Can women's literacy and education spending serve as robust pillars of development in Madagascar?

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Abstract

This study examines the role of women's literacy and public education expenditure as drivers of sustainable development in Madagascar. Despite high female labor force participation (82.6% in 2024), structural constraints, including low secondary school completion rates (33.5% for girls in 2023) and predominant engagement in vulnerable employment (88.2%), hinder women's economic contributions. Employing an econometric framework with three models—time-series analysis for Madagascar (1990–2023) and panel regressions (fixed and random effects) across low-income Sub-Saharan African countries—we find that a one-percentage-point increase in female literacy corresponds to an approximate 1.7 USD increase in per capita GDP and a 0.00235-point rise in the Human Development Index (HDI), with statistically significant coefficients across all models. These findings underscore the critical role of women's education in fostering economic growth and human development. However, persistent gender gaps in formal employment, financial inclusion (only 25.2% of women held financial accounts in 2022), and political representation (16.5% of parliamentary seats) highlight the need for comprehensive policy interventions. We recommend increased investment in girls' education, labor market formalization, and enhanced financial and political inclusion to unlock the full potential of women's human capital for Madagascar's sustainable development.

Keywords: female economic inclusion, educational expenditure, GDP per capita, Madagascar,hdi,panel regression human capital, gender inequality, economic growth, financial inclusion

1 Introduction

Education is a cornerstone of human freedom and dignity, empowering individuals to overcome immediate survival constraints and make autonomous life choices. Sen (1999). It serves as a critical driver of sustainable development by enhancing human capital, reducing poverty, and improving public health outcomes. Kabeer(2013). In low income countries like Madagascar, education is particularly vital for fostering inclusive and equitable development, yet persistent gender disparities undermine its transformative potential. WorldBank(2012) . Women's economic inclusion is essential for sustainable development, as it amplifies productivity, strengthens household investments in health and education, and promotes social stability. Duflo(2012).

In Madagascar, women's labor market participation is notably high, with 82.6% of women aged 15 and above engaged in the workforce in 2024, compared to 87.6% of men. ILO(2021). Yet, this near parity masks profound qualitative inequalities, as 88.2% of economically active women are confined to vulnerable employment, such as unpaid family work or informal sector jobs, compared to 81.4% of men ILO(2021). These precarious conditions limit women's economic contributions and expose them to market fluctuations and economic shocks, hindering capital accumulation and long term financial independence WorldBank(2012). Educational disparities further exacerbate these challenges. While Madagascar has achieved a female literacy rate of 78.9%, surpassing the regional average of 74.5% for low income countries, only 33.5% of girls complete the first cycle of secondary education, compared to 30.3% of boys ILO(2021). This low completion rate restricts access to advanced skills, technical training, and formal sec-

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tor opportunities, perpetuating a cycle of underutilized female human capital. Gakidou(2010)

The economic implications of these disparities are significant, as gender gaps in employment and entrepreneurship result in substantial productivity losses at the macroeconomic level Cuberes(2016) . Greater female labor market participation is associated with increased GDP per capita, highlighting the economic cost of gender inequalities Xu(2025). Beyond economic metrics, women's education yields broader social benefits, including improved child health, reduced fertility rates, and enhanced household decision making power, which collectively contribute to the Human Development Index (HDI). Duflo(2012). In Madagascar, 74.9% of women participate in major household decisions, yet their underrepresentation in political and managerial roles limits their influence on policies that could address these structural barriers ILO(2021). Limited access to financial services only 25.2% of women held a bank or mobile money account in 2022 compared to 27.5% of men further curtails their ability to invest in entrepreneurial activities or secure economic autonomy .ILO(2021)

This study addresses the central question: How can investments in women's education, particularly female literacy and public education expenditure, accelerate economic development in Madagascar despite entrenched gender inequalities?. By employing an econometric framework with time-series and panel, this analysis examines the impact of female literacy and public education expenditure on GDP per capita and HDI.

2 Literature review

The economic inclusion of women and their access to education are widely recognized as critical drivers of sustainable development, particularly in low-income countries like Madagascar.

This review synthesizes key findings from the literature, focusing on how female literacy and educational investments influence economic growth and human development, while addressing the structural barriers that limit women's contributions in contexts similar to Madagascar.

2.1 Women's Education as a Catalyst for Economic Growth

Education is a cornerstone of human capital development, enabling individuals to overcome socioeconomic constraints and contribute to national prosperity (Sen, 1999). In developing economies, women's education is particularly transformative, as it enhances productivity, reduces poverty, and fosters equitable growth (World Bank, 2012).

Empirical studies consistently demonstrate that increasing female participation in the labor market significantly boosts GDP per capita (Xu, 2025; Cuberes and Teignier, 2016). For instance, Xu (2025) finds that greater access to formal employment for women directly increases economic output, while Cuberes and Teignier (2016) estimate that gender gaps in employment and entrepreneurship lead to substantial productivity losses at the macroeconomic level.

In Madagascar, where women are heavily engaged in economic activities but predominantly in the informal sector (ILO, 2021), these findings underscore the untapped potential of female human capital to drive inclusive growth.

Education amplifies women's economic contributions by equipping them with cognitive and non-cognitive skills. Duflo (2012) highlights that educated women invest more in their children's health and education, generating intergenerational benefits that align with Madagascar's development goals. Similarly, Gakidou et al. (2010) show that increased female educational attainment correlates with reduced child mortality, a critical issue in Madagascar where health outcomes remain below regional averages. These social benefits complement the economic gains, reinforcing the argument that female literacy is not only a social justice imperative but also a prag-

matic strategy for national development.

2.2 Structural Barriers to Women's Economic Inclusion

Despite the clear benefits of women's education, systemic barriers in low-income countries like Madagascar hinder its full realization. In Sub-Saharan Africa, persistent gender disparities in access to education, formal employment, and financial resources limit women's contributions to economic growth (IMF, 2022; Seguino, 2000). The International Labour Organization (ILO, 2021) notes that women in Madagascar are disproportionately concentrated in informal, low-productivity jobs, with limited access to social protections or financial services (e.g., only 25.2% of women held a bank or mobile money account in 2022). This structural precariousness undermines the economic returns of female literacy, as educated women are often unable to translate their skills into stable, well-paid employment.

Moreover, low secondary school completion rates among Malagasy girls (3.5% in 2023, as per Figure 3) restrict access to advanced skills and formal sector opportunities, perpetuating cycles of poverty and exclusion (World Bank, 2012). Early motherhood, with an adolescent fertility rate of 130 births per 1,000 girls in 2023 (Figure 8), further interrupts educational trajectories, limiting women's economic empowerment (Duflo, 2012). These challenges highlight the need for policies that extend beyond basic literacy to ensure educational continuity and labor market integration.

2.3 The Role of Institutions and Policy

Institutions and public policies play a critical role in reducing gender inequalities and maximizing the developmental impact of women's education (Klasen, 2018). K.B. (2024) argues that increased female participation in strategic sectors enhances resource allocation and economic resilience, a finding particularly relevant for Madagascar, where women are underrepresented in political and managerial roles (16.5% of parliamentary seats and 28.6% of managerial positions, as per Figures 6 and 7). Agrawal and Jariwala (2025) emphasize that gender equality is not only a development goal but also a lever for sustainable economic outcomes, suggesting that integrated policies addressing education, employment, and financial inclusion could amplify Madagascar's growth potential.

However, some scholars caution against overly narrow approaches that focus solely on gender without considering broader socioeconomic dynamics (Beneria, 2003). In Madagascar, social norms, limited financial access, and inconsistent education spending (averaging 2.84% of GDP, below UNESCO's 6% benchmark) constrain the effectiveness of educational investments. A holistic approach, combining increased education funding with reforms to formalize women's labor and enhance their decision-making power, is essential to unlock the full potential of female human capital.

2.4 Relevance to Madagascar

The literature underscores that while female literacy is a necessary condition for economic and human development, it is not sufficient without complementary structural reforms. Madagascar's relatively high female literacy rate (78.9%, Figure 4) compared to regional peers is a promising foundation, but the low secondary school completion rate and high prevalence of informal employment limit its impact. The interplay between education, economic participation, and institutional support forms the basis of this study's econometric analysis, which quantifies the contributions of female literacy and education expenditure to Madagascar's GDP per capita and Human Development Index.

3 Public education expenditure and international comparisons in Madagascar

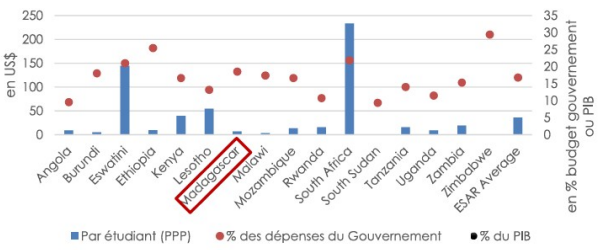
Public investment in education constitutes a fundamental pillar in the development of human capital, particularly for women, whose educational attainment yields broad economic and social dividends, as shown by Duflo (2012). In the case of Madagascar, public spending on education has been not only insufficient but also highly inconsistent, thereby weakening its capacity to reduce gender disparities and support long-term development objectives, as underscored by Kabeer (2013).

Between 2015 and 2019, the share of education in total government expenditure displayed considerable volatility: it stood at 17.5% in 2015, fell to 16.2% in 2016, rose to 18.8% in 2018, and then declined sharply to 15.2% in 2019 (LFR-LR, 2020). The average allocation of 17.26% over the period remains below UNESCO's recommended threshold of 20%. A similar trend is observed when education spending is considered as a share of nominal GDP. It increased from 2.5% in 2015 to 3.2% in 2016, but then declined to 2.6% in 2019, with an average of 2.84%—well below both the international average of 5.4% and UNESCO's recommended 6% (LFR-LR, 2020). These figures indicate that Madagascar has not reached the financial targets set by its own Plan Sectoriel de l'Éducation (PSE), which aimed for an average of 21.74% of total government expenditure and 3.71% of GDP to be dedicated to education.

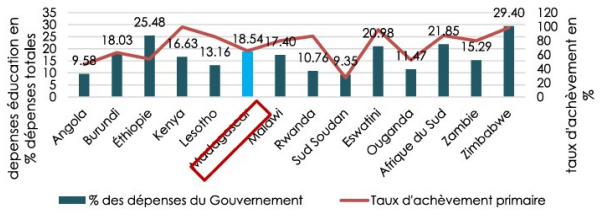
Comparative budget data from countries in the Eastern and Southern African Region (ESAR) reveal Madagascar's mixed performance. In 2019, the country allocated 15.2% of its national budget to education, surpassing several of its regional peers in budget share (Government Spending Watch, 2020). However, when measured as a share of GDP, its 3.34% places it in the lower tier above Angola (2.1%) and Zimbabwe (1.55%), but below countries like Eswatini, Lesotho, and South Africa, all of which exceed the 6% UNESCO benchmark (Government Spending Watch, 2020). This discrepancy reflects a critical misalignment between the country's economic capacity and its investment in education, with direct consequences for the development of female human capital, as emphasized by Cuberes and Teignier (2016).

Graphical data on school completion rates further highlight Madagascar's lag behind regional peers. Countries such as Kenya, Lesotho, Malawi, Rwanda, and Zambia register higher primary school completion rates despite comparable or lower levels of education expenditure as a share of GDP (Government Spending Watch, 2020). In contrast, Madagascar's completion rate for lower secondary education remains low only 33.5% for girls in 2023 limiting access to advanced skills and formal employment opportunities (ILO, 2021). This persistent underinvestment perpetuates gender inequality and constrains the country's prospects for inclusive development, as again noted by Kabeer (2013).

Figure 1: Comparison of public education spending between Madagascar and countries in the ESAR region.



(a) Share of public education expenditure in the national budget (%)



(b) Education expenditure as a percentage of GDP (%)

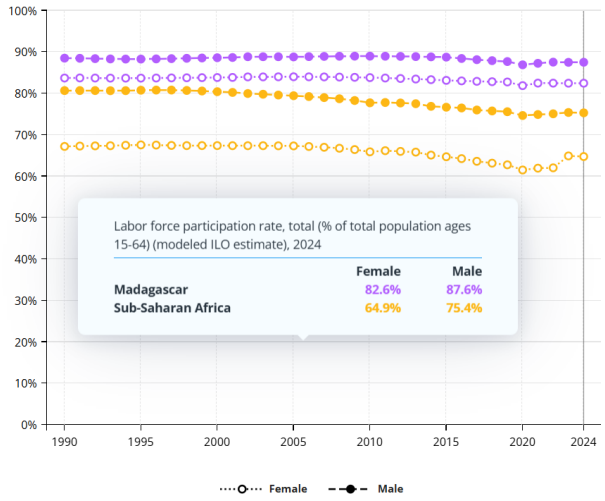
Source: `www.governmentspendingwatch.com`

4 Overview of gender inequalities in Madagascar

4.1 High female labor force participation masks qualitative disparities

Women's participation in Madagascar's labor market remains notably high. In 2024, 82.6% of women aged 15 and older were economically active, compared to 87.6% of men (Figure 2). This rate surpasses the Sub-Saharan African regional average, suggesting a relatively narrow quantitative gender gap. However, aggregate participation rates mask substantial qualitative disparities in employment conditions and economic outcomes for women.

Figure 2: Labor Market Participation Rates by Sex

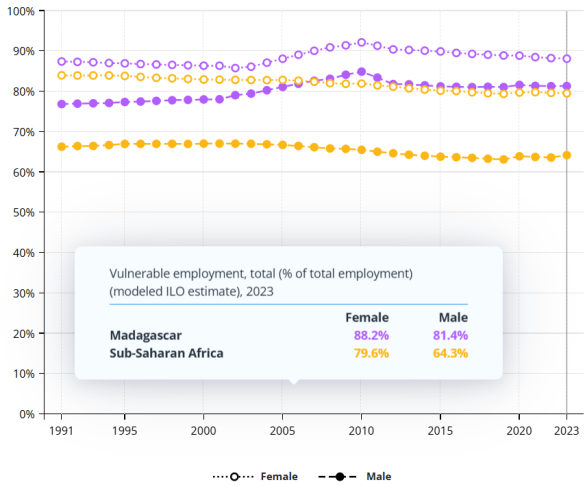


Source: International Labour Organization

4.2 Structural precarity disadvantages women despite workforce presence

Figure 3 reveals the pervasive precariousness of female employment in Madagascar. In 2023, 88.2% of economically active women were engaged in vulnerable employment, compared to 81.4% of men, a gap of 6.8 percentage points. Vulnerable employment includes unpaid family workers, own-account workers without remuneration, and informal sector employees without formal contracts or social protections.

Figure 3: Employment Vulnerability by Gender



Source: International Labour Organization

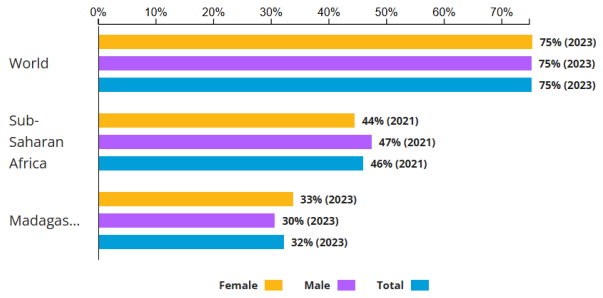
Despite near parity in participation rates, this stark disparity in employment quality indicates structural economic exclusion: women are disproportionately confined to low-productivity, unstable, and unprotected jobs. Such conditions increase their exposure to market volatility, economic shocks, and climatic risks, while limiting opportunities for capital accumulation, savings, and investment.

4.3 Low secondary education completion undermines women's economic prospects

The roots of these labor market inequalities lie fundamentally in educational attainment. In 2023, only 33.5% of girls completed the first cycle of secondary education, slightly above the 30.3% of boys (Figure 4). Although this reflects a modest gender advantage in completion rates, the overall low coverage of secondary education is well below regional and income group averages, where female secondary completion typically exceeds 40%.

Secondary education completion is a critical threshold for accessing higher education, technical training, and higher quality employment. The limited

Figure 4: Secondary School Completion Rates by Gender



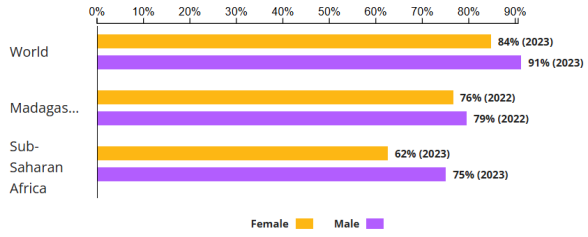
Source: International Labour Organization

attainment among Malagasy girls severely restricts their pathways into the formal sector, as reflected in the high rates of employment vulnerability (Figure 3). Moreover, low secondary completion undermines broader socioeconomic empowerment by restricting access to financial literacy, civic engagement, and negotiation power within households and workplaces.

4.4 Basic literacy gains are insufficient without educational progression

Basic literacy rates among women in Madagascar are comparatively high (approximately 78.9%, Figure 5), exceeding the Sub-Saharan African regional average (74.5%) and that of low-income countries (70.5%). This progress reflects decades of investment in primary education and literacy programs.

Figure 5: Literacy Rates by Gender



Source: International Labour Organization

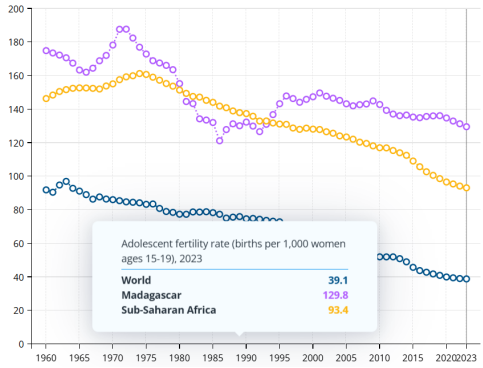
Nevertheless, literacy alone represents a minimal threshold of human capital. Without secondary education and subsequent technical or higher education opportunities, basic literacy rarely translates into stable, qualified, or well-remunerated employment. Consequently, many literate women remain confined to informal or low-productivity sectors with limited prospects for upward mobility.

This disconnect between basic literacy and quality employment curtails women's bargaining power within households and limits their access to economic resources such as credit or property. It also restricts their ability to participate in entrepreneurial activities or hold leadership positions. Thus, improvements in literacy rates must be complemented by policies that facilitate educational progression and formal sector integration to achieve meaningful economic empowerment.

4.5 High adolescent fertility curtails educational and economic opportunities

Reproductive health indicators further compound gender inequalities. The adolescent fertility rate remains high at 130 births per 1,000 adolescent girls in 2023 (Figure 6), exceeding averages for comparable low-income countries. Early motherhood frequently interrupts educational trajectories and reduces women's labor market opportunities, perpetuating cycles of socioeconomic disadvantage.

Figure 6: Adolescent Fertility Rate

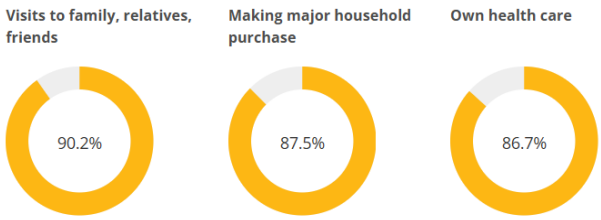


Source: International Labour Organization

4.6 Domestic decision making autonomy does not extend to formal spheres

Regarding intra-household agency, Figure 7 indicates that 74.9% of women participate in major household decisions, such as significant purchases or healthcare. This suggests moderate autonomy within the domestic sphere.

Figure 7: Women's Participation in Household Decision-Making



Source: International Labour Organization

However, this relative autonomy rarely extends to formal economic and political arenas, where women remain underrepresented. The aggregate data illustrate persistent barriers to women's full empowerment and inclusive participation in Madagascar's economic and political life.

4.7 Integrating education, employment, and empowerment to address gender gaps

Madagascar exhibits a paradoxical profile: advances in female literacy coexist with significant structural deficits in secondary education completion, employment quality, economic empowerment, and political participation. The high labor force participation rate of women does not translate into equitable economic outcomes due to the predominance of vulnerable and informal employment.

Addressing these intertwined challenges requires comprehensive policies that promote girls' retention and success in secondary education, facilitate women's transition into formal, secure employment, enhance access to financial services, and increase political representation. Only through such integrated approaches can gender disparities be effectively reduced and inclusive growth fostered.

The theoretical framework of this study underscores education, labor market integration, and empowerment as mutually reinforcing drivers of gender equality whose impacts warrant further empirical investigation within the Malagasy context.

5 Empirical methodology

This section outlines the framework used to assess the effects of female literacy and public education expenditure on economic and human development in Madagascar. We combine a time series analysis for Madagascar (1990–2023) with a panel approach for selected low-income Sub-Saharan African countries. The methodology covers the theoretical model, empirical specifications, development metrics, data sources, variable definitions, and limitations.

5.1 Theoretical framework

The analysis builds on an extended Solow growth model (Solow, 1956), where human capital plays a central role. The standard Cobb-Douglas function is:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}, \quad 0 < \alpha < 1, \tag{1}$$

with Y_t output, K_t capital, L_t labor, and A_t total factor productivity. Normalizing by labor gives:

$$\frac{Y_t}{L_t} = A_t \left(\frac{K_t}{L_t}\right)^{\alpha}. \tag{2}$$

To account for human capital, we introduce H_t, average human capital per worker. Effective labor becomes $H_t L_t$, leading to:

$$\frac{Y_t}{L_t} = A_t \left(\frac{K_t}{L_t}\right)^{\alpha} H_t^{1-\alpha}. \tag{3}$$

Assuming H_t depends on two key factors:

- **Female literacy rate** (LitFem_t): proxy for women's educational attainment.
- **Public education expenditure** (EduPub_t): government investment in human capital.

We posit:

$$H_t = f(\text{LitFem}_t, \text{EduPub}_t). \tag{4}$$

Taking logs and substituting yields:

$$\ln\left(\frac{Y_t}{L_t}\right) = \ln A_t + \alpha \ln\left(\frac{K_t}{L_t}\right) + (1-\alpha)\Big[\gamma_1 \ln(\text{LitFem}_t) + \gamma_2 \ln(\text{EduPub}_t)\Big]. \tag{5}$$

5.2 Beyond GDP: including Human Development Index

GDP per capita offers a narrow view of development. To capture broader welfare dimensions, we re-estimate the model using the Human Development Index (HDI), incorporating health, education, and income dimensions (Sen, 1999; Nussbaum, 2000). This allows us to explore whether gains in female education translate into broader social benefits.

5.3 Empirical models

We estimate three models:

Model 1: GDP per capita (time series)

$$\begin{aligned}\ln(\text{GDPpc}_t) = \beta_0 &+ \beta_1 \text{EduPub}_t \\ &+ \beta_2 \text{LitFem}_t \\ &+ \beta_3 \text{Dummy}_t + \varepsilon_t.\end{aligned} \tag{6}$$

Model 2: HDI (time series)

$$\begin{aligned}HDI_t = \beta_0 &+ \beta_1 \text{EduPub}_t \\ &+ \beta_2 \text{LitFem}_t \\ &+ \beta_3 \text{Dummy}_t + \varepsilon_t.\end{aligned} \tag{7}$$

Model 3: GDP per capita (panel data)

$$\begin{aligned}\ln(\text{GDPpc}_{it}) = \alpha_i &+ \lambda_t \\ &+ \beta_1 \text{LitFem}_{it} + \beta_2 \text{EduPub}_{it} \\ &+ \varepsilon_{it},\end{aligned} \tag{8}$$

where α_i and λ_t denote country and time fixed effects, respectively. We use fixed effects (FE) and random effects (RE) estimators, with Hausman tests guiding model choice.

5.4 Data and coverage

The time series covers 1990–2023 (34 annual observations for Madagascar). Data sources include the World Bank and UNDP. The panel comprises Madagascar, Malawi, Mozambique, Burkina Faso, Niger, DRC, Rwanda, and Tanzania.

5.5 Variable rationale

Female literacy robustly proxies women's human capital, influencing productivity, health, and fertility. Public education spending reflects state commitment to education. The structural break dummy controls for political or economic shocks.

5.6 Limitations

The analysis faces constraints such as limited time series length and omitted variables due to data gaps. Yet, the model remains theoretically sound and empirically coherent.

6 Empirical results

6.1 Presentation of results

The econometric results are reported in Tables 2, 3, and 4. All estimated coefficients conform to theoretical expectations, except for the dummy variable (Dummy), which is not statistically significant.

Beyond coefficient significance and model fit, robustness was tested using structural stability analyses

Table 1: Variables: Definitions and Sources

Variable	Definition	Source
GDPpc	GDP per capita (constant 2015 USD)	World Bank
HDI	Human Development Index	UNDP
EduPub	Public education expenditure (% of GDP)	World Bank
LitFem	Female literacy rate (age 15+)	World Bank
Dummy	Structural break dummy (1991, 2002, 2009, 2020)	Author's calculation

Table 2: OLS Regression – Dependent Variable: ln(GDPpc)

Explanatory Variables	Coefficient (Standard Error)
EduPub	48.10* (23.71)
LitFem	7.91*** (1.92)
Constant	-242.61** (103.45)
Dummy	-8.26 (39.65)
R^2	0.6018
Adjusted R^2	0.5620
F-statistic	15.11 (p-value: 0.000004)

Note: Standard errors in parentheses.
*p < 0.10; **p < 0.05; ***p < 0.01

Table 3: OLS Regression – Dependent Variable: HDI

Explanatory Variables	Coefficient (Standard Error)
EduPub	0.0150 (0.0137)
LitFem	0.00235*** (0.00055)
Dummy	-0.00319 (0.0125)
Constant	0.3001*** (0.0510)
R^2	0.5802
Adjusted R^2	0.5015
F-statistic	7.37 (p-value: 0.0025)

Note: Standard errors in parentheses.
*p < 0.10; **p < 0.05; ***p < 0.01

based on recursive residuals, namely the CUSUM and CUSUM of squares tests.

As shown in Figure 8, test statistics remain within the 5% critical limits, indicating no significant structural breaks during the study period. This confirms the stability of coefficients and reinforces the reliability of the estimated results.

6.2 Interpretation of results

6.2.1 Model 1: GDP per capita

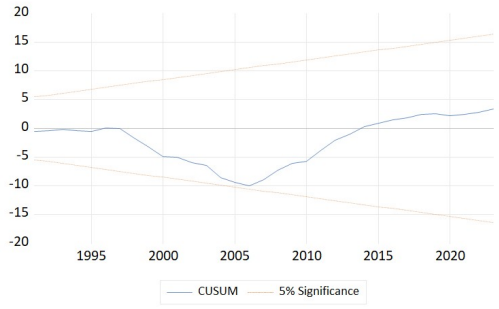
Female literacy (LitFem) has a positive and highly significant effect: a one-point increase raises per

Table 4: Panel Estimation – Dependent Variable: ln(GDPpc)

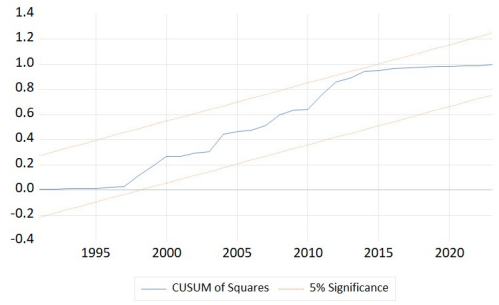
Explanatory Variables	**Fixed Effects**	**Random Effects**
LitFem	0.017*** (0.004)	0.010*** (0.003)
EduPub (% GDP)	0.047 (0.045)	0.092** (0.039)
Constant	—	5.499*** (0.221)
R^2	0.448	0.893
Adjusted R^2	0.264	0.887

Note: Standard errors in parentheses.
*p < 0.10; **p < 0.05; ***p < 0.01

Figure 8: Coefficient stability tests: CUSUM and CUSUM of squares



(a) Test CUSUM



(b) Test CUSUM of scares

capita GDP by about 7.91 USD. Public education expenditure (EduPub) also positively influences GDP, with a 48 USD increase per percentage point of GDP spent. The constant is negative and significant; the structural break dummy (Dummy) is not significant.

6.2.2 Model 2: Human Development Index

Education spending (EduPub) has a positive but statistically insignificant effect on HDI. Female literacy (LitFem) shows a small but highly significant positive impact, with each percentage point increase linked to a 0.00235 rise in HDI. The dummy variable is insignificant; the intercept is positive and significant.

6.2.3 Model 3: Panel estimation

Panel results confirm a strong positive link between female literacy and GDP per capita: a 1-point increase in literacy raises GDP per capita by 1.7% (fixed effects) or 1.0% (random effects), both significant. Public education expenditure is significant only in the random effects model, with a 9.2% GDP increase per point. The high R^2 (0.893) indicates education variables explain much of the cross-country GDP variation, reinforcing the economic importance of investing in women's education.

7 Discussion

The empirical results present a consistent and compelling case for the pivotal role of female literacy in driving Madagascar's development trajectory. The time series analysis reveals that a one-percentage-point increase in the adult female literacy rate is associated with an average increase of 7.91 USD in GDP per capita, significant at the 1 % level. This

finding resonates with the theoretical propositions of Sen (1999), who conceptualized education as a means of expanding individual capabilities, and Duflo (2012), who emphasized the catalytic role of women's education in generating both economic and intergenerational social returns.

Beyond economic metrics, the analysis underscores the multidimensional impact of women's education. Model 2 demonstrates that each additional percentage point in female literacy correlates with a 0.00235-point increase in the Human Development Index (HDI), a result highly significant at the 1 % level. This aligns with Gakidou et al. (2010), who showed that female educational attainment is a determinant of improved child health and survival. Thus, female literacy emerges not merely as a component of human capital, but as a vector of broader developmental synergies.

However, this positive correlation masks structural limitations that constrain the full realization of these gains. Although Madagascar boasts a relatively high adult female literacy rate compared to regional peers, secondary school completion remains alarmingly low only 33.5 % of girls complete the first cycle in 2023. As the World Bank (2012) notes, the transition from basic literacy to advanced competencies is essential for productive labor market integration. The absence of such continuity explains the limited effect of education expenditure on HDI, as evidenced by the statistically insignificant coefficient of public spending in Model 2. This suggests that financial investments alone are insufficient without complementary reforms to improve quality, accessibility, and retention.

The panel estimation further confirms that the economic benefits of female education are not unique to Madagascar but extend across low-income Sub-Saharan countries. Female literacy is consistently associated with higher GDP per capita in both fixed and random effects models, with respective coefficients of 0.017 and 0.010 (significant at the 1 % level). These results support the argument advanced by Cuberes and Teignier (2016) and Xu (2025), that closing gender gaps in human capital yields substantial macroeconomic dividends.

Yet, the paradox of underutilized female human capital persists. Despite high labor force participation among Malagasy women (82.6 %), over 88 % remain in vulnerable, informal, or unpaid employment (ILO, 2021). This disconnect between human capital formation and economic outcomes reflects institutional weaknesses that hinder the translation of skills into stable, productive work. Moreover, only 25.2 % of women had access to a financial account in 2022, curtailing their economic autonomy and capacity to invest (ILO, 2021).

Madagascar's Politique Générale de l'État (PGE) addresses these gaps through its Human Capital pillar, prioritizing education within a humanitarian focus to boost enrollment, establish accessible vocational training for youth employability, and reduce unemployment (see Politique Générale de l'État, Madagascar). The PGE also commits to building modern schools and regionally tailored universities with qualified teachers, aligning with the need for quality and continuity in education to maximize the economic and social returns of female literacy, as evidenced by the significant correlations with GDP per capita (7.91 USD per percentage point) and HDI (0.00235-point increase per percentage point) in Models 1 and 2.

The underrepresentation of women in decision-making spheres compounds these issues. With merely 16.5 % of parliamentary seats and 28.6 % of managerial positions held by women (ILO, 2021), the policymaking space remains insufficiently responsive to gender-specific constraints. As Klasen (2018) argues, institutional structures condition the extent to which human capital is converted into growth, resilience, and equitable development.

Taken together, these findings underscore the need for an integrated policy agenda. Investments in female education must be embedded within broader

strategies that (i) ensure educational continuity and quality beyond primary levels, (ii) promote formalization of female labor, (iii) expand access to credit and financial services, and (iv) enhance women's political and institutional representation. Without such structural transformation, the developmental returns to female literacy—though empirically evident—risk remaining potential rather than realized.

8 Conclusion

This study substantiates the critical importance of female human capital as a catalyst for both economic growth and broader human development in Madagascar. The empirical evidence highlights that improvements in female literacy not only significantly enhance GDP per capita but also contribute measurably to raising the Human Development Index, thereby fostering inclusive and sustainable progress.

However, realizing the full potential of female education demands more than increased fiscal allocation; it requires targeted policies addressing educational quality, access, and the removal of structural barriers in labor markets, financial services, and political representation. Only through such a comprehensive and intersectional approach can Madagascar effectively harness the transformative power of women's education.

Ultimately, investing in female literacy emerges not simply as a social imperative but as a pragmatic strategy to build a more equitable, resilient, and prosperous society, underpinning long-term national development goals.

References

[1] Agrawal, P., & Jariwala, H. (2025). Gender equality and economic performance: A cross-country empirical assessment. *Journal of Development Economics*, 163, 102708.

[2] Barro, R. J. (1991). Economic growth in a cross section of countries. *The Quarterly Journal of Economics*, 106(2), 407–443.

[3] Benería, L. (2003). *Gender, Development and Globalization: Economics as if All People Mattered*. Routledge.

[4] Cuberes, D., & Teignier, M. (2016). Aggregate effects of gender gaps in the labor market: A quantitative estimate. *Journal of Human Capital*, 10(1), 1–32. https://doi.org/10.1086/683847

[5] Duflo, E. (2012). Women empowerment and economic development. *Journal of Economic Literature*, 50(4), 1051–1079. https://doi.org/10.1257/jel.50.4.1051

[6] Gakidou, E., Cowling, K., Lozano, R., & Murray, C. J. L. (2010). Increased educational attainment and its effect on child mortality in 175 countries between 1970 and 2009: A systematic analysis. *The Lancet*, 376(9745), 959–974. https://doi.org/10.1016/S0140-6736(10)61257-3

[7] International Monetary Fund. (2022). *Women in the labor force: The missing factor for economic growth in Sub-Saharan Africa*. https://www.imf.org/en/News/Articles/2022/03/08/cf-sub-saharan-africa-women-labor-force

[8] International Labour Organization. (2021). *World Employment and Social Outlook: Trends 2021*. Geneva: ILO. https://www.ilo.org/global/research/global-reports/weso/2021/lang--en/index.htm

[9] Kabeer, N., & Natali, L. (2013). Gender equality and economic growth: Is there a win-win? *IDS Working Paper*, 417. https://doi.org/10.1111/j.2040-0209.2013.00417.x

[10] K.B. (2024). Women's participation and economic innovation in developing economies. *Journal of Policy and Gender Studies*, 8(1), 45–60.

[11] Klasen, S. (2018). Gender, institutions, and economic development: Findings and open research

and policy issues. *Feminist Economics*, 24(2), 1–34. https://doi.org/10.1080/13545701.2017.1385604

[12] Lucas, R. E. Jr. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3–42.

[13] Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, 107(2), 407–437.

[14] Nussbaum, M. C. (2000). *Women and Human Development: The Capabilities Approach*. Cambridge University Press.

[15] Seguino, S. (2000). Gender inequality and economic growth: A cross-country analysis. *World Development*, 28(7), 1211–1230. https://doi.org/10.1016/S0305-750X(99)00135-3

[16] Sen, A. (1999). *Development as Freedom*. Oxford University Press.

[17] Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, 70(1), 65–94.

[18] Swan, T. W. (1956). Economic growth and capital accumulation. *Economic Record*, 32(2), 334–361.

[19] World Bank. (2012). *World Development Report 2012: Gender Equality and Development*. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/4391

[20] Xu, L. (2025). Gender parity and GDP growth in emerging economies: A panel data analysis. *Economic Modelling*, 131, 106999.

[21] Mbatha, D. S. . (2024). Gender Inequality and Economic Development in Developing Economies. Journal of Developing Economies, 6(1), 1–11. https://doi.org/10.47672/jde.1872