, while parity in labour participation in agrarian economies supports basic economic resilience, its transformative im-

impact on growth remains contingent on improving the quality of women's employment opportunities.

A crucial factor influencing the economic impact of gender parity on labour force participation is the opportunity for women to engage in formal and high-productivity employment (Lawin et al., 2022; Şahin, 2022). In regions where women are given equitable access to formal employment, skill development, and career advancement, the economic benefits of labour parity are markedly amplified (Hazarika et al., 2024; Ndzabela & Lukman, 2023). Women in the formal sector enjoy higher wages, legal protection, and the ability to contribute directly to economic growth (Lawin et al., 2022; Mazhar, 2022). In contrast, in settings where informal work predominates, such as in parts of Sub-Saharan Africa and South Asia, the absence of formal employment options limits the overall economic impact of gender parity on labour (Sobhee, 2020). Formalizing women's employment, therefore, is not only critical to achieving gender parity but also instrumental in maximizing economic growth (Buterin et al., 2023; Devadas & Kim, 2020).

2.2.3. Gender parity in governance and economic growth

Gender parity in governance has emerged as a powerful driver of economic growth, shaping not only policy inclusivity but also overall national stability and productivity (Emeka et al., 2024). As women achieve equal representation in political and leadership roles, the breadth and diversity of decision making expands, resulting in policies that address a wider array of societal needs (Bac et al., 2024). Empirical evidence shows that when governance structures include women in equal measures, economies experience improved efficiency, transparency, and resilience, driven by more comprehensive and balanced policy initiatives (Emeka et al., 2024; H. Khan et al., 2024). However, the degree to which gender parity in governance influences economic growth varies across political contexts, with pronounced differences between high- and low-income countries (Emeka et al., 2024; Gunu et al., 2024).

The effect of gender parity on economic growth varies between middle-income and low-income countries. While female representation in government brings similar benefits, such as improved public services and greater policy inclusivity, pathways to economic impact are often shaped by unique structural challenges such as institutional constraints, social norms, and limited political agency for women (Domínguez Reyes, 2021; Sijapati & Subedi, 2020). In many developing regions, women in governance roles face significant barriers, including limited support networks, resource constraints, and sociocultural expectations, which can hinder their leadership effectiveness (Liadi et al., 2021). Despite these challenges, evidence from several low- and middle-income countries shows that even modest gains in female political representation can have transformative effects on local economies (Khorshed, 2020). Female leaders are often instrumental in championing policies that support marginalized communities, drive gender equality, and enhance educational and economic opportunities, particularly for women and children (Turrent & del, 2019).

In sub-Saharan Africa, where structural inequalities in governance are deeply rooted, leadership gender parity is an essential component of inclusive economic growth (Alwago, 2023). Countries in this region with higher rates of female representation in the government tend to prioritize investments in social infrastructure such as healthcare and education, which are critical for long-term economic stability (Ojo, 2024a). Women leaders often advocate programs aimed at reducing poverty and supporting small enterprises, which are particularly beneficial in economies dominated by informal and small-scale industries (Ojo, 2024b). Female leaders play a vital role in strengthening grassroots economic resilience by promoting policies to empower rural and underserved communities (T. N. Nchofoung et al., 2024). Moreover, empirical studies suggest that gender parity in governance in these countries can contribute to more peaceful and stable societies because female leaders are typically more likely to engage in consensus building

and conflict resolution, which are crucial for economic growth in regions prone to political instability (Motsage, 2023).

3. Methodology

This study employs a comprehensive methodological approach to examine the impact of gender parity in education, labour force participation, and governance on Uganda's economic growth. Recognizing the unique socio-economic structure of Uganda, this study leveraged a time-series econometric framework to capture the short- and long-term effects of gender equality on economic development.

To achieve this, an Autoregressive Distributed Lag (ARDL) model is applied, which is particularly well-suited for analyzing relationships between variables with mixed integration orders (I(0) and I(1)) (H. A. Hussein & Warsame, 2023; Samatar, 2023). Unlike the Johansen cointegration test, which requires all variables to be integrated at the same level, the ARDL model provides greater flexibility, allowing for the estimation of relationships between variables that exhibit different stationarity properties (Wegari et al., 2023). This makes it particularly suitable for Uganda's economic data, where variables such as gender parity indicators, labour force participation, and governance measures may follow different integration processes (Mir et al., 2024; Worku, 2023).

The ARDL model is preferred over other time-series models because of its ability to provide separate estimates for short-run dynamics and long-run equilibrium relationships, making it especially useful for understanding both the immediate and sustained effects of gender parity on economic growth (KILIC, 2025; Wani et al., 2024). Additionally, the ARDL approach is efficient in small sample sizes, making it ideal for economic studies where data availability may be limited (Chakraborty, 2024; Dhar & Sarker, 2024). Another key advantage of the ARDL framework is that it naturally incorporates an error correction mechanism (ECM), which quantifies the speed of adjustment towards long-run equilibrium when short-term deviations occur (Lim, 2024; Sahnoune & Lagoune, 2024). Furthermore, unlike conventional cointegration techniques, the ARDL model is more robust to structural breaks, which are common in developing economies such as Uganda, due to policy shifts, economic fluctuations, and external shocks (Berwal & Singh, 2024; Ramos-Herrera, 2024).

3.1. Data sources and types

This study relies on secondary data from reputable international sources to examine the impact of gender parity on economic growth in Uganda. The key variables covering gender parity in education, labour force participation, governance, and relevant economic indicators were sourced from databases such as the World Bank, United Nations Educational, Scientific and Cultural Organization (UNESCO), and the International Labour Organization (ILO). The data span from 1997 to 2023 and capture important social and economic trends for an in-depth analysis. Table 2 provides a summary of each variable along with its description and source.

3.2. Empirical model

This study draws on endogenous growth, human capital, and feminist development theories to examine how gender parity in education, labour force participation, and governance impacts Uganda's economic growth.

The theoretical foundation begins with a production function that expresses economic output (Y) as a function of physical capital (K), human capital (H), and labour (L), where productivity (A) represents the efficiency with which these inputs are utilized (Koutsoyiannis & Koutsoyiannis, 1979; Preece, 1985).

$$Y = AK^\alpha H^\beta L^{1-\alpha-\beta} \quad (1)$$

Table 1
Summary of key studies on gender parity and economic growth.

Author	Country of focus	Methodology	Conclusions
Akinwande et al. (2024)	Nigeria	GC, RALS	Gender inequality (GPIN) and financial development (FIDX) have a significant causal relationship with economic growth (GDPC) in Nigeria, indicating that addressing gender disparities and enhancing financial development can lead to improved economic performance in both the long and short term.
Adoho and Alpaslan (2024)	Côte d'Ivoire	OLG	Improved economic growth and reduced poverty levels could be achieved through implementing a composite reform program that integrates both broad-based development policies and gender-based policies. This includes reducing gender bias in the marketplace and enhancing women's bargaining power.
Mirziyoyeva and Salahodjaev (2023)	Europe and Central Asia (ECA)	GMM, FEM, OLS and REM	Female participation in parliament has a positive and significant effect on economic growth, with a specific finding that a 10 %-point increase in women's representation in parliament correlates with a 0.74 %-point increase in GDP growth.
Yıldırım and Akinci (2021)	Middle-income countries	GMM, FEM and OLS	Middle-income countries exhibit a U-shaped relationship between female labour force participation rate and economic growth, supporting the U Feminisation Theory.
Altuzarra et al. (2021)	Sub-Saharan African (SSA) countries	GMM and OLS	Gender equality in education significantly contributes to economic growth, with a more pronounced effect observed in sub-Saharan African countries compared to the broader group of developing countries. Women in these countries face substantial challenges in influencing political priorities that could foster economic growth.
Agénor et al. (2021)	Morocco	OLG	Policies aimed at mitigating gender bias in the workplace can lead to economic growth, particularly when there is a stronger presence of skilled women in the labor market, as they act as agents of change and enhance bargaining power within families.
Farooq et al. (2020)	Organization of Islamic Cooperation (OIC) member countries	GMM	Gender parity, measured by the ratio of female to male labor force participation, is found to have a positive impact on economic growth, alongside other factors such as foreign remittances, government expenditures, capital formation, and human capital, which contribute significantly to economic growth in OIC member countries.

Table 1 (continued)

Author	Country of focus	Methodology	Conclusions
Mishra et al. (2020)	30 Asian countries	ARDL and PMG	The promotion of gender parity leads to increased employment creation and poverty reduction, thereby fostering economic growth in the context of the 30 Asian countries studied.
Scarborough (2020)	United States of America (USA)	FEM	Higher levels of occupational gender segregation negatively impact economic growth, particularly in the finance and technology sectors, which rely on the exchange of information and innovation. This suggests that gender diversity is crucial for fostering economic productivity and development in local labor markets.
Mandal et al. (2018)	127 developing and developed countries	GMM and OLS	Gender-specific human capital, encompassing both education and health, plays a crucial role in determining economic growth, highlighting the importance of addressing gender disparities in these areas to enhance overall economic performance.
Karoui and Feki (2018b)	Tunisia	ADF, PP and GC	Gender inequality in education has a detrimental impact on economic growth by negatively affecting the intellectual environment, the skills of children, and the overall qualification of the workforce, which in turn reduces productivity and economic performance.
Karoui and Feki (2018a)	Sub-Saharan African (SSA) countries	GMM, OLS and REM	Inequalities in life expectancy between men and women negatively affect economic growth, and an increase in female labor force participation relative to men can lead to a reduction in economic development.
Klasen (2018)	Pakistan, India, Turkey, Sudan, and Nigeria	SR	Gender gaps in education significantly hinder economic growth, with robust evidence supporting this claim, while there is a need for more detailed research on the effects of employment gaps and their relationship to economic growth, as well as the efficiency of farms and firms.
Cabeza-García et al. (2018)	127 high- and low-income countries	GMM	Increased access to secondary education and the labor market for women, along with their active political participation, positively contributes to economic growth, highlighting the importance of gender equality in fostering inclusive economic development.
Morais Maceira (2017)	European Union (EU) countries	E3MEM	Improving gender equality, particularly in areas such as STEM education, labor market activity, and pay, can significantly boost GDP per capita and increase women's employment, leading to higher productivity and enhanced economic growth across the EU.

(continued on next page)

Table 1 (continued)

Author	Country of focus	Methodology	Conclusions
H. U. R. Khan et al. (2017)	20 high-income OECD countries	DOLS, GMM and FEM	Achieving gender parity in educational attainment significantly contributes to economic growth, indicating that investments in education for both genders can lead to better economic outcomes in high-income OECD countries.
M. K. Khan (2016)	Pakistan	ECM, VAR	Addressing gender inequality and enhancing female access to education and health services are crucial for fostering sustainable economic growth in Pakistan.
Kabeer (2016)	Ghana, Bangladesh	FIF	The positive impact of gender equality on economic growth is largely influenced by the near-universal assignment of unpaid care work to women, which enhances children's well-being and education, thereby contributing to the productivity of future generations.
Mitra et al. (2015)	101 countries	EFA	Developing nations should focus on enhancing women's access to education and economic opportunities, whereas developed societies should prioritize achieving greater equality in outcomes to foster economic growth.
Bandara (2015)	Sub-Saharan African (SSA) countries	GMM, OLS and 2SLS	The gender gap in effective labor, which encompasses both labor force participation and education, has a significant negative impact on economic output per worker in African countries, indicating that the underutilization of women's potential in the labor market is detrimental to economic growth.

Abbreviations for the methods used are defined as follows: Autoregressive Distributed Lag (ARDL) Augmented Dickey-Fuller test (ADF) Dynamic Ordinary Least Squares (DOLS) Energy-Environment-Economy Macro-Econometric model (E3MEM) Error Correction Model (ECM) Exploratory Factor Analysis (EFA) Feminist Institutional Framework (FIF) First Difference (FD) Fixed Effects Model (FEM) Generalised Method of Moments (GMM) Granger Causality (GC) Ordinary Least Squares (OLS) Overlapping Generations (OLG) Pooled Mean Group (PMG) Random Effects (RE) Residual Augmented Least Square (RALS) Systematic Review (SR) Two-Stage Least Squares (2SLS) Vector Autoregression (VAR) Vector Error Correction Model (VECM).

In this framework, A serves as a productivity factor that can be enhanced by gender parity, reflecting how inclusive practices in education, labour participation, and governance improve economic performance. To integrate gender parity into this model, productivity (A) is defined as a function of gender parity indicators:

$$A = A_0 \cdot f(GPE, GPL, GPG) \tag{2}$$

where A_0 is the baseline productivity level, and $f(GPE, GPL, GPG)$ capture the productivity enhancements associated with gender parity in the education (GPE), labour force participation (GPL), and governance (GPG). By substituting this modified A into Equation (1), gender parity indirectly influences economic output through its effect on productivity, resulting in the following model.

$$Y = A_0 \cdot f(GPE, GPL, GPG) \cdot K^\alpha H^\beta L^{1-\alpha-\beta} \tag{3}$$

Table 2
Description of variables.

Variable	Description	Source
GDP per capita (GDPPc)	Annual GDP per capita growth rate	World Bank (World Development Indicators)
Education Parity Index (PRIM)	Ratio of female-to-male enrollment in primary education	UNESCO Institute for Statistics
Labour Force Participation (LABOUR)	Ratio of female-to-male labour force participation	International Labour Organization (ILO)
Governance Parity (SEATS)	Proportion of seats held by women in parliament	Inter-Parliamentary Union (IPU)
Gross Capital Formation (INVEST)	Percentage of GDP invested in physical capital	World Bank (World Development Indicators)
Trade Openness (OPEN)	Total trade as a percentage of GDP	World Bank (World Development Indicators)

Source: Author's analysis of theoretical and empirical literature

To make this model suitable for empirical testing, it was transformed into a log-linear form by taking the natural logarithm of both sides, producing a linearized model that simplifies the estimation.

$$\ln Y = \ln A_0 + \alpha \ln K + \beta \ln H + (1 - \alpha - \beta) \ln L + g_1 GPE + g_2 GPL + g_3 GPG + \epsilon \tag{4}$$

In this expression, g_1 , g_2 , and g_3 represent the effects of gender parity in education, labour force participation, and governance, respectively, on productivity. This formulation allows us to assess both the direct contributions of capital, human capital, and labour to economic output, as well as the indirect contributions from gender parity as a factor enhancing productivity.

For empirical implementation in Uganda, we use proxy variables for each theoretical component. GDP per capita (GDPPc) represents economic output (Y), while Education Parity Index (PRIM), Labour Force Participation (LABOUR), and Governance Parity (SEATS) serve as proxies for GPE, GPL, and GPG, respectively. Additionally, Gross Capital Formation (INVEST) is used as a proxy for physical capital (K) and Trade Openness (OPEN) is included as a control variable to account for broader economic influences. Thus, the final empirical model is as follows.

$$GDP_{PC_t} = \alpha + \beta_1 PRIM_t + \beta_2 SEATS_t + \beta_3 LABOUR_t + \beta_4 INVEST_t + \beta_5 OPEN_t + \epsilon_t \tag{5}$$

Each variable in this model reflects a theoretically grounded component, thus providing a structured approach for assessing the impact of gender parity on economic growth in Uganda. By linking these theoretical constructs to empirical proxies, this model allows for a rigorous analysis of how gender equality in education, labour, and governance drives economic outcomes.

3.3. Estimation approach

The Autoregressive Distributed Lag (ARDL) model was chosen as the primary estimation technique for this study because of its distinct advantages in handling time series data with mixed integration orders. Unlike conventional cointegration methods, which typically require all variables to be integrated in the same order, the ARDL model can accommodate variables that are combinations of I(0) and I(1) (M. A. Hussein & Hmood, 2024; Natsiopoulou & Tzeremes, 2022). This flexibility is particularly beneficial for this study, given that socioeconomic data on gender parity indicators, economic growth, and control variables in Uganda may not share the same integration properties (Makua et al., 2022). By allowing for mixed integration, the ARDL model provides a robust and reliable framework for analyzing the effects of gen-

der parity on economic growth without the risk of spurious results arising from integration mismatches (Khudair & Mohammed, 2022).

3.3.1. Stationarity test

Most time-series models assume that the time series are stationary (statistical properties such as mean and variance remain constant over time) (Zuo, 2019). The unit root test validates this assumption (Das & Das, 2019). If the data are nonstationary over time, regression can lead to spurious regression (Cheng et al., 2021). This study used the Augmented Dickey Fuller (ADF) test, that is, regressing Δy on its lag and testing for the significance of its coefficient (da Costa Figueiredo & da Silva, 2018). The null hypothesis for the DF test is that the time series is nonstationary (Zuo, 2019). For all cases in which the test statistic was less than the critical value, the null hypothesis was rejected, and it was concluded that the series were stationary or otherwise non-stationary (KHAN & HASHMI, 2020). The ADF test equation is as follows:

$$\Delta Y_t = \alpha_0 + \beta X_{t-1} + \alpha(t) + \sum_{i=1}^k \beta \Delta X_{t-1} + \mu_t \quad (6)$$

Where Y_t is observed over time, optimal lag length i is set to ensure that any autocorrelation in ΔX_t is absorbed, and the error term is distributed as white noise. For each variable, ADF was run with the null hypothesis $H_0 : \beta_i = 0$ against the alternative that the data were trend stationary, $H_1 : \beta_i < 1$. The critical value was set to 5 %. The null hypothesis was rejected for every p-value less than the 5 percent level of significance.

This study used a differencing method to transform a non-stationary variable into a stationary variable. The differenced series represents the change in each observation of the original series. It only has $t-1$ values, because it is not possible to calculate the difference for the first observation. The differencing equation is given as:

$$\Delta Y_t = Y_t - Y_{t-1} = \alpha_0 + \mu_t \quad (7)$$

where ΔY_t is the first-differenced outcome variable (the difference between t_0 and t_1) and μ_t is the first-differenced error.

3.3.2. Autoregressive distributed lag (ARDL) model

The autoregressive distributed lag (ARDL) model is based on OLS. It exploits the lagged values of the dependent variable and the current and lagged values of the independent variables to estimate time-series equilibrium relationships with robust results. According to (Pesaran & Shin, 1995), the augmented ARDL (p, q_1, q_2, \dots, q_k) model can be expressed as:

$$\varnothing(L, p)y_t = \alpha_0 + \sum_{i=1}^n b_i(L, q_i)x_{it} + \delta w_t + \cup_t; t = 1, \dots, n \quad (8)$$

where y_t is the dependent variable, α_0 is the constant term, x_{it} is the independent variable, L is the lag operator, and w_t is the $s \times 1$ vector of deterministic variables, including intercept terms, dummy variables, time trends, and other exogenous variables with fixed lags.

The (conditional) unrestricted Error Correction Model (ECM) version of the selected ARDL model can be obtained by rewriting the equation in terms of the lagged levels and first differences of $y_t, x_{1t}, x_{2t}, \dots, x_{kt}$, and w_t as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 t + \lambda_{yx} Z_{t-1} + \sum_{i=1}^{p-1} b_i \Delta y_{t-i} + \sum_{i=0}^{p-1} b_i \Delta x_{t-i} + \delta w_t + \cup_t \quad (9)$$

where Δ is the first difference operator, t is the trend, the coefficient b_i expresses the short-run dynamics of the model's convergence to equilibrium, and $Z_t = y'_t, x'_t$

According to (Pesaran & Shin, 1995) equation (9) can be expressed in the unrestricted error correction model (UECM) version of ARDL as follows:

$$\begin{aligned} \Delta GDPpc = & \alpha_0 + \sum_{i=1}^n b_1 \Delta (GDPpc)_{t-i} + \sum_{i=1}^n b_2 \Delta (PRIM)_{t-i} \\ & + \sum_{i=1}^n b_3 \Delta (SEATS)_{t-i} + \sum_{i=1}^n b_4 \Delta (LABOUR)_{t-i} \\ & + \sum_{i=1}^n b_5 \Delta (INVEST)_{t-i} + \sum_{i=1}^n b_6 \Delta (OPEN)_{t-i} \\ & + b_7 (GDPpc)_{t-1} + b_8 (PRIM)_{t-1} + b_9 (SEATS)_{t-1} \\ & + b_{10} (LABOUR)_{t-1} + b_{11} (INVEST)_{t-1} \\ & + b_{12} (OPEN)_{t-1} + \beta ECM_{t-1} + \varepsilon_t \end{aligned} \quad (10)$$

where b_i ($i = 1-6$) are long-run parameters, b_i ($i = 7-12$) are short-term parameters, ε_t is a vector of stochastic error terms, with zero means and constant variance-covariance. Δ is a short-run change parameter, and ECM represents the error correction term.

3.3.3. The Autoregressive Distributed Lag (ARDL) F-bounds cointegration test

This research utilized the Autoregressive Distributed Lag (ARDL) "Bounds test" technique specified by (Pesaran & Shin, 1995) to determine the existence of a long-term relationship and to estimate both long- and short-term coefficients. The ARDL model generates a dynamic error correction model (ECM) that incorporates short-term fluctuations with long-term equilibrium without losing long-term information (Elian et al., 2020; Lim, 2024). The error correction model is used to explain the short-term adjustments that occur towards equilibrium in response to structural shocks. The ARDL (p, q) model approach for cointegration testing has the following form.

$$\begin{aligned} \Delta GDPpc = & \alpha_0 + b_1 (GDPpc)_{t-1} + b_2 (PRIM)_{t-1} + b_3 (SEATS)_{t-1} \\ & + b_4 (LABOUR)_{t-1} + b_5 (INVEST)_{t-1} + b_6 (OPEN)_{t-1} \\ & + \sum_{i=1}^p b_7 \Delta (GDPpc)_{t-i} + \sum_{i=0}^q b_8 \Delta (PRIM)_{t-i} \\ & + \sum_{i=0}^q b_9 \Delta (SEATS)_{t-i} + \sum_{i=0}^q b_{10} \Delta (LABOUR)_{t-i} \\ & + \sum_{i=0}^q b_{11} \Delta (INVEST)_{t-i} + \sum_{i=0}^q b_{12} \Delta (OPEN)_{t-i} + \varepsilon_t \end{aligned} \quad (11)$$

where $i = 1, \dots, k; p, q$ are optimal lag orders. (p) is the optimal lag for the dependent variable, and (q) is the optimal lag for exogenous variables. ε_t is the vector of error terms. The F-statistic is based on the null hypothesis that the coefficients of lagged variables are zero. ($b_1 - b_6$) model the long-run relationship, while ($b_7 - b_{12}$) represent the short-run dynamics of the model. Thus, we tested the following hypothesis: no long-run relationship exists ($H_0; b_i = b_j = 0$)

The rule of thumb is that if the calculated F-statistic is greater than the critical value for the upper bound $I(1)$, we reject the null hypothesis, conclude that there is cointegration, and proceed to estimate the error correction model (ECM). If a long-run relationship exists, the ARDL representation of equation (11) can be formulated as follows:

$$\begin{aligned} GDPpc = & \alpha_0 + \sum_{i=1}^n b_1 GDPpc_{t-i} + \sum_{i=1}^n b_2 PRIM_{t-i} \\ & + \sum_{i=1}^n b_3 SEATS_{t-i} + \sum_{i=1}^n b_4 LABOUR_{t-i} \\ & + \sum_{i=1}^n b_5 INVEST_{t-i} + \sum_{i=1}^n b_6 OPEN_{t-i} + \varepsilon_t \end{aligned} \quad (12)$$

If the calculated F-statistic is lower than the critical value for the lower bound, $I(0)$, the study fails to reject the null hypothesis and concludes that there is no cointegration in the variables. In this case, only the short-run ARDL model is estimated.

3.4. Estimation of the ECM representation of the autoregressive distributed lag (ARDL) model

In the event of an existing cointegrating relationship, a dynamic error correction model (ECM) can be derived from the Autoregressive Distributed Lag (ARDL) model through simple linear reparameterization. The ECM for the ARDL approach used in this study is given by:

$$\begin{aligned} \Delta GDPpc = & \alpha_0 + \sum_{i=1}^p b_1 \Delta (GDPpc)_{t-i} \\ & + \sum_{i=1}^q b_2 \Delta (PRIM)_{t-i} + \sum_{i=1}^q b_3 \Delta (SEATS)_{t-i} \\ & + \sum_{i=1}^q b_4 \Delta (LABOUR)_{t-i} + \sum_{i=1}^q b_5 \Delta (INVEST)_{t-i} \\ & + \sum_{i=1}^q b_6 \Delta (OPEN)_{t-i} + \beta ECT_{t-1} + \varepsilon_t \end{aligned} \tag{13}$$

Where $b_1, b_2, b_3, b_4, b_5, b_6$ refer to short-run dynamic coefficients that bring the model back to equilibrium, Δ refers to short-run change parameters, and (p, q) to the determined optimal lags for regressand and regressors, respectively. where error correction term (ECT) is the error correction term. β which should be negative (0 to -1) and statistically significant, represents the speed of adjustment at which the model returns to the long-run equilibrium following a short-run shock.

4. Results

4.1. Descriptive analysis

This section provides a summary of the descriptive statistics to offer initial insights into the data distribution and characteristics of the key variables during the study period (1997–2023).

The descriptive statistics presented in Table 3 provide an overview of the central tendencies, dispersion, and distribution of the key variables used in the analysis, including gender parity in primary education (PRIM), female parliamentary representation (SEATS), female-to-male labour force participation rate (LABOUR), and economic growth measured by Gross Domestic Product (GDP) per capita growth (GDPpc). The mean values indicate that, on average, gender parity in education (PRIM) is close to perfect at 0.993, suggesting near-equal primary school enrollment for boys and girls in Uganda over the study period. However, the relatively high standard deviation (0.041) for this variable indicates variability in gender parity across years. Similarly, the average proportion of parliamentary seats held by women (SEATS) was 29.76 %, which reflects some level of female political representation, although it is still below parity.

The variable representing labour force participation (LABOUR) has a notably high mean value of 87.94 %, indicating that women's partici-

Table 3
Descriptive statistics of the study variables.

	GDPPC	PRIM	SEATS	LABOUR	INVEST	OPEN
Mean	2.613	0.993	29.762	87.935	23.202	39.046
Median	2.405	1.008	31.846	87.198	24.178	38.055
Maximum	7.602	1.032	35.412	94.161	30.819	56.258
Minimum	-0.423	0.874	17.794	82.501	16.447	30.044
Std. Dev.	1.946	0.041	5.944	3.659	2.960	5.105
Skewness	0.381	-1.384	-0.858	0.283	-0.162	1.105
Kurtosis	2.310	4.001	2.307	1.731	2.616	4.438
Jarque-Bera	4.573	37.565	14.841	8.360	1.094	30.117
Probability	0.102	0.000	0.001	0.015	0.579	0.000
Sum	271.751	103.257	3095.260	9145.234	2413.003	4060.770
Sum Sq. Dev.	390.104	0.175	3639.026	1378.794	902.663	2684.373

Source: Author's analysis of World Development Indicators data (1997–2023)

pation in the labour force is close to that of men. However, a standard deviation of 3.66 % shows moderate variation in the female-to-male participation ratio over time. The mean GDP per capita growth rate (GDPPc) was 2.61 %, with a significant range from a minimum of -0.42 % to a maximum of 7.60 %, indicating periods of both economic decline and robust growth. The positive skewness of GDPPc (0.386) and its relatively flat distribution (platykurtic with a kurtosis of -0.664) suggest that, while economic growth is generally positive, it includes occasional dips below the mean.

The Jarque-Bera normality test results in Table 3 indicate that while some variables follow a normal distribution, others do not. Specifically, GDP per capita growth (GDPPc) and gross capital formation (INVEST) do not reject the null hypothesis of normality, whereas education parity (PRIM), governance parity (SEATS), labour force participation (LABOUR), and trade openness (OPEN) deviate from normality. However, such deviations are common in economic time-series data and do not inherently undermine the validity of the econometric model. The ARDL framework does not require normally distributed variables for valid estimation, as it remains robust even in the presence of non-normality (Cho et al., 2023; Knief & Forstmeier, 2021; Natsiopoulou & Tzeremes, 2022)

4.2. The relationship between gender parity dimensions and economic growth

The scatterplots in Fig. 1 reveal the diverse relationships between economic growth and independent variables from 1997 to 2023. The negative relationship between education (proxied by primary school enrolment) and economic growth, implies that as education improves, growth seems to decline slightly or vice versa. However, the non-steep slope suggests that this might be a chance association requiring deeper analysis. Similarly, female participation in public governance and economic growth shows a weak negative relationship, where increased representation corresponds to marginal declines in growth, or vice versa.

Female labour force participation and economic growth depicts a negative trend, with a more pronounced slope indicating a stronger inverse relationship. Conversely, there is a steep positive relationship between fertility rate and economic growth, suggesting that higher fertility aligns with increased growth. These trends underscore the complex dynamics that are potentially influenced by socioeconomic factors, policy contexts, and historical conditions, necessitating further multivariate examination to unpack causality and control for confounding variables.

4.3. Diagnostic tests

The diagnostic tests ensured the robustness and reliability of the model results. Pre-estimation diagnostics, including tests for stationarity and multicollinearity, validate the assumptions that are essential for an accurate model specification.

4.3.1. Stationarity test

The stationarity results presented in Table 4 provide crucial insights into the integration properties of the study variables, which is essential in selecting the appropriate econometric approach for analysis. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were used to examine whether each variable exhibits unit root behavior. The findings indicate that the variables exhibit different integration orders, confirming the presence of both I(0) and I(1) variables in the dataset.

The results show that education parity (PRIM) is stationary at level, meaning it is I(0). This implies that gender parity in primary education does not follow a stochastic trend and remains stable over time without requiring differencing. In contrast, GDP per capita growth (GDPPc), governance parity (SEATS), labour force participation (LABOUR), gross

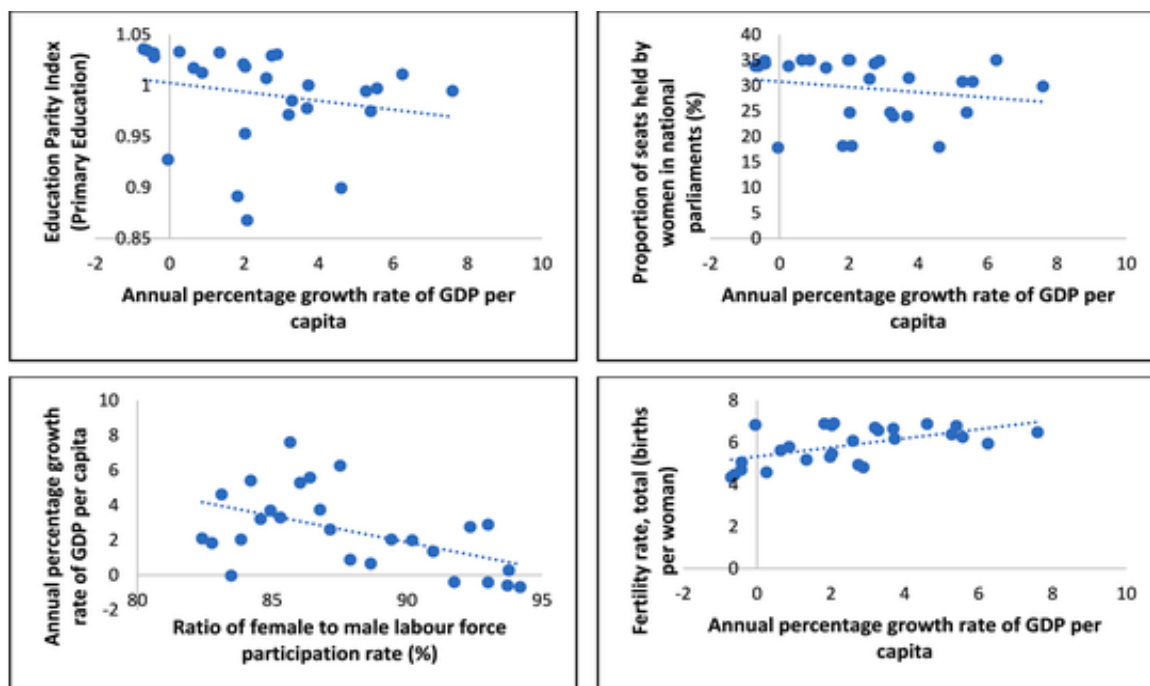


Fig. 1. Scatterplots showing the relationship between gender parity dimensions and economic growth of Uganda from 1997 to 2023.

Table 4 Augmented Dickey-Fuller and Phillips-Perron stationarity test Results.

Variable	Test	Levels			1st Diff.		Critical Values			I(d)
		Statistic	Prob.	5 %	Statistic	Prob.	1 %	5 %	10 %	
GDPpc	ADF	-1.157	0.690	-2.893	-3.473**	0.011	-3.501	-2.893	-2.583	I(1)
	PP	-2.126	0.235	-2.890	-3.549***	0.009	-3.496	-2.890	-2.582	
PRIM	ADF	-3.226**	0.021	-2.890						I(0)
	PP	-6.698***	0.000	-2.890						
SEATS	ADF	-2.249	0.191	-2.891	-3.399**	0.013	-3.498	-2.891	-2.583	I(1)
	PP	-1.802	0.378	-2.890	-3.344**	0.015	-3.496	-2.890	-2.582	
LABOUR	ADF	-1.251	0.650	-2.893	-1.517	0.521	-3.501	-2.893	-2.583	I(1)
	PP	1.091	0.997	-2.890	-5.830***	0.000	-3.496	-2.890	-2.582	
INVEST	ADF	-1.821	0.368	-2.893	-2.004	0.285	-3.505	-2.894	-2.584	I(1)
	PP	-1.816	0.371	-2.890	-3.728***	0.005	-3.496	-2.890	-2.582	
OPEN	ADF	-2.526	0.113	-2.891	-3.233**	0.021	-3.498	-2.891	-2.583	I(1)
	PP	-2.005	0.284	-2.890	-3.541***	0.009	-3.496	-2.890	-2.582	

Notes: *, ** and *** indicate significance at 10 %, 5 % and 1 % level, respectively; Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP).

Source: Author's computation using data from the World Development Indicators, World Bank, 2023.

capital formation (INVEST), and trade openness (OPEN) are non-stationary at level but become stationary after first differencing, classifying them as I(1). This suggests that these variables exhibit stochastic trends over time, meaning their past values influence their present behavior, and differencing is required to transform them into a stationary process.

The presence of both I(0) and I(1) variables in Table 4 justifies the use of the Autoregressive Distributed Lag (ARDL) model, which accommodates variables integrated at different levels. Unlike traditional models that require all variables to have the same integration order, ARDL is appropriate in cases where some variables are I(0) while others are I(1).

4.3.2. Multicollinearity test

The multicollinearity test results in Table 5 reveal substantial issues, particularly with the variables LABOUR and FERTILITY, which exhibit extremely high variance inflation factor (VIF) values of 545.63 and 497.18, respectively. These figures correspond to very low tolerance

Table 5 Multicollinearity test.

Variable	After dropping FERTILITY		After dropping LABOUR	
	VIF	1/VIF	VIF	1/VIF
PRIM	39.75	0.025	10.92	0.092
SEATS	30.22	0.033	18.89	0.053
LABOUR	545.63	0.002	4.91	0.204
INVEST	5.76	0.174	4.84	0.206
OPEN	1.72	0.582	1.54	0.647
FERTILITY	497.18	0.002	-	-
Mean VIF	186.71		8.22	

Source: Author's analysis using data from World Development Indicators, World Bank, 2023

values (1/VIF) of approximately 0.002, indicating that less than 0.2 % of the variance in these variables is independent of the other predictors. Such low tolerance suggests severe multicollinearity, implying that these variables share nearly all of their variance in the model, making it challenging to discern their unique contributions to economic growth.

To mitigate this issue, FERTILITY was removed, which significantly reduced the VIF of LABOUR to 4.91, thus improving its tolerance to 0.204. This adjustment reduced the mean VIF to a manageable 8.22, indicating that FERTILITY is the primary source of redundancy. Retaining LABOUR with an acceptable VIF ensures that the model captures its critical impact on GDP per capita, given the variable's relevance to Uganda's predominantly female agricultural labour force. By focusing on variables with higher tolerance values, the model offers more robust and reliable estimates, thus enhancing our confidence in the study's findings on gender parity and economic growth.

4.4. The Autoregressive Distributed Lag (ARDL) model estimation

4.4.1. Optimal lag length selection

The results in Table 6 are central to determining the appropriate lag length for the Autoregressive Distributed Lag (ARDL) model. Using statistical criteria, such as the Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), Hannan-Quinn Criterion (HQC), and Final Prediction Error (FPE), lag 2 was identified as optimal. This conclusion is supported by the lowest values for AIC (-10.3343), HQC (-9.75445), and FPE (2.2e-11) at lag 2.

The likelihood ratio (LR) test at lag 2 produces a significant result (p-value = 0.000), validating the choice of lag 2. Higher lags, such as three or four, show increasing values for these criteria, indicating that additional lags would unnecessarily complicate the model without improving its explanatory power. Thus, the selection of lag 2 ensures a balance between model simplicity and its ability to accurately capture the dynamics of the underlying data, which is essential for robust ARDL estimation and subsequent analysis. Furthermore, the Akaike information criterion (AIC) was employed to determine the optimal ARDL model. Among the top models with the lowest AIC values, the ARDL (2 2 0 0 2) model is the most appropriate.

4.4.2. The F-Bounds test for cointegration

The Autoregressive Distributed Lag (ARDL) F-Bounds Test for Cointegration in Table 7 confirms a long-term equilibrium relationship between GDP per capita growth (dependent variable) and the independent variables: gender parity in education (measured by the primary school enrolment gender parity index), female labour force participation (ratio of female to male labour force participation), female representation in public governance (proportion of seats held by women in parliament), gross capital formation, and trade openness.

The F-statistic of 5.904 is significantly higher than the upper critical bound value of 3.79 at the 5 % level, leading to the rejection of the null hypothesis of no cointegration. This finding validates the presence of a meaningful long-run relationship among the variables, demonstrating that changes in gender parity dimensions, investment levels, and trade openness have sustained effects on economic growth in Uganda. This result further justifies the application of the ARDL framework and the

subsequent estimation of both short-term dynamics and long-term coefficients through the error correction model.

4.4.3. Estimation of the error correction model

The error correction term (ECT) was -0.210 with a probability value of 0.000, making it highly significant at the 1 % level. This negative and significant coefficient confirms a stable long-run relationship between GDP per capita (GDPpc) and explanatory variables. The ECT indicates that approximately 21 % of the deviations from the long-run equilibrium are corrected annually. This relatively moderate adjustment speed suggests that Uganda's economic growth partially corrects the short-run disequilibria in gender parity, investment, and trade openness each year.

In the long run, the coefficient for PRIM is 23.134 with a probability value of 0.153, which is statistically insignificant at the 5 % level. This suggests that improvements in gender parity in primary education have a positive direction but no significant long-term impact on Uganda's economic growth. The lack of significance could indicate that while education parity contributes to human capital accumulation, its direct economic effects are realized only with complementary factors, such as labour market integration and governance reforms. In the short run, the first-differenced coefficient for PRIM (D1) was 40.760 with a probability value of 0.323, indicating no significant immediate effect. However, the lagged differenced coefficient PRIM (LD) is -84.149 with a probability value of 0.039, which is significant at the 5 % level. This significant negative lagged effect may reflect transitional challenges or resource allocation inefficiencies as gender parity in education improves.

In the long run, the coefficient for LABOUR is -0.630 with a probability value of 0.000, making it highly significant at the 1 % level. This indicates that an increase in female-to-male labour force participation correlates with a significant reduction in GDP per capita growth. This negative long-run impact suggests structural challenges within Uganda's labour market, where increased female participation does not translate into productivity gains. Instead, it could reflect inefficiencies such as under-employment or a concentration of women in low-productivity sectors.

The short-run coefficient for the first difference of SEATS is 0.460 with a probability value of 0.000, making it highly significant at the 1 % level. This finding indicates that increased female representation in governance has a substantial positive short-term impact on economic growth, likely through improved policymaking and equitable resource allocation. However, the lagged short-run coefficient for SEATS (-0.351) is also statistically significant at the 1 % level (p = 0.009), suggesting a partial reversal of these benefits in subsequent periods because of the challenges in maintaining consistency or implementation. In the long run, the coefficient for SEATS is 0.172 with a probability value of 0.230, making it statistically insignificant at the 5 % level. While the positive sign aligns with the theories of inclusive governance that drive sustainable growth, the lack of significance may indicate that other structural factors or long-term dynamics dilute the measurable impact of governance parity.

The long-run coefficient for OPEN is 0.108 with a probability value of 0.024, which is significant at the 5 % level. This positive and significant effect suggests that trade openness contributes to long-term eco-

Table 6

Lag selection criteria.

Lag	LL	LR	df	p	FPE	AIC	HQIC	SIC
0	660.674				0.416486	13.3135	13.3662	13.4437
1	421.455	2164.3	25	0.000	2.7e-10	-7.82909	-7.51279	-7.04754
2	571.717	300.53*	25	0.000	2.2e-11*	-10.3343*	-9.75445*	-8.9015*
3	580.627	17.819	25	0.850	3.1e-11	-10.0125	-9.16905	-7.9284
4	593.305	25.357	25	0.443	4.1e-11	-9.7661	-8.65902	-7.03067

Notes: *indicates lag order selected by the criterion; LR = sequential modified LR test statistic (5 % level).

Source: Author's analysis using data from World Development Indicators, World Bank, 2023

Table 7

Showing results of the Autoregressive Distributed Lag (ARDL) F-Bounds Test for Cointegration.

Bounds Test	Null Hypothesis: No levels relationship			
	Value	Significance	I(0)	I(1)
F-statistic	5.904	10 %	2.26	3.35
K	5	5 %	2.62	3.79
		2.5 %	2.96	4.18
		1 %	3.41	4.68

Source: Author's analysis using data from World Development Indicators, World Bank, 2023

Table 8

Error correction representation for autoregressive distributed lag (2 2 2 0 0 2) model.

	Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
Adjustment	L1	-0.210	0.036	-5.90	0.000
	Long Run				
Long Run	PRIM	23.134	16.0450	1.44	0.153
	SEATS	0.172	0.143	1.21	0.230
	LABOUR	-0.630	0.113	-5.57	0.000
	INVEST	-0.380	0.148	-2.57	0.012
	OPEN	0.108	0.0472	2.29	0.024
Short Run	PRIM (D1)	40.760	41.003	0.99	0.323
	PRIM (LD)	-84.149	40.097	-2.10	0.039
	SEATS(D1)	0.460	0.121	3.81	0.000
	SEATS(LD)	-0.351	0.132	-2.65	0.009
	OPEN(D1)	0.111	0.051	2.18	0.032
	OPEN(LD)	-0.120	0.052	-2.32	0.023
	C	7.293	3.477	2.10	0.039
	R-squared	0.681	Durbin Watson		2.210
	Adjusted R-squared	0.634	Log likelihood		-34.816
	Root MSE	0.367			

Source: Author's analysis using data from World Development Indicators, World Bank, 2023

economic growth by integrating Uganda into global markets and enhancing competition. In the short run, the first-differenced coefficient for OPEN (D1) is 0.111 with a probability value of 0.032, which is also significant at the 5 % level, reinforcing the immediate growth benefits of increased trade activity. The lagged differenced coefficient OPEN (LD) is -0.120, with a probability value of 0.023, and significant at the 5 % level, indicating potential short-term adjustments or vulnerabilities associated with external shocks.

For Investment (INVEST), the long-run coefficient is -0.380, with a probability value of 0.012, making it significant at the 5 % level. The negative coefficient suggests inefficiencies in investment allocation, where high levels of gross capital formation may not directly translate into economic growth because of the misallocation of resources or lack of complementary investments in human capital and technology. The constant term (C) is 7.293 with a probability value of 0.039, which is significant at the 5 % level. This indicates the baseline growth rate of GDP per capita when all the explanatory variables are held constant.

The diagnostic statistics confirmed the robustness and reliability of the ARDL model. An R-squared value of 0.681 indicated that 68.1 % of the variation in GDP per capita growth was explained by the model's independent variables, reflecting a good fit. The Adjusted R-squared value of 0.634 accounted for the number of predictors, confirming that the included variables collectively provide meaningful insights without overfitting. The F-statistic, with a probability value of 0.000, is highly significant at the 1 % level, underscoring the joint significance of the explanatory variables in explaining GDP per capita growth. A Durbin-Watson statistic of 2.210 suggests no significant autocorrelation in the residuals, validating the model's assumption of independent errors.

4.4.4. Model stability diagnostics

The residual diagnostic tests summarized in Table 9 confirm the adequacy and robustness of the Autoregressive Distributed Lag (ARDL) model used in this study. The Breusch-Godfrey LM test for autocorrelation yielded a chi-square statistic of 2.139 with a probability value of 0.343, indicating no serial correlation among the residuals at the 5 % significance level. This implies that the model error terms are not correlated, thus meeting one of the key assumptions for a reliable time-series regression.

For the White test for heteroscedasticity, the chi-square statistic was 102.00 with a p-value of 0.293, suggesting homoscedasticity, meaning that the variance of the residuals was constant across observations. Additionally, the Linktest for functional form showed that the predicted value (\hat{y}) was statistically significant ($p = 0.028$), while the squared predicted value (\hat{y}^2) was not significant ($p = 0.179$). While the Linktest reported a statistically significant coefficient for the predicted value (\hat{y}), suggesting potential model misspecification, the squared predicted value (\hat{y}^2) was not significant. This result implies that the model may contain some linear prediction bias, but no critical higher-order misspecification. Furthermore, the model passed all other diagnostic checks, including the CUSUM, Breusch-Godfrey, and White tests, which collectively confirm the model's robustness. Given that the ARDL framework is resilient to minor misspecification and the functional form remains theoretically grounded, we consider the model specification to be adequate and reliable for inference.

Model stability was assessed using the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests, both presented in Fig. 2. The CUSUM test confirmed that the model coefficients remained stable throughout the sample period, as the cumulative residuals stayed well within the 5 % significance bounds. This indicates the absence of any structural breaks or shifts in the relationship between GDP per capita growth and the explanatory variables. Likewise, the CUSUMSQ test, which evaluates variance stability, showed no evidence of parameter volatility. The consistent results from both tests affirm that the ARDL model is structurally stable and appropriate for drawing reliable inferences across Uganda's dynamic policy landscape between 1997 and 2023.

5. Discussion of results

5.1. Gender parity in education (primary school enrolment) and GDP per capita growth

The findings on gender parity in education reveal both potential and systemic barriers that limit its impact on economic growth. In the short term, the positive but statistically insignificant coefficient suggests that immediate improvements in educational parity do not yield measurable economic benefits (Aggarwal et al., 2023; Wang et al., 2023). At the same time, the significant negative lagged effect indicates transitional challenges, such as resource reallocation or inefficiencies in integrating newly educated women into productive economic roles (Bangura & Mambo, 2023; Ndzabela & Lukman, 2023).

Table 9

Residual diagnostic tests.

Test	Statistic	Prob.	Result
Breusch-Godfrey LM	Autocorrelation Chisq	2.139	0.343 No autocorrelation
Linktest	Functional Form \hat{y}	0.631	0.028 No misspecification
	\hat{y}^2	0.637	0.179 errors
White's test	Homoskedasticity Chisq (95)	102.000	0.293 Homoscedastic

Source: Author's analysis using data from World Development Indicators, World Bank, 2023

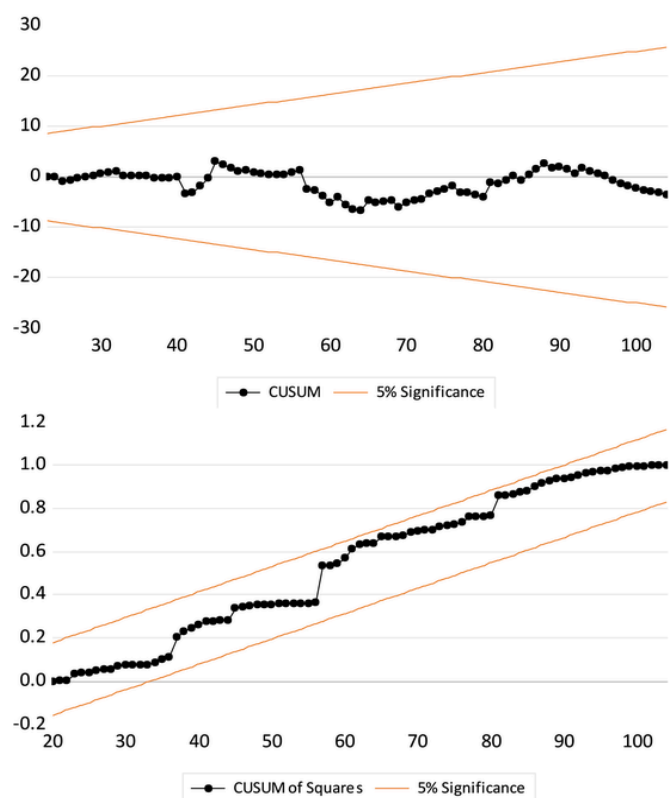


Fig. 2. Results of the CUSUM and CUSUM of squares test.

In the long run, the positive yet statistically insignificant coefficient highlights the latent potential of gender parity in education to contribute to sustained economic growth (Chentoufi et al., 2024; Haller, 2023). However, these benefits remain unrealized due to structural barriers, such as under-employment, occupational segregation, and limited access to high-value sectors (Kuteesa et al., 2024). These dynamics align with the Human Capital Theory, which posits that education enhances productivity and economic output by improving workforce skills (Bentaouet Kattan et al., 2023; Ullah et al., 2024). The findings suggest that, while education parity builds human capital, systemic challenges dilute its economic impact in Uganda (Aggarwal et al., 2023).

The negative short-run lagged effect in Uganda may reflect a mismatch between educational outcomes and labour market demands, where educated women face significant challenges in accessing quality jobs that fully utilize their skills (Aggarwal et al., 2023; Ndzabela & Lukman, 2023). Addressing these inefficiencies requires targeted interventions to align educational investment with economic opportunities (Alnaa & Matey, 2023). Expanding vocational training and STEM education for women can help bridge the gap between education and labour market productivity, ensuring that educational parity translates into tangible economic contributions over time (Bentaouet Kattan et al., 2023; Kuteesa et al., 2024).

Sociocultural constraints play a critical role in limiting women's participation in formal and high-productivity sectors, further hindering the economic potential of gender parity in education (Kuteesa et al., 2024; Starbird et al., 2016). Institutional biases and traditional norms that restrict women's access to leadership roles and higher-income employment undermine the realization of the benefits of educational equity (Moyo, 2022; Starbird et al., 2016). Policies addressing these barriers, such as pay equity initiatives, childcare support, and anti-discrimination laws, are essential to enable women to transition from educational attainment to effective economic participation (Alnaa &

Matey, 2023; Ngwoke, 2020). The results emphasize the importance of integrating educational equity with broader structural reforms in labour markets and governance (Khare, 2023). For Uganda, a multidimensional approach is necessary to transform gender parity in education from a social milestone to a powerful driver of inclusive, sustained economic growth (S. Khan & Durowaiye, 2023; Kuteesa et al., 2024).

5.2. Gender parity in labour force participation and GDP per capita growth

The results for gender parity in labour force participation show a significant and complex relationship with GDP per capita growth in Uganda. The long-run coefficient for LABOUR is significantly negative, indicating that an increase in women's labour force participation relative to that of men is associated with a decline in economic growth over the study period (Apire et al., 2023). This result challenges conventional expectations rooted in Human Capital Theory, which suggests that higher female labour force participation should enhance overall productivity by expanding the pool of skilled workers (Devadas & Kim, 2020). However, in Uganda's context, the negative long-term effect suggests deeper structural issues within the labour market (Kabeer, 2021).

Despite efforts to achieve gender parity in labour force participation, economic benefits may not be fully realized if the increase in participation is concentrated in low-productivity sectors, such as subsistence agriculture and informal trade (Verick, 2018). The predominance of women in these sectors, which are characterized by low wages, limited access to capital, and inadequate infrastructure, likely dilutes the potential economic returns from increased labour participation (Menon & van der Meulen Rodgers, 2018).

This counterintuitive result aligns with Feminist Development Theory, which argues that mere inclusion in the labour force is insufficient for economic empowerment if women remain confined to low-wage, low-skill sectors with limited upward mobility (A. M. Khan et al., 2023; Öçal & Kutlu, 2024). The inefficiency of LABOUR may reflect systemic barriers, such as inadequate access to capital, technology, and formal employment opportunities for women, which prevents them from fully realizing their economic potential (Ojo, 2023; Özçatal, 2023). It also suggests that without targeted interventions to improve the quality of jobs available to women, simply increasing their labour force participation could exacerbate existing economic inequalities rather than reduce them (Chopra, 2024; Elson, 2023).

To address these challenges, policy interventions should focus on creating pathways for women to access higher-productivity sectors such as vocational training, support for female entrepreneurship, and improved access to finance. For instance, policies that enable access to credit and support business registration have been identified as significant antecedents for fostering women's entrepreneurship in sub-Saharan Africa (Adegbile et al., 2024).

Reducing sociocultural barriers and enhancing institutional support, such as childcare and anti-discrimination policies, can help women transition from informal to formal higher-paying jobs. Access to subsidized childcare has been shown to increase women's participation in the labour force and improve their well-being (Giannelli, 2015). These measures could potentially transform the current negative impact of increased female labour participation into a positive driver of economic growth, aligning Uganda's labour market dynamics with the theoretical benefits predicted by Endogenous Growth Theory, which emphasizes the role of human capital quality in driving sustained economic development (Heath & Jayachandran, 2016).

5.3. Gender parity in public governance and GDP per capita growth

Findings on gender parity in governance reveal an intricate relationship with economic growth, highlighting both its immediate benefits and the challenges of sustaining these impacts over time. In the short run, the positive and statistically significant coefficient suggests that in-

creased female representation in governance meaningfully contributes to economic growth by enhancing the decision-making processes, improving policy inclusivity, and addressing structural inequities (Khorsheed, 2020; Mirziyoyeva & Salahodjaev, 2023).

However, the significant negative lagged short-term effect indicates that these immediate gains may partially reverse in subsequent periods, potentially reflecting challenges, such as institutional resistance, inconsistent implementation of inclusive policies, and difficulties in integrating diverse perspectives into long-term governance practices (Emeka et al., 2024; Park, 2023). In the long run, the statistically insignificant coefficient suggests that the broader systemic benefits of governance parity have not yet been fully realized, underscoring the importance of institutional reforms in sustaining and amplifying the contributions of women in leadership roles (Jung, 2023; Tusalem, 2022).

Global evidence supports the transformative potential of gender parity in governance, with inclusive leadership often associated with more equitable resource allocation, improved public service delivery, and enhanced economic resilience (T. Nchofoung et al., 2023). However, the lack of long-term significance in Uganda reflects the structural and cultural barriers that limit the institutionalization of inclusive governance practices (Ahikire et al., 2015). These barriers may include tokenistic representation, the limited influence of women in decision-making positions, and sociocultural biases that undermine the effectiveness of female leaders (Horowitz, 2009; Lakwo, 2009). Addressing these challenges requires deliberate efforts to strengthen institutional frameworks that support women in governance and to ensure that their contributions are integrated into national development strategies (Kangave & Rukundo, 2024; Mushemeza, 2009). Programs focusing on leadership development, mentorship, and capacity building for women in politics can enhance their effectiveness and influence (Asaba, 2013, 2015).

The results further emphasize the need for a comprehensive policy approach to maximize the economic benefits of gender parity in governance. Legislative reforms that institutionalize quotas or mandates for female representation, coupled with initiatives to address sociocultural biases, can create a more enabling environment for women in leadership (H. Khan et al., 2024; Verma, 2023). Efforts to ensure continuity and consistency in gender-inclusive policies are critical for translating short-term gains into sustained economic impact (Emeka et al., 2024; Tusalem, 2022). In Uganda, integrating governance parity with broader economic and social reforms can transform women's representation into drivers of long-term growth and inclusivity (Gunu et al., 2024; Kabeer, 2021). These findings underscore the importance of embedding gender equity in governance structures to achieve sustainable and equitable economic development (Domínguez Reyes, 2021; Mohapatra et al., 2023).

6. Conclusions and policy implications

6.1. Conclusions

This study explores the relationship between gender parity in primary school enrollment and economic growth in Uganda, highlighting both its potential benefits and underlying challenges. The long-run results show a positive but statistically insignificant impact, suggesting that, while gender parity in education contributes to human capital development, systemic barriers may limit its economic potential. In the short run, the significant negative lagged effect points to transitional inefficiencies, such as mismatches between educational outcomes and labour market demands, which impede the immediate realization of economic benefits from educational equity. The findings reflect the broader complexities of translating gender parity in education into tangible economic growth, particularly in developing economies, such as Uganda. While gender equity in education is foundational for fostering long-term productivity and innovation, structural inefficiencies in

labour markets and socio-cultural constraints may dilute its impact. These results emphasize the importance of addressing these barriers to fully leverage educational parity's potential for sustained economic growth.

This study examines the relationship between gender parity in governance and economic growth in Uganda. The significant short-term positive impact of female representation on governance highlights the importance of inclusive leadership in enhancing policy quality and addressing structural inequities. However, the significant negative lagged short-term effect suggests that these gains are not consistently sustained, potentially because of institutional resistance or difficulties in implementing inclusive governance policies. In the long run, the statistically insignificant coefficient indicates systemic barriers that hinder the full realization of the economic benefits of governance parity. Structural and cultural constraints such as tokenistic representation and limited decision-making power for women undermine the potential of inclusive governance to drive sustained economic growth. These findings emphasize the need to address these challenges to fully capitalize on the economic potential of gender equity in governance.

This study highlights a significant and complex relationship between gender parity in labour force participation and economic growth in Uganda. The findings reveal a negative long-run impact of increased female-to-male labour force participation ratios on GDP per capita growth. This unexpected outcome underscores structural inefficiencies within Uganda's labour market, where higher female participation does not translate into proportional economic benefits. Barriers such as occupational segregation, underemployment, and the concentration of women in low-productivity sectors limit their contributions to economic growth. The results reflect the systemic challenges that hinder the translation of numerical labour force parity into meaningful economic outcomes. These include mismatches between women's participation and access to high-productivity opportunities as well as broader structural constraints within the economy. This analysis aligns with theoretical insights that emphasize the importance of workforce efficiency and employment quality in driving economic growth. Achieving gender parity in labour force participation alone is insufficient to ensure sustained economic development without addressing these underlying barriers.

6.2. Study limitations

While this study provides important insights into the relationship between gender parity and economic growth in Uganda, some limitations should be acknowledged. First, the study relies on secondary data, which, although sourced from reputable institutions, may contain minor measurement inconsistencies due to differences in data collection methods over time. However, careful selection of data sources and robust econometric techniques help mitigate potential biases. Second, while the Autoregressive Distributed Lag (ARDL) model effectively captures both short-run and long-run relationships, it does not explicitly account for external shocks such as political instability or global economic fluctuations, which could influence economic growth beyond gender parity dynamics. Despite this, the model remains well-suited for the study's objectives, as it provides reliable estimates of the long-term equilibrium relationships and short-term adjustments between gender parity and economic growth in Uganda.

6.3. Policy implications

These findings highlight the need for comprehensive policies to bridge the gap between gender parity in education and economic benefits. To fully realize the potential of educational equity, Uganda must align its educational systems with labour market demands by expanding access to vocational training, STEM programs, and entrepreneurial skills tailored for women. These initiatives would equip women with

the practical skills needed to transition to high-growth and high-productivity sectors. Addressing sociocultural norms that restrict women's participation in formal and well-paying sectors is equally crucial. This includes tackling discriminatory hiring practices, promoting gender-equitable workplaces, and implementing mentorship programs that enable women to advance into leadership and specialized roles.

The findings emphasize the need for targeted policies to address the structural inefficiencies that limit the economic benefits of gender parity in labour force participation. Uganda must focus on enhancing the quality of female employment by reducing occupational segregation and enabling women to access high-productivity sectors such as technology, manufacturing, and formal services. Expanding skill-development programs tailored to market demand, particularly in emerging industries, can bridge the gap between participation and productivity. Additionally, enforcing pay equity laws and implementing anti-discrimination policies are critical to ensure that women's contributions are valued and rewarded fairly in the workforce. These measures can help create a labour market where gender parity is not just about numbers but also about meaningful economic contributions.

These findings underscore the importance of institutional reforms in ensuring that gender parity in governance translates into sustained economic growth. Strengthening policies that support women's active and meaningful participation in decision-making is critical. Uganda should institutionalize quotas or mandates for female representation in governance structures to ensure consistent inclusivity in leadership roles. Beyond numerical representation, capacity-building initiatives such as leadership training, mentorship programs, and platforms for political engagement are essential for empowering female leaders and enhancing their effectiveness. These efforts should be complemented by measures to integrate gender-responsive policies into national governance frameworks to ensure that women in leadership positions can drive systemic changes that foster equitable resource allocation and inclusive development.

6.4. Further research

While this study provides critical insights into the relationship between gender parity and economic growth in Uganda, several areas warrant further exploration to deepen understanding and enhance policy relevance. First, future research could examine the sectoral dynamics of gender parity in labour force participation, focusing on how specific industries or occupational structures influence the economic contributions of women. A disaggregated analysis of formal versus informal employment as well as productivity variations across sectors could offer more granular insights into the barriers that limit women's economic impact. Second, the role of sociocultural and institutional factors in mediating the relationship between gender parity and economic growth remains unclear. Future studies could investigate how cultural norms, governance quality, and institutional support systems shape the effectiveness of gender equity initiatives in education, labour, and governance.

CRedit authorship contribution statement

Geoffrey Mubiinzi: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Geoffrey Ssebabi Mutumba:** Writing – review & editing, Methodology, Data curation, Conceptualization.

Data availability

Data will be made available on request.

Ethical statement

Ethical approval is not applicable to this manuscript. This study **never** involved human subjects.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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