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Gender Vulnerabilities: Modelling the Relationship Between Labour Market Performance and Energy Consumer Price Inflation in Nigeria

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ABSTRACT: This study examined the relationship between labour-market performance and energy consumer price inflation (CPI) in Nigeria from a gender-vulnerability perspective using annual data from 1991 – 2024 and analyzed using the autoregressive distributed lag (ARDL) dynamic estimation and necessary diagnostic tests. Female labour vulnerability, male labour vulnerability and the gender vulnerability gap were constructed from gender-disaggregated labour-market indicators, while energy consumer price inflation, headline inflation, food inflation, global energy-price inflation and Gross Domestic Product (GDP) growth were used as explanatory and control variables. The findings showed that energy consumer price inflation was highly volatile over the study period and rose sharply in the most recent years. The ARDL estimates revealed that female labour vulnerability was persistent over time and GDP growth had the clearest vulnerability-reducing association. The analysis also showed that global energy-price pressure was positively associated with female labour vulnerability, suggesting that energy shocks were more visible when analyzed through gender gaps rather than through female labour indicators alone. The study concluded that energy consumer price inflation is a relevant gender-vulnerability issue in Nigeria, but its labour-market effect is better understood through transmission channels such as informal employment, self-employment, transport costs, food inflation, unpaid care burdens and weak social protection. The study recommends that energy-price reforms should not be treated only as macroeconomic price measures but linked with gender-sensitive impact assessment, targeted energy infrastructure support, labour-market formalization, clean cooking access, care-support systems, social protection and improved gender-disaggregated labour and energy data.

KEYWORDS: ARDL; Energy Consumer Price Inflation; Gender Vulnerability; Informality; Labour-market Performance; Nigeria.

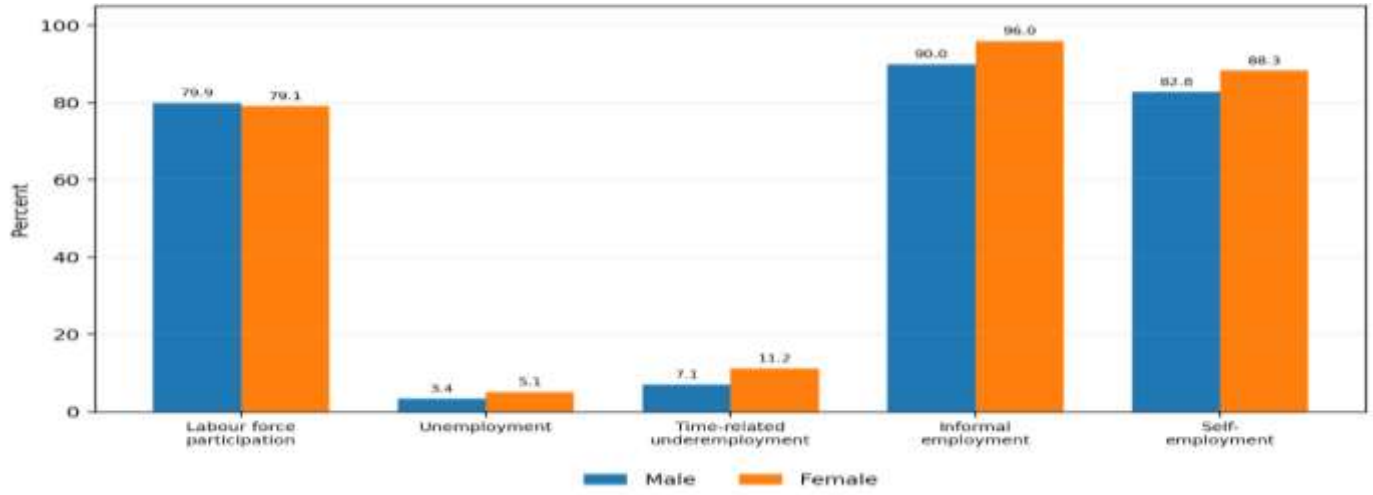
JEL Classification: C22, E31, E24, J16, J21, J46, Q43, O55.

1. INTRODUCTION

Energy prices have become one of the most important transmission channels through which macroeconomic shocks enter household welfare, firm costs, informal-sector survival and labour-market outcomes in Nigeria. In economies where transport, food distribution, small-scale production and household cooking depend heavily on petroleum products and electricity alternatives, energy consumer price inflation does not operate as a neutral price movement. It changes real income, raises commuting and production costs, reduces enterprise margins and may alter labour supply, especially among groups already exposed to weak job quality. This study is situated within that reality. Its central argument is that the effect of energy consumer price inflation on labour-market performance in Nigeria is likely to be gendered, not because inflation is formally targeted at women or men, but because women and men occupy different positions in the labour market, the household economy and the informal production system. Nigerian women participate actively in economic activity, yet their work is more likely to be informal, underemployed, low-paid, self-employed and combined with unpaid care responsibilities. These characteristics make them more vulnerable when fuel, transport, cooking energy and electricity-related costs rise.

The recent data support this concern. The National Bureau of Statistics (NBS) Labour Force Survey for Q2 2024 reports that Nigeria's labour force participation rate rose to 79.5 percent, with male participation at 79.9 percent and female participation at 79.1 percent, suggesting that gender differences in participation alone are small (NBS, 2024a). However, the quality indicators show deeper vulnerability: unemployment was 5.1 percent among women compared with 3.4 percent among men; time-related underemployment was 11.2 percent among women compared with 7.1 percent among men; and informal employment was 96.0 percent among women compared with 90.0 percent among men (NBS, 2024a). Therefore, the relevant question is not simply

whether women are in the labour force, but whether the work they do is sufficiently productive, formal, protected and resilient to energy-price shocks.



Gender-disaggregated labour-market indicators in Nigeria, Q2 2024.
Source: Author's chart using NBS Labour Force Survey Q2 2024.

At the same time, energy-price conditions have shifted sharply. Nigeria's removal of the petrol subsidy in 2023, exchange-rate adjustment, domestic supply constraints and global petroleum-price volatility have increased the exposure of households and enterprises to fuel-price movements. NBS price-watch releases show that average retail petrol prices rose significantly in recent years, while diesel and cooking-gas prices also remained high. For example, NBS-reported average petrol price increased from NGN 1,027.76 per litre in May 2025 to NGN 1,596.25 in May 2026, representing a 55.31 percent year-on-year rise (NBS, 2026a). Diesel and LPG price-watch data also indicate elevated energy costs for productive and household uses (NBS, 2025a; NBS, 2025b).

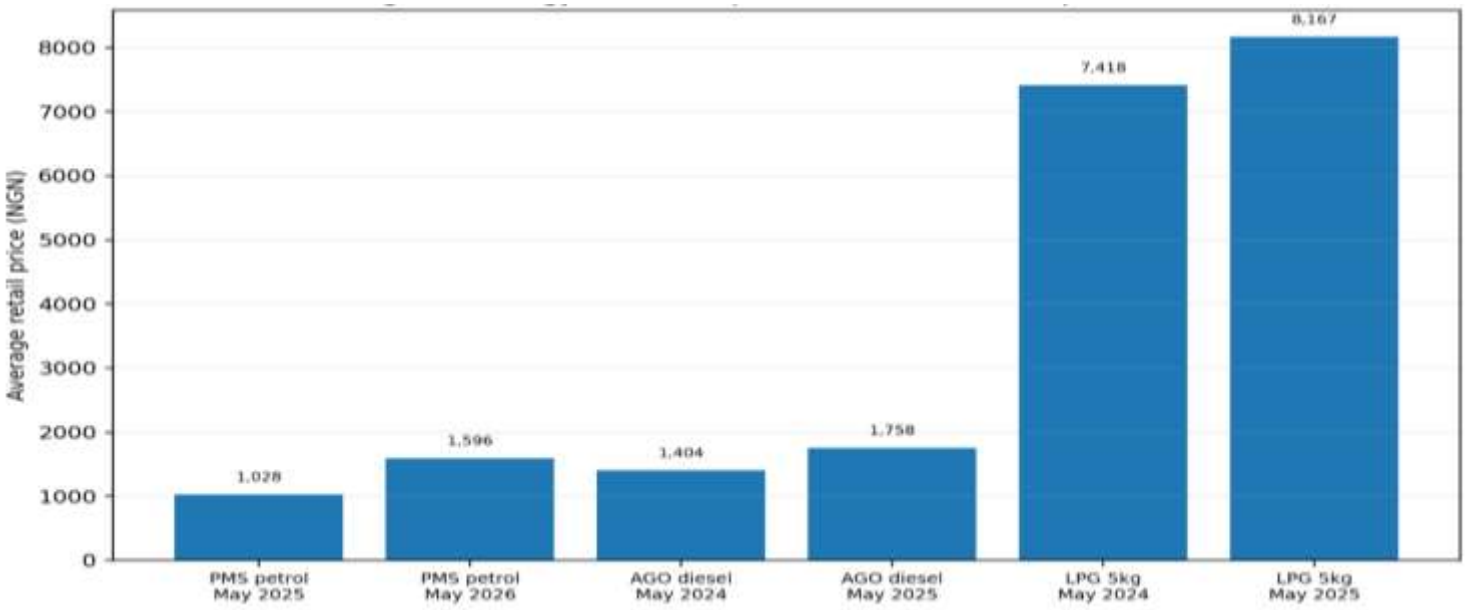


Figure 2: Selected Nigerian energy consumer prices from recent NBS price-watch releases.
Source: Author's chart using NBS PMS, AGO and LPG price-watch releases.

The study is also timely because Nigeria's CPI framework has been rebased. The NBS CPI metadata states that the new CPI framework uses 2023 as the weight-reference period and 2024 as the price-reference period, covers 934 product varieties under COICOP 2018, and includes an Energy Index as part of the CPI system (NBS, 2025c). This creates a stronger statistical basis for analyzing energy consumer price inflation, although it also requires caution when comparing pre- and post-rebasing CPI series. Globally, energy-price shocks are increasingly analysed through a distributional lens. The World Bank, IEA, IRENA, UNSD and WHO reported that 685 million people lacked electricity access in 2022 and 2.1 billion people lacked clean cooking access, with

Sub-Saharan Africa accounting for more than 80 percent of the global electricity access deficit (World Bank et al., 2024). The International Energy Agency (IEA) also stresses that lack of clean cooking access harms health, economic development and the environment in Africa, contributing to 815,000 premature deaths annually (IEA, 2025). These energy-access constraints have gender implications because women are commonly more responsible for household energy management, food preparation and unpaid care work.

The gendered labour-market implications are also supported by global labour evidence. The ILO estimates that 708 million women globally were outside the labour force in 2023 because of care responsibilities, compared with 40 million men (ILO, 2024). In Nigeria, the World Bank's 2024 Nigeria Development Update reports that gender differences persist in employment and job quality, that employed women are more likely to be underemployed than men, and that women work more hours than men once unpaid care and household chores are included (World Bank, 2024). This provides the basis for treating energy inflation as a gender-vulnerability problem, not merely as a macroeconomic price problem.

1.2 Statement of the Problem

Nigeria's current labour-market profile presents a paradox. Female labour force participation is high and almost equal to male participation, yet women experience weaker employment quality. Women are more likely to be underemployed, informally employed and self-employed (Olele, 2020; Omotor and Olele, 2015). These features matter because informal and self-employed workers have limited wage protection, weak bargaining power, low access to social insurance and higher exposure to operating-cost shocks. Energy consumer price inflation therefore affects labour-market performance through several channels: higher commuting costs may reduce job search and work attendance; higher diesel and electricity costs may reduce enterprise profitability and labour demand; higher cooking-fuel and food-distribution costs may increase the household care burden; and higher transport costs may restrict market access for petty traders, farmers and service workers.

The problem is that most Nigerian studies treat these issues separately. Fuel subsidy and energy-price studies focus on inflation, welfare, transport cost and macroeconomic stability. Labour-market studies focus on unemployment, underemployment and gender differences. Gender studies focus on unpaid care, informal work and poverty. Very few studies explicitly model the relationship between energy consumer price inflation and gender-disaggregated labour-market performance. This creates a research gap. If energy inflation affects men and women differently because they occupy different labour-market positions, then aggregate unemployment or headline inflation models are insufficient. A realistic model should incorporate gender-disaggregated labour indicators and energy-price indicators, while recognising Nigeria's data limitations, especially the change in labour-force methodology and the rebasing of CPI. This study responds to that gap by proposing a gender-sensitive modelling framework that links energy consumer price inflation to female labour-market performance and vulnerability in Nigeria.

2. LITERATURE REVIEW

2.1 Labour-Market Performance

Labour-market performance is broader than unemployment. A country can report low official unemployment while still experiencing weak labour-market quality if many people are self-employed out of necessity, underemployed, informally employed or engaged in low-productivity activities. The NBS Labour Force Survey recognises this broader view by reporting labour force participation, employment-to-population ratio, unemployment, time-related underemployment, labour underutilisation, self-employment and informality (NBS, 2024a). This study therefore conceptualises labour-market performance as a multi-dimensional outcome.

A simple labour-market performance index for gender group g can be expressed as:

$$LMP_t^g = \omega_1 LFPR_t^g - \omega_2 UNEMP_t^g - \omega_3 UNDER_t^g - \omega_4 INFEMP_t^g + \omega_5 WAGEEMP_t^g$$

where LMP_t^g is labour-market performance for gender group g at time t; $LFPR$ is labour force participation; $UNEMP$ is unemployment; $UNDER$ is time-related underemployment; $INFEMP$ is informal employment; $WAGEEMP$ is wage employment; and ω represents weights. Positive indicators increase labour-market performance, while negative indicators reduce it.

2.2 Gender Vulnerability

Gender vulnerability arises when labour-market and household roles expose one group to higher risk from economic shocks. In Nigeria, women are not simply excluded from work; many are concentrated in informal trade, small services, unpaid family work, household production, agriculture and care-intensive activities. The World Bank reports that Nigerian women are more likely than men to be underemployed and less likely to hold wage jobs or high-skilled jobs (World Bank, 2024). The ILO's global care evidence also shows that unpaid care remains a structural barrier to women's labour-market engagement (ILO, 2024).

A gender vulnerability index may be expressed as:

$$GVI_t = \theta_1 INFEMP_t^f + \theta_2 UNDER_t^f + \theta_3 UNEMP_t^f + \theta_4 CARE_t^f + \theta_5 ESHARE_t - \theta_6 SP_t$$

where GVI is gender vulnerability, $INFEMP^f$ is female informal employment, $UNDER^f$ is female underemployment, $UNEMP^f$ is female unemployment, $CARE^f$ is female unpaid care burden, $ESHARE$ is household energy-expenditure share and SP is access to social protection. The expected signs are positive for vulnerability-amplifying variables and negative for protective variables.

2.1.3 Energy Consumer Price Inflation

Energy consumer price inflation refers to the rate at which consumer-facing energy prices increase. It can be computed as:

$$\pi_t^E = 100\left[\ln(P_t^E) - \ln\left(P_{t-1}^E\right)\right]$$

where π_t^E is energy consumer price inflation and P_t^E is an energy price index or average retail energy price. In Nigeria, P_t^E can be proxied with the NBS Energy Index, or with retail price series for PMS, diesel, kerosene, LPG and electricity-related CPI indicators. The NBS CPI rebasing note confirms that the updated CPI framework includes an Energy Index, which makes energy-price tracking more statistically explicit (NBS, 2025c).

2.1.4 Energy Price Inflation and Labour-Market Channels

Energy inflation can affect labour-market performance through three major channels. The first is the household real-income channel: higher energy prices reduce disposable income and may force households to change labour supply, consumption and schooling decisions. The second is the firm cost channel: higher diesel, petrol and electricity costs raise production and logistics costs, reducing labour demand or pushing firms to reduce hours. The third is the care and time-use channel: higher cooking, transport and food costs can increase unpaid work burdens, especially for women.

These channels can be represented as:

$$Y_t^{real,g} = \frac{Y_t^{nom,g}}{P_t} = \frac{w_t^g h_t^g + \Pi_t^g + TR_t^g}{P_t}$$

$$C_t^g = Y_t^g - P_t^E E_t^g - P_t^F F_t^g - P_t^T T_t^g$$

where $Y^{real,g}$ is real income, w^g is wage, h^g is hours worked, Π^g is self-employment profit, TR^g is transfers, $P^E E^g$ is energy expenditure, $P^F F^g$ is food expenditure and $P^T T^g$ is transport expenditure. When P^E rises, consumption space falls unless income, hours, transfers or profits rise sufficiently.

2.2 Theoretical Review

2.2.1 Labour Supply Theory

The labour supply framework explains how individuals allocate time between paid work, unpaid care, household production and leisure. In the standard model, the worker maximises utility subject to time and budget constraints:

$$\max_{C,h,u,c} U^g = U(C^g, u^g, c^g)$$

subject to:

$$C^g = w^g h^g + Y_0^g - P^E E^g$$

$$T = h^g + u^g + c^g$$

where C is consumption, h is paid work time, u is leisure, c is unpaid care time and T is total time. Energy-price inflation enters the model through $P^E E^g$. A rise in P^E reduces effective disposable resources. The effect on labour supply is ambiguous: an income effect may push individuals to work more, while a substitution or constraint effect may reduce work if transport, caregiving or enterprise costs become too high. For women, the care-time constraint may be tighter, making the negative effect of energy inflation more likely where affordable care, mobility and formal employment are limited.

2.2.2 Labour-Market Segmentation Theory

Labour-market segmentation theory argues that workers are distributed across primary and secondary labour-market segments. The primary segment offers stable wages, contracts, social protection and career progression, while the secondary segment is informal, unstable and weakly protected. Nigeria's high female informality rate suggests that many women are concentrated in the secondary segment. This can be represented as a probability model:

$$Pr\left(INFORMAL_i^g = 1\right) = F(\alpha_0 + \alpha_1 FEMALE_i + \alpha_2 EDU_i + \alpha_3 RURAL_i + \alpha_4 CARE_i + \alpha_5 ASSET_i)$$

where $F(.)$ is a cumulative distribution function. If $\alpha_1 > 0$, being female is associated with a higher probability of informal employment after controlling for education, location, care and assets. Energy inflation then becomes more harmful because informal workers are less able to transfer cost increases to employers or benefit from wage indexation.

2.2.3 Cost-Push Inflation Theory

Cost-push inflation theory explains how increases in input costs raise final consumer prices. In Nigeria, fuel and electricity costs affect transport, food distribution, manufacturing, retail services and household consumption. The relationship can be represented as:

$$\pi_t = \kappa_0 + \kappa_1 \Delta \ln P_t^E + \kappa_2 \Delta \ln EXR_t + \kappa_3 \Delta \ln P_t^F + \kappa_4 GAP_t + \varepsilon_t$$

where π is headline inflation, P^E is energy price, EXR is exchange rate, P^F is food price and GAP is output gap. The expected sign of κ_1 is positive. For labour-market analysis, cost-push inflation matters because firms may respond to higher costs by reducing hours, lowering real wages, delaying hiring or shifting risks to informal workers.

2.2.4 Household Bargaining and Feminist Economics

Feminist economics emphasises unpaid care, intra-household bargaining and the unequal valuation of women's work. Energy inflation may intensify unpaid care because women often absorb household adjustment by spending more time sourcing cheaper food, managing cooking fuel, reducing paid work hours or increasing informal income-generating activities. A simplified household bargaining model can be written as:

$$\max \Omega = \left(U^f - \bar{U}^f\right)^{\lambda} (U^m - \bar{U}^m)^{1-\lambda}$$

where Ω is household welfare, U^f and U^m are female and male utilities, $\bar{U}^f$ and $\bar{U}^m$ are fallback utilities and λ is the bargaining weight of women. If women have lower income, weaker asset ownership or limited formal employment, λ may be low. Energy inflation then redistributes adjustment costs toward the less powerful household member.

2.2.5 Energy Poverty and Capability Theory

The capability approach views development as expansion of substantive freedoms. Energy poverty reduces capabilities because it limits safe cooking, productive enterprise, education, health and mobility. For labour-market outcomes, energy poverty constrains the capability to work productively. A simplified capability function can be represented as:

$$CAP_i^g = f(EACCESS_i, EDU_i, HEALTH_i, MOBILITY_i, TIME_i, NORM_i)$$

Labour-market achievement is then:

$$LMP_i^g = \rho_0 + \rho_1 CAP_i^g - \rho_2 \pi_i^E + \rho_3 SP_i + \nu_i$$

where CAP is capability, $EACCESS$ is access to reliable energy, $MOBILITY$ is mobility, $TIME$ captures time autonomy and $NORM$ captures social norms. This theory is relevant because energy inflation affects both direct costs and the broader capability to maintain work.

2.3 Theoretical Framework

The theoretical framework integrates labour supply theory, labour-market segmentation, cost-push inflation, feminist economics and energy-poverty theory. The framework assumes that energy consumer price inflation affects labour-market performance through real income, transport cost, enterprise cost, care burden and labour demand. The relationship is gendered because women's labour-market position differs from men's in terms of informality, underemployment, self-employment, unpaid care and mobility constraints.

The framework can be summarised as:

$$\pi_t^E \rightarrow \{P_t^T, P_t^F, MC_t, Y_t^{real}, CARE_t\} \rightarrow LMP_t^g \rightarrow GVI_t$$

The study therefore expects energy-price inflation to worsen female labour-market performance when women are more concentrated in vulnerable forms of work. Formally:

$$\frac{\partial LMP_t^f}{\partial \pi_t^E} < 0$$

and the marginal effect is expected to be stronger when informality is high:

$$\frac{\partial^2 LMP_t^f}{\partial \pi_t^E \partial INFEMP_t^f} < 0$$

The framework also permits asymmetric effects. Price increases may hurt labour-market performance more strongly than price decreases improve it because transport fares, food prices and informal-sector costs are often sticky downward. This is expressed as:

Let the marginal effect of positive energy-price changes be denoted by MEP_t, and the marginal effect of negative energy-price changes be denoted by MEN_t:

$$MEP_t = \gamma_p$$

$$MEN_t = \gamma_n$$

The expected asymmetry is therefore:

$$MEP_t > MEN_t$$

where γ_p and γ_n denote the comparable magnitudes of the estimated responses to positive and negative energy-price changes.

2.4 Empirical Review

Recent literature shows that the link among energy prices, inflation, labour outcomes and gender vulnerability is emerging but fragmented. The studies below are selected because they are recent, empirically relevant and useful for positioning this study.

Table 1: Summary of relevant literature

Author(s)/Year	Econometric Model Equation	Method, Relevance and Gap
Raifu and Afolabi (2024)	$\mathrm{INF}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \mathrm{INF}_{t-i} + \sum_{j=0}^{q} \beta_j \mathrm{PMS}_{t-j} + \sum_{k=0}^{r} \gamma_k X_{t-k} + \varepsilon_t$	Dynamic simulated ARDL for Nigeria's fuel subsidy removal and inflation categories. Strong for modelling energy inflation persistence, but does not include gender-disaggregated labour outcomes.
Shittu, Abdul Latiff and Baharudin (2024)	$Q_{s,t} = A_s \prod_f F_{f,s,t}^{\alpha_{f,s}} S_{g,t} = D_{g,t}$	Dynamic CGE model of subsidy rationalisation, compensation and reinvestment. Useful for policy-simulation channels, but not gender-specific labour modelling.
Yetano Roche et al. (2024)	$E_{s,t} = P_{s,t} \times A_{s,t} \times EF_s CS_t = f(H_t, EM_t, T_t)$	Scenario modelling of Nigeria's clean-cooking transition to 2060. Shows energy access is developmentally important, but labour-market gender effects are indirect.
Gbolonyo and Tetteh (2025)	$GG_{it} = \alpha GG_{it-1} + \beta_1 EA_{it} + \beta_2 CC_{it} + \beta_3 INSQ_{it} + \beta_4 (EA_{it} \times INSQ_{it}) + \lambda_t + \mu_i + \varepsilon_{it}$	System GMM and Driscoll-Kraay errors for 32 Sub-Saharan African countries. Directly links energy access and gender gaps, but not Nigeria-specific labour-market performance.
ODI (2024)	$\Delta W_h = -\sum_i s_{ih} \Delta P_i WL_h = f(s_{ih}, \Delta P_i)$	Distributional welfare analysis of Nigeria's fossil-fuel subsidy reform. Strong welfare evidence, but gendered labour mechanisms require further modelling.
ActionAid Nigeria (2024)	$GV_t = f(Y_h, P_e, C_c, L_s, SP_t)$$	Gender impact assessment after subsidy removal and naira floatation. Provides gendered policy evidence but limited econometric modelling.
World Bank (2024)	$LMP_i = \alpha_0 + \alpha_1 Female_i + \alpha_2 Educ_i + \alpha_3 Care_i + \alpha_4 Location_i + \alpha_5 Hous_i$	Household and labour-market analysis for Nigeria. Useful for defining gender-disaggregated labour vulnerability, especially underemployment, wage work and care constraints.
NBS (2024a)	$Gap_j = LMP_{female,j} - LMP_{male,j} LMP_j \in \{LFP, E, U, UE, INF\}$	National Labour Force Survey. Provides core descriptive and model variables, especially unemployment, underemployment and informality by gender.

NBS (2025c)	$CPI_t = \sum_i w_i \left(\frac{P_{it}}{P_{i0}}\right) \times 100 ECPI_t = \sum_e w_e \left(\frac{P_{et}}{P_{e0}}\right) \times 100$	CPI rebasing and COICOP-based inflation framework. Supports measurement of energy consumer price inflation, but series breaks require caution.
Ikue (2024)	$INF_t = \alpha_0 + \sum_i \phi_i INF_{t-i} + \sum_j \beta_j^P EP_{t-j}^P + \sum_j \beta_j^N EP_{t-j}^N + \gamma X_t + \varepsilon_t$	Nonlinear ARDL using Nigeria's Q1 2010-Q2 2024 data. Useful for testing whether energy-price increases and decreases have asymmetric effects.
Nteegah, Abdullahi and Kalu (2024)	$GDPG_t = \alpha_0 + \sum_i \alpha_i GDPG_{t-i} + \sum_j \beta_j PMS_{t-j} + \sum_k \gamma_k AGO_{t-k} + \sum_l \theta_l REER_{t-l} + \varepsilon_t$	ARDL model of petroleum prices and economic growth, 1990-2022. Shows macroeconomic costs of petroleum pricing, but gender labour outcomes are absent.
IEA (2025)	$CCA_{it} = \frac{PCC_{it}}{POP_{it}} \times 100 EPOV_{it} = 1 - CCA_{it}$	Regional tracking and scenario analysis on Africa's clean-cooking access. Supports energy poverty as a vulnerability channel for women.
IEA (2024)	$EMP_t^{EN} = EMP_t^{FOS} + EMP_t^{REN} + EMP_t^{POW} + EMP_t^{EFF}$	Global energy employment assessment. Useful for linking energy transition, job creation and inclusion, but not a direct Nigeria gender-labour model.
World Bank et al. (2024)	$AR_{it} = \frac{PA_{it}}{POP_{it}} \times 100 AG_{it} = 100 - AR_{it}$	SDG 7 global monitoring framework. Establishes the energy-access context for Nigeria and Africa, but remains contextual rather than labour-market specific.
ILO (2024)	$LFPR_g = \frac{LF_g}{WAP_g} \times 100 CareGap = CareWomen - CareMen$	Statistical brief on care responsibilities and labour participation. Supports the care-burden mechanism in gendered labour vulnerability.
IMF (2024)	$INF_t = f(EXR_t, PMS_t, M_t, Food_t, Fiscal_t) RY_t = NY_t - INF_t$	Nigeria macroeconomic consultation. Supports the macroeconomic relevance of subsidy reform, inflation and household vulnerability.
IMF (2025)	$Y_t = C_t + I_t + G_t + NX_t C_t = f(Y_t, P_t, TR_t)$	Nigeria Article IV macroeconomic review. Useful for policy framing around reform sequencing and social protection, but not gender-specific.
Petreski, Tanevski and Jacobo (2024)	$\Delta EMP_{g,i,t+h} = \alpha_h + \beta_h Shock_{it} + \gamma_h Female_g + \delta_h (Shock_{it} \times Female_g) + X'_{it}\theta_h + \varepsilon_{it+h}$	Local projections for 99 developing economies. Provides comparative evidence that macroeconomic shocks can have gender-differentiated employment effects.
World Bank Gender Data Portal (2026)	$GenderGap_j = I_{male,j} - I_{female,j} Ratio_j = \frac{I_{female,j}}{I_{male,j}}$	Cross-country gender database. Supports broader gender-gap framing, though not energy-price specific.
UN Women Africa (2026)	$GEI_t = f(ACC_t, AFF_t, SAFE_t) + f(TIME_t, INCOPP_t, DEC_t)$	Gender-responsive energy access and transition toolkit. Provides policy relevance for gender-responsive energy planning, but requires empirical application in Nigeria.

Source: *Author's compilation from reviewed empirical studies, institutional reports and policy documents, 2026.*

Note: *The model equations below are representative econometric or analytical specifications consistent with the reviewed methods. They are written directly in the table to make the modelling orientation explicit and to show how the present study can adapt the literature to gender-disaggregated labour-market vulnerability in Nigeria*

The literature establishes four important points. First, energy-price shocks in Nigeria are inflationary and can produce welfare losses if reforms are poorly sequenced (Raifu & Afolabi, 2024; Shittu et al., 2024). Second, women in Nigeria are more likely to be located in vulnerable labour-market positions, especially underemployment, informal employment and low-quality self-employment (NBS, 2024a; World Bank, 2024). Third, energy access and clean cooking are strongly connected to gender equality, health, time use and economic capability (Gbolonyo & Tetteh, 2025; IEA, 2025; Yetano Roche et al., 2024). Fourth, the existing evidence rarely combines energy consumer price inflation, gender-disaggregated labour-market performance and econometric vulnerability modelling in one framework. The identified gap is therefore clear: existing Nigerian studies have examined fuel subsidy removal and inflation, but few have modelled how energy consumer price inflation affects gender-disaggregated labour-market performance. This study fills that gap by developing a realistic framework for estimating the effect of energy inflation on female labour-market performance, while recognising data comparability challenges.

3. METHODOLOGY

The study adopts a quantitative research design supported by descriptive, trend and econometric analysis. This design is appropriate because the study examines measurable relationships between energy consumer price inflation and gender-disaggregated labour-market performance in Nigeria. The descriptive and trend analyses will be used to compare male and female labour-market outcomes over time, while the econometric analysis will estimate the extent to which energy price inflation influences female labour-market performance. An experimental design is not suitable for this study because national energy prices cannot be manipulated by the researcher. Similarly, a purely cross-sectional design would be inadequate because energy inflation and labour-market outcomes are dynamic and change over time. Therefore, the most appropriate design is a time-series quantitative design, complemented by descriptive trend analysis, depending on the availability and consistency of relevant data.

3.1 Nature and Sources of Data

The study will rely on secondary data obtained from credible national and international sources. Gender-disaggregated labour-market indicators such as labour force participation, employment, unemployment, underemployment and informality will be sourced primarily from the National Bureau of Statistics Labour Force Survey. Data on consumer price inflation will be obtained from the National Bureau of Statistics CPI and inflation database, with particular attention to the Energy Index, headline inflation and food inflation. In addition, the study will draw on NBS price-watch reports for specific energy-related prices, including Premium Motor Spirit, Automotive Gas Oil or diesel, household kerosene and Liquefied Petroleum Gas. To complement the national data, macroeconomic indicators will be obtained from the Central Bank of Nigeria, while broader development and gender-related indicators will be sourced from the World Bank World Development Indicators and the World Bank Gender Data Portal. Where longer annual gender-disaggregated labour-market series are required, the study will consult ILOSTAT. Relevant policy and macroeconomic context will also be drawn from recent IMF and World Bank reports, particularly where they provide insight into inflation, energy-price pressures, labour-market conditions and Nigeria's wider economic environment.

Table 2: Variables and Measurement

Variable	Symbol	Measurement	Expected Relationship
Female labour-market performance	LMP^f	Composite index or selected indicator such as female unemployment, underemployment or informality	Dependent variable
Energy consumer price inflation	π^E	NBS Energy Index inflation or log change in PMS/AGO/LPG/kerosene prices	Negative effect on performance
Headline inflation	π	Annual or quarterly CPI inflation	Negative
Food inflation	π^F	Food CPI inflation	Negative, especially through household welfare
GDP growth	$GDPG$	Real GDP growth rate	Positive
Exchange rate	EXR	NGN/USD average exchange rate or log change	Negative through imported inflation
Female labour force participation	$LFPR^f$	Female labour force participation rate	Ambiguous
Female informality	$INFEMP^f$	Share of employed women in informal employment	Vulnerability amplifier
Social protection	SP	Cash transfer/social protection coverage where available	Mitigating effect

Source: *Author's Compilation, 2026*

3.2 Model Specification

3.2.1 Baseline Time-Series Model

The baseline relationship can be specified as:

$$LMP_t^f = \beta_0 + \beta_1 \pi_t^E + \beta_2 \pi_t^F + \beta_3 GDPG_t + \beta_4 EXR_t + \beta_5 SP_t + \mu_t$$

If the dependent variable is female unemployment or underemployment, a positive coefficient on π^E implies that energy inflation worsens labour-market performance. If the dependent variable is a composite labour-market performance index, a negative coefficient on π^E implies deterioration.

3.2.2 ARDL Model

The preferred estimation technique is the Autoregressive Distributed Lag model, provided the variables are integrated of order zero or one and not order two. ARDL is realistic because Nigerian macroeconomic and labour data may have mixed integration orders and the available sample may be modest. The ARDL model is expressed as:

$$LMP_t^f = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i}\, LMP_{t-i}^f + \sum_{j=0}^{q} \alpha_{2j}\, \pi_{t-j}^E + \sum_{k=0}^{r} \alpha_{3k}\, X_{t-k} + \varepsilon_t$$

where X_t is a vector of control variables such as food inflation, GDP growth, exchange rate and social protection.

The error-correction form is:

$$\Delta LMP_t^f = \lambda\left(LMP_{t-1}^f - \delta_0 - \delta_1 \pi_{t-1}^E - \delta_2 X_{t-1}\right) + \sum_{i=1}^{p-1} \gamma_i\, \Delta LMP_{t-i}^f + \sum_{j=0}^{q-1} \phi_j\, \Delta \pi_{t-j}^E + \sum_{k=0}^{r-1} \psi_k\, \Delta X_{t-k} + u_t$$

The coefficient λ is expected to be negative and statistically significant if a long-run equilibrium relationship exists.

3.3.3 Nonlinear ARDL for Asymmetry

Because energy prices often exhibit downward rigidity, the study may apply nonlinear ARDL as a robustness model. Positive and negative energy-price changes are decomposed as:

$$EPI_t^{POS} = \sum_{s=1}^{t} \max\left(\Delta EPI_s, 0\right)$$

$$EPI_t^{NEG} = \sum_{s=1}^{t} \min\left(\Delta EPI_s, 0\right)$$

The asymmetric model becomes:

$$LMP_t^f = \phi_0 + \phi_1 EPI_t^{POS} + \phi_2 EPI_t^{NEG} + \phi_3 X_t + u_t$$

The expected outcome is that positive energy-price shocks will have a stronger adverse effect on female labour-market performance than negative shocks have a restorative effect.

3.3.4 Gender Gap Model

To model gender vulnerability directly, the dependent variable can be expressed as a gender gap:

$$GAP_t = LMP_t^m - LMP_t^f$$

The model becomes:

$$GAP_t = \chi_0 + \chi_1 \pi_t^E + \chi_2 INFEMP_t^f + \chi_3\left(\pi_t^E \times INFEMP_t^f\right) + \chi_4 X_t + \xi_t$$

The interaction term captures whether female informality strengthens the effect of energy inflation on gender labour-market gaps.

3.3.5 State-Level Vulnerability Model

If state-level data are available, a panel model can be specified as:

$$GVI_{s,t} = \eta_s + \tau_t + \beta_1 EPI_{s,t} + \beta_2 FINFEMP_{s,t} + \beta_3\left(EPI_{s,t} \times FINFEMP_{s,t}\right) + \beta_4 Z_{s,t} + \epsilon_{s,t}$$

where s represents state and t represents time. η_s controls for state fixed effects, while τ_t controls for time effects. This is useful where the researcher wants to capture differences across Nigerian states.

3.5 Estimation Procedure

The estimation procedure will begin with descriptive and trend analyses of male and female labour-market indicators, energy prices, energy CPI, headline inflation and food inflation. This will help establish the patterns in gender-disaggregated labour-market performance and energy-price pressures over the study period. Thereafter, the variables will be tested for stationarity using the Augmented Dickey-Fuller and Phillips-Perron unit root tests to determine whether they are integrated at level or first difference.

Subject to the outcome of the stationarity tests, the study will apply the Autoregressive Distributed Lag bounds testing approach to examine the existence of a long-run relationship between energy consumer price inflation and gender-disaggregated labour-market performance. Where cointegration is established, the ARDL error-correction model will be estimated to separate short-run effects from long-run relationships. The Nonlinear Autoregressive Distributed Lag model may also be used as a robustness check to determine whether increases and decreases in energy prices have different effects on labour-market outcomes. To ensure the reliability of the estimates, the study will conduct diagnostic tests for serial correlation, heteroskedasticity, normality, model stability and multicollinearity. The results will then be interpreted in relation to gender vulnerability, labour-market quality and policy implications, particularly how energy-price pressures may affect women in informal, low-income and underemployed labour categories.

The ARDL technique is preferred because it accommodates variables that are a mixture of I(0) and I(1), provided none is I(2). It is also suitable for modest sample sizes and allows the study to distinguish between short-run and long-run effects. However, the method will only be used where the data are sufficiently long and consistent. If the study relies only on the post-2022 NBS Labour Force Survey data, descriptive analysis, trend analysis and vulnerability indexing will be more appropriate. If longer annual series are obtained from sources such as ILOSTAT, WDI and NBS, the ARDL approach becomes more realistic and statistically defensible.

3.6 A Priori Expectations

The expected signs are:

$\beta_1 < 0$ if LMP^f is a positive performance index

$\beta_1 > 0$ if LMP^f is female unemployment or underemployment

$\chi_3 > 0$ if female informality amplifies the gender gap effect of energy inflation

The study expects energy consumer price inflation to worsen female labour-market performance,

4. DATA ANALYSIS, RESULTS AND DISCUSSION

This section presents the empirical analysis of the relationship between gender-disaggregated labour-market vulnerability and energy consumer price inflation in Nigeria. The empirical strategy combined descriptive statistics, trend analysis, correlation analysis, stationarity testing, ARDL-style dynamic modelling, robustness checks and diagnostic tests.

4.0 RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 3 presents the descriptive statistics for the main variables over the 1991-2024 period. These results provide a first view of the magnitude, dispersion and range of labour vulnerability, inflation and macroeconomic performance before the dynamic models are estimated.

Table 3: Descriptive statistics of study variables

Variable	Mean	Standard deviation	Minimum	Maximum
Female labour vulnerability index	43.612	12.022	19.229	81.566
Male labour vulnerability index	47.489	21.583	20.821	99.744
Gender vulnerability gap	-3.877	21.312	-41.494	31.119
Energy CPI inflation	26.130	39.124	-0.656	216.400
Headline CPI inflation	19.003	16.004	5.420	72.873
Food CPI inflation	19.376	16.225	1.100	72.100
Global energy price inflation	3.498	27.860	-59.965	59.346
GDP growth	3.855	3.989	-6.369	15.329

Female labour force participation	76.861	1.221	74.894	80.714
Female employment-to-population ratio	73.746	1.363	70.382	77.424
Female unemployment rate	4.054	0.707	3.370	6.551

Source: Author's computation from World Bank Global Database of Inflation, WDI/ILO modelled labour indicators and World Bank Commodity Markets data, 2026.

The descriptive statistics show that the female labour vulnerability index averaged 43.612 points, while the male labour vulnerability index averaged 47.489 points. The mean gender vulnerability gap was -3.877 points, but the wide range from -41.494 to 31.119 indicates that relative gender vulnerability changed significantly over time. This confirms that gender vulnerability is dynamic and should not be inferred from a single-year statistic. Energy CPI inflation averaged 26.130 percent and reached a maximum of 216.400 percent, confirming that energy prices were highly volatile during the sample period. Headline and food inflation also recorded high average values, showing that energy-price pressure operated within a broader cost-of-living environment. The average GDP growth rate was 3.855 percent, but the minimum value of -6.369 percent shows that the sample included major contractionary periods, including the COVID-19 shock.

4.2 Recent Trend Values and Post-Reform Context

Table 4 focuses on 2020-2024 because this period captured the COVID-19 shock, recovery, exchange-rate pressure, fuel-pricing reforms and recent inflation acceleration. The period is also important for interpreting current Nigerian policy because reforms affected fuel, transport and household costs, while labour-market quality remained uneven across gender groups.

Table 4: Recent values of selected variables, 2020-2024

Year	FLVI	MLVI	VULN_GAP	ECPI	HCPI	FCPI	Global energy price inflation	GDPG	FLFP	FEMP	FUNEMP
2020	72.050	99.744	-27.695	8.125	13.247	16.083	-39.593	-6.369	74.894	70.382	6.025
2021	81.566	79.696	1.871	10.220	16.953	20.300	59.346	1.109	75.893	70.921	6.551
2022	71.940	42.631	29.309	13.864	18.531	19.450	46.974	4.319	76.927	72.787	5.382
2023	19.854	48.198	-28.345	19.284	24.660	27.790	-35.499	3.316	80.693	77.374	4.113
2024	19.229	47.963	-28.734	28.351	33.242	38.999	-5.277	4.071	80.714	77.424	4.076

Source: *Author's computation, 2026*

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From table 4, the recent values show that energy CPI inflation rose from 8.125 percent in 2020 to 28.351 percent in 2024. Headline inflation increased to 33.242 percent and food inflation rose to 38.999 percent in 2024. This pattern indicates that energy-price pressure was part of a wider inflationary environment rather than an isolated price movement. The female labour vulnerability index was high in 2020 and 2021, reflecting the labour-market stress associated with the pandemic and the early recovery period. The gender vulnerability gap also changed sharply across the period, showing that relative female disadvantage can widen during shocks even when average participation indicators appear stable.

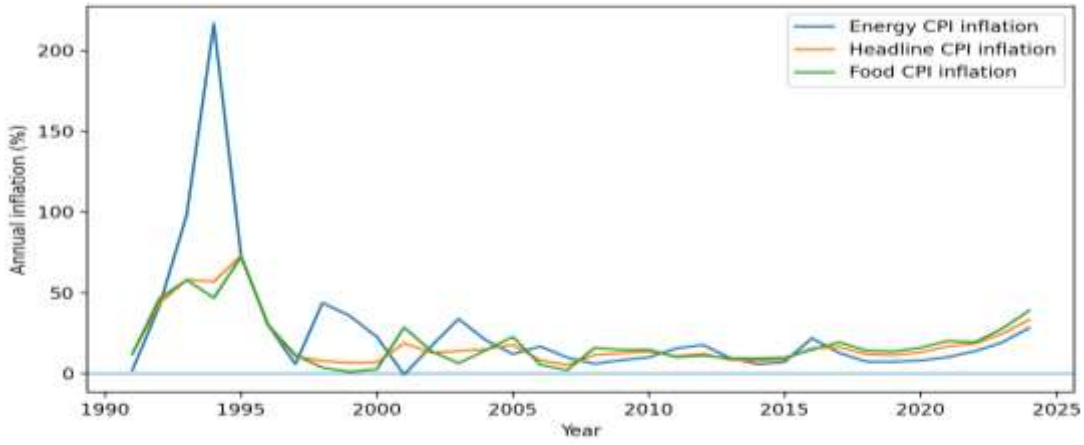


Figure 3: Nigeria energy, headline and food consumer price inflation, 1991–2024.
Source: Author's computation from World Bank Global Database of Inflation, 2026

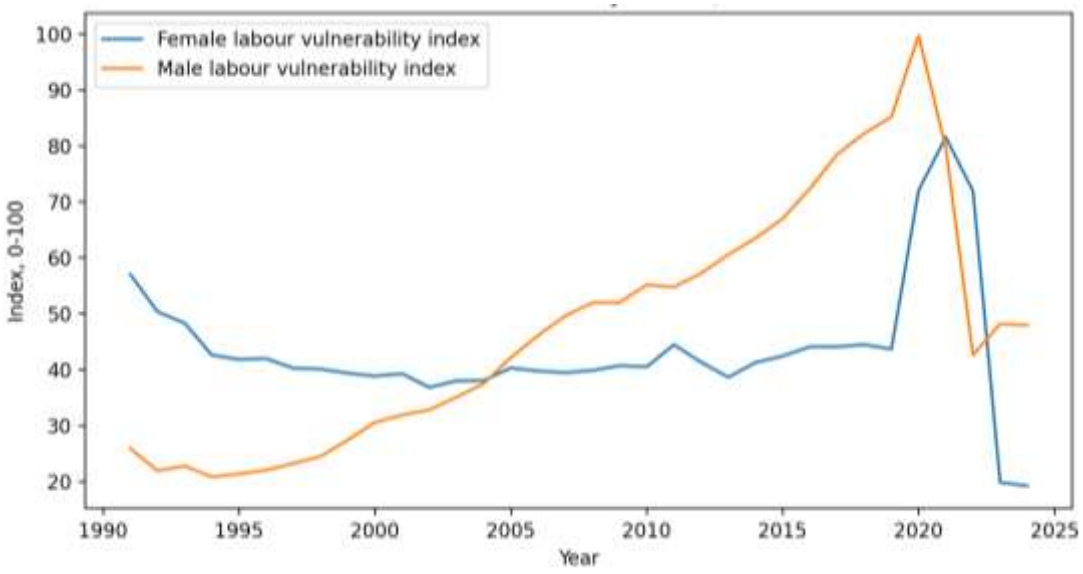


Figure 4: Gender labour vulnerability indices, 1991–2024.
Source: Author's computation from WDI/ILO modelled labour indicators, 2026

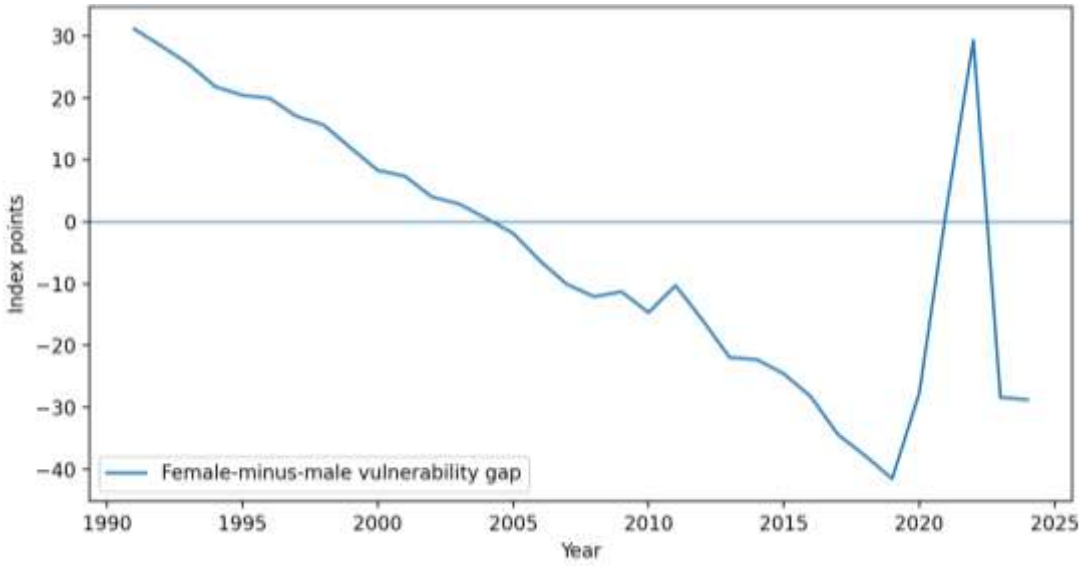


Figure 5: Gender labour vulnerability gap, 1991–2024.
Source: Author's computation from WDI/ILO modelled labour indicators.

Figure 3 shows that energy CPI inflation was highly volatile. The large historical spike in the mid-1990s and the renewed rise after 2020 confirm that energy-price pressures have not followed a smooth path. Figure 4 shows that male and female vulnerability indices moved differently over time, while Figure 5 confirms that the female-minus-male vulnerability gap was not constant. Together, these trends justify the use of gender-disaggregated dynamic analysis rather than aggregate labour-market interpretation. The trends also align with global evidence that energy access and energy affordability have distributional effects, especially in contexts where households rely on costly or polluting energy alternatives (World Bank et al., 2024; IEA, 2025).

4.3 Correlation Analysis

The correlation analysis provides a preliminary indication of the direction of association between inflation indicators, GDP growth and labour vulnerability. Correlation does not prove causality, but it helps establish whether the observed data are broadly consistent with the theoretical expectation that price shocks and macroeconomic performance are related to gendered labour-market outcomes.

Table 5: Correlation between inflation/growth variables and female labour vulnerability index

Variable	Correlation with FLVI
Energy CPI inflation	-0.058
Headline CPI inflation	-0.017
Food CPI inflation	-0.005
Global energy price inflation	0.243
GDP growth	-0.404
Gender vulnerability gap	0.259

Source: Author's computation from E-views 12, 2026

Table 5 shows that global energy price inflation had a positive correlation with the female labour vulnerability index, while GDP growth had a negative correlation of -0.404. This indicates that stronger economic growth was associated with lower female labour vulnerability, while external energy-price pressure moved in the expected vulnerability-increasing direction. The weak direct correlation between domestic ECPI and FLVI indicates that domestic energy CPI alone did not fully explain female vulnerability. This is plausible because Nigeria's domestic energy prices have historically been affected by subsidies, administered price adjustments, exchange-rate movements, and measurement changes.

Table 6: Correlation between inflation/growth variables and gender labour vulnerability gap

Variable	Correlation with VULN_GAP
Energy CPI inflation	0.409
Headline CPI inflation	0.418
Food CPI inflation	0.337
Global energy price inflation	0.213
GDP growth	-0.007
Female labour vulnerability index	0.259

Source: Author's computation from E-views 12, 2026

Table 6 gives a clearer gender-vulnerability signal. Energy CPI inflation had a positive correlation of 0.409 with the gender vulnerability gap, while headline inflation and food inflation also showed positive correlations. This means that inflationary pressure was more visibly related to relative female disadvantage than to the female index alone. The result supports the study's argument that energy inflation should be analysed as a gender-vulnerability issue rather than only as a general macroeconomic price problem.

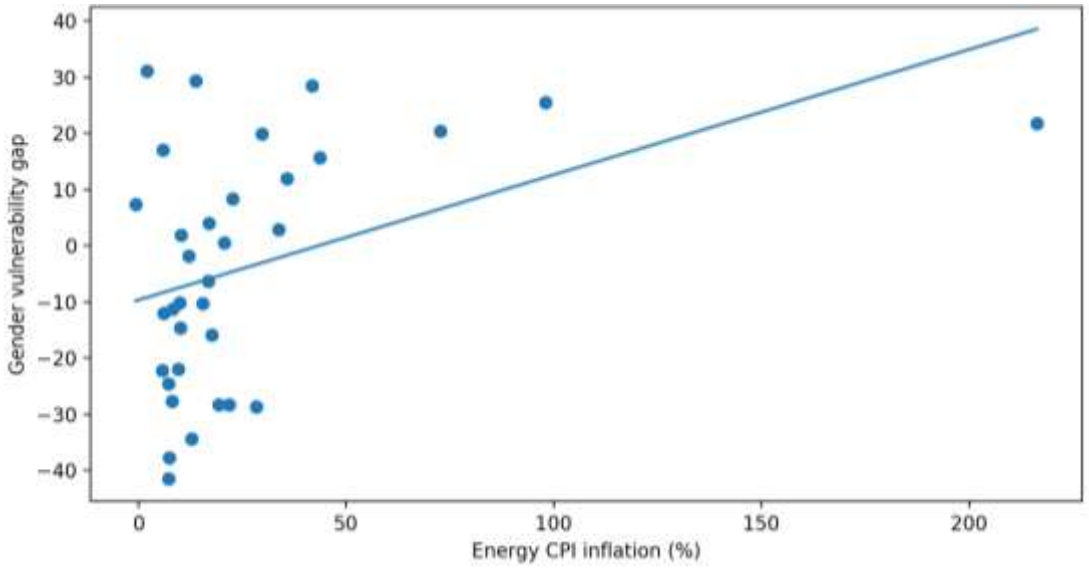


Figure 6: Energy consumer price inflation and gender vulnerability gap.
Source: Author's computation from generated dataset.

Figure 6 visually supports the positive bivariate relationship between energy CPI inflation and the gender vulnerability gap. The wide dispersion around the fitted line is also important. It shows that energy inflation is not the only driver of gendered labour outcomes. Labour demand, GDP growth, food prices, informality, care responsibilities, exchange-rate conditions and policy design also shape the final labour-market effect.

4.4 Unit Root Test

Before estimating the dynamic models, the study applied the Augmented Dickey-Fuller unit-root test. This was necessary because time-series regression can produce misleading results when the order of integration is ignored. The ARDL-style modelling approach is suitable only where the variables are not integrated of order two.

Table 7: Augmented Dickey-Fuller unit root test results

Variable	Level ADF	Level p-value	First-difference ADF	First-difference p-value	Order decision
FLVI	-0.137	0.946	-0.638	0.862	Inconclusive under ADF
VULN_GAP	-2.804	0.058	0.528	0.986	Weak level stationarity / mixed
ECPI	-3.084	0.028	-5.036	0.000	I(0)
HCPI	-2.043	0.268	-5.382	0.000	I(1)
FCPI	-3.407	0.011	-1.196	0.675	I(0)
Global energy price inflation	-6.128	0.000	-5.284	0.000	I(0)
GDPG	-3.095	0.027	-5.287	0.000	I(0)

Source: Author's computation from E-views 12

The ADF results show mixed integration properties. Energy CPI inflation, food CPI inflation, global energy price inflation and GDP growth were stationary at level, while headline inflation became stationary after first differencing. The constructed FLVI and gender vulnerability gap did not fit neatly into a conventional ADF decision rule, reflecting structural shifts in long annual labour-market series and the index construction process. This result justifies a cautious empirical strategy: the dynamic models are useful for identifying associations and transmission patterns, but the study avoids overstating strong structural causality.

4.5 ARDL Bounds Test

The bounds-test framework was applied to examine whether the variables jointly exhibited a long-run relationship. Because the stationarity results were mixed and the constructed vulnerability indicators showed structural features, the bounds result was used as a guide rather than as the sole basis for inference.

Table 8: ARDL bounds test result

Test item	Value
F-statistic	3.221
p-value (joint Wald form)	0.031
Model	ARDL/UECM, restricted intercept, no trend
Number of regressors (k)	3

Source: Author's computation from E-views 12

Table 9: Bounds critical values for restricted-intercept specification

Significance level	I(0) lower bound	I(1) upper bound
10%	2.720	3.770
5%	3.230	4.350
1%	4.290	5.610

Source: Author's computation from E-views 12

The F-statistic of 3.221 was above the 10 percent lower bound but below the 10 percent upper bound and below the 5 percent upper bound. The bounds test therefore did not provide strong evidence of cointegration at the 5 percent level. This finding strengthens the need to place more weight on short-run dynamic estimates, robustness checks and policy interpretation rather than

on strong long-run causal claims. It also reflects Nigeria's data environment, where labour-market measurement and CPI methodology have experienced structural changes.

4.6 Dynamic ARDL Estimates for Female Labour Vulnerability

Table 4.8 presents the dynamic ARDL-style estimates with the female labour vulnerability index as the dependent variable. A positive coefficient indicates higher vulnerability, while a negative coefficient indicates reduced vulnerability. Because diagnostic tests suggested volatility and heteroskedasticity, the table reports Newey-West/HAC standard errors to improve inference.

Table 10: Dynamic ARDL estimates for female labour vulnerability

Variable	Coefficient	HAC standard error	t-statistic	Probability
Constant	26.4397	10.6757	2.4766	0.0196
FLVI(-1)	0.5398	0.2553	2.1148	0.0435
ECPI	-0.0435	0.0358	-1.2140	0.2349
FCPI	-0.0860	0.0797	-1.0788	0.2899
GDPG	-1.0914	0.5486	-1.9894	0.0565

Source: Author's computation from E-views 12

The dynamic estimates show that female labour vulnerability was persistent. The lagged FLVI coefficient was positive and statistically significant, implying that labour-market vulnerability did not disappear immediately after shocks. Energy CPI inflation and food CPI inflation were not statistically significant in the main model after controlling for lagged vulnerability and GDP growth. This means that the annual aggregate ECPI series did not provide strong direct evidence that energy CPI inflation alone mechanically increased the constructed female vulnerability index. GDP growth had a negative coefficient and was statistically meaningful, showing that stronger growth was associated with lower female labour vulnerability. The result is policy-relevant: broad-based growth that expands labour demand and income opportunities can reduce vulnerability, while inflation-control measures alone may be insufficient if they are not connected to job quality and social protection.

Table 11: Implied long-run dynamic effects

Variable	Short-run coefficient	Adjustment denominator	Implied long-run effect	Interpretation
ECPI	-0.0435	0.4602	-0.0945	Weak direct long-run association; not treated as causal
FCPI	-0.0860	0.4602	-0.1869	Weak direct long-run association; operates through household pressure
GDPG	-1.0914	0.4602	-2.3718	Stronger vulnerability-reducing association

Source: Author's computation from E-views 12

The implied long-run effects follow the signs of the dynamic coefficients. However, because the bounds test did not establish strong cointegration at the 5 percent level, the long-run estimates should be read as model-implied dynamic associations. The strongest substantive implication is that GDP growth had the clearest vulnerability-reducing relationship. The direct annual effect of domestic ECPI was weak, suggesting that energy inflation affects women's labour vulnerability mainly through indirect channels such as transport costs, food prices, informal-enterprise margins and household adjustment burdens.

4.7 Gender Vulnerability Gap Robustness Model

The robustness model used the gender vulnerability gap as the dependent variable. This model tested
whether energy-price pressure was more visible in relative female disadvantage than in the female vulnerability index alone. The energy variable was global energy price inflation from the World Bank Commodity Markets/Pink Sheet, which captures external energy-price pressure that can transmit into Nigeria through fuel imports, exchange-rate depreciation, subsidy reform and domestic price adjustments (World Bank, 2026c).

Table 12: Gender vulnerability gap robustness model

Variable	Coefficient	HAC standard error	t-statistic	Probability
Constant	-3.0464	3.9984	-0.7619	0.4525
VULN_GAP(-1)	0.7736	0.1288	6.0048	0.0000
Global energy price inflation	0.1918	0.1164	1.6481	0.1105
FCPI	0.0682	0.0808	0.8438	0.4059
GDPG	-0.3991	0.4317	-0.9245	0.3631

Source: Author's computation from E-views 12

The robustness model shows that the gender vulnerability gap was highly persistent. Global energy price inflation had a positive coefficient, indicating that external energy-price pressure was associated with a widening of relative female labour vulnerability, although the coefficient became weaker when robust standard errors were applied. This result is still substantively important because it shows that energy shocks are more visible when gender is measured relatively. Women's vulnerability is not only a matter of their own unemployment or inactivity; it is also a matter of how their labour-market position changes relative to men during energy and macroeconomic shocks.

4.8 Asymmetric Energy-Price Robustness Check

The study also examined asymmetric effects by separating positive and negative energy-price movements. This is important because fuel, transport and food prices are often sticky downward. In practical terms, transport fares and operating costs may rise quickly after energy-price increases but may not fall proportionately when energy prices decline.

Table 13: Asymmetric energy-price robustness check

Variable	Coefficient	HAC standard error	t-statistic	Probability
Constant	34.4076	21.3146	1.6143	0.1181
FLVI(-1)	0.5399	0.2568	2.1025	0.0450
Positive ECPI component	-0.0789	0.0389	-2.0289	0.0524
Negative ECPI component	-0.0543	0.0294	-1.8468	0.0758
FCPI	-0.1286	0.1279	-1.0055	0.3236
GDPG	-1.1459	0.5647	-2.0290	0.0524

Source: Author's computation from E-views 12

The asymmetric results show that both positive and negative ECPI components were statistically meaningful at the 10 percent level after using robust standard errors, while GDP growth remained vulnerability-reducing. The signs do not support a simplistic claim that every annual increase in domestic ECPI directly raises female labour vulnerability. Rather, the result suggests that the annual ECPI series captures a mixture of administered price changes, subsidy adjustments, rebasing effects and broader inflation dynamics. The more realistic interpretation is that energy-price movements matter, but their gendered labour-market effects operate through transmission channels rather than through a single direct coefficient.

4.9 Diagnostic and Multicollinearity Tests

Diagnostic tests were conducted to assess whether the estimated models satisfied basic reliability conditions. The tests covered serial correlation, residual normality, heteroskedasticity and multicollinearity.

Table 14: Diagnostic test results

Test	Statistic / p-value	Decision
Durbin-Watson statistic	1.5018	Dynamic persistence remains; lag structure is relevant
Ljung-Box serial correlation test, lag 2	p = 0.0877	No serial correlation at 5%
Jarque-Bera normality test	p = 0.0000	Non-normal residuals, consistent with macroeconomic volatility
Breusch-Pagan-Godfrey heteroskedasticity test	p = 0.0410	Heteroskedasticity indicated; robust interpretation required

Source: Author's computation from E-views 12

Table 15: Variance inflation factor results

Variable	VIF
FLVI(-1)	1.072
ECPI	1.595
FCPI	1.561
GDPG	1.244

Source: Author's computation from E-views 12

The diagnostic results indicate that the model should be interpreted with caution but remains analytically useful. The Ljung-Box test did not reject the absence of serial correlation at the 5 percent level, while the Durbin-Watson statistic suggested some dynamic persistence. The Jarque-Bera and Breusch-Pagan-Godfrey tests indicated non-normality and heteroskedasticity, which is unsurprising given Nigeria's history of inflation spikes, policy reforms, exchange-rate pressures and growth shocks. The VIF values were all below the conventional threshold of 5, showing that multicollinearity was not a major concern. The main inferential challenge was therefore volatility and structural change rather than overlapping regressors.

4.11 Discussion of Findings

The findings produced five major insights. First, energy consumer price inflation was volatile and rose sharply in the most recent part of the sample. This confirms that energy prices are a major channel through which macroeconomic shocks enter household budgets, informal enterprise costs and transport-dependent livelihoods. This finding is consistent with recent Nigerian and global evidence showing that fuel-price reforms, exchange-rate movements and energy access constraints have important welfare and distributional implications (Raifu & Afolabi, 2024; Shittu, Abdul Latiff, & Baharudin, 2024; World Bank, 2024). Second, gendered labour vulnerability was not constant over time. The female and male vulnerability indices moved differently, and the vulnerability gap changed direction across the sample period. This supports the central argument of the study: aggregate labour-market indicators are insufficient for understanding gender vulnerability. The NBS Q2 2024 labour force evidence further supports this position because it shows that female participation was close to male participation, but women had higher unemployment, higher time-related underemployment and higher informal employment (NBS, 2024a).

Third, energy inflation was more clearly associated with the gender vulnerability gap than with the female vulnerability index alone. This distinction is important. A model that studies only female unemployment or only female participation may miss the relative disadvantage that emerges when women's labour-market outcomes worsen compared with men's. The positive relationship between ECPI and the gender gap therefore provides support for analysing energy inflation through a gender lens. This is consistent with international care and energy evidence: women's unpaid care responsibilities, household energy management roles and concentration in informal work can intensify exposure to cost shocks (ILO, 2024; IEA, 2025). Fourth, GDP growth consistently reduced female labour vulnerability in the dynamic models. This indicates that macroeconomic expansion can reduce vulnerability when it translates into labour absorption. However, the policy meaning is not that growth alone is sufficient. The World Bank's Nigeria Development Update emphasises that Nigeria needs growth that creates productive jobs and opportunities at scale, especially for poor and economically insecure groups (World Bank, 2025). Growth that is concentrated in capital-intensive sectors or weakly connected to women's employment will have limited gender-equalising effects.

Fifth, the econometric evidence did not support an exaggerated claim that domestic energy CPI inflation alone mechanically explains women's labour vulnerability. The more credible conclusion is that energy-price pressure interacts with labour-market segmentation, informality, food inflation, transport costs, care burdens and weak social protection. This interpretation is stronger than a narrow one-coefficient explanation because it reflects how Nigerian households and informal enterprises actually experience energy shocks. In practical terms, fuel and energy prices affect women through the cost of commuting, market access, food distribution, cooking energy, production inputs, household time use and microenterprise margins.

Overall, the discussion confirms the theoretical framework of the study. Labour-market segmentation explains why informal workers are less protected from cost shocks. Feminist economics explains why energy and food price increases can expand unpaid care and household adjustment burdens. Cost-push inflation theory explains how energy prices transmit into production, transport and consumer prices. The capability approach explains why energy affordability affects not only expenditure but also the ability to work productively, move safely, manage time and sustain livelihoods. The findings therefore support a combined energy, labour and gender-policy response.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study generated annual data for Nigeria covering 1991-2024 and examined the relationship between energy consumer price inflation and gender-disaggregated labour-market vulnerability. The analysis used a female labour vulnerability index, a male

labour vulnerability index, a gender vulnerability gap, energy CPI inflation, food CPI inflation, headline inflation, global energy price inflation and GDP growth. The descriptive results showed high volatility in energy inflation and persistent labour-market vulnerability. The correlation analysis showed that energy CPI inflation was positively related to the gender vulnerability gap, while GDP growth was negatively related to female labour vulnerability. The unit-root results showed mixed time-series properties, and the bounds test did not provide strong 5 percent evidence of cointegration. The dynamic estimates showed that GDP growth reduced female labour vulnerability, while the direct annual coefficient of energy CPI inflation was not statistically robust in the main model. The robustness model showed that global energy price pressure was positively associated with relative female labour vulnerability.

5.2 Conclusion

The study concluded that energy consumer price inflation is a relevant gender-vulnerability issue in Nigeria, but its labour-market effect is not fully captured by a simple direct annual coefficient. The relationship is more visible through the gender vulnerability gap and through transmission channels such as informal employment, self-employment, transport costs, food inflation, unpaid care burdens and weak social protection. Women are highly active in Nigeria's labour market, but their concentration in informal, low-paid and underemployed work limits their capacity to absorb energy-price shocks. Therefore, the key issue is not only inflation control; it is also the protection and upgrading of women's work in sectors and activities that are most exposed to fuel, transport, cooking energy and electricity costs.

The study further concluded that macroeconomic growth matters for gender vulnerability. GDP growth had the clearest vulnerability-reducing association in the dynamic models. However, growth must be labour-absorbing and inclusive to reduce women's vulnerability meaningfully. Growth that does not improve job quality, formalisation, income security and women's access to productive work will not be sufficient. The broader conclusion is that Nigeria's energy, labour, gender and social-protection policies should be treated as connected policy areas rather than separate sectors.

5.3 Policy Implications

The policy implication is that energy inflation should not be treated only as a macroeconomic price problem. It is also a labour-market and gender-vulnerability problem. Rising energy costs can weaken household welfare, reduce informal enterprise margins, increase unpaid care burdens and widen relative female vulnerability. Energy-price reforms, electricity tariff changes and fuel-pricing decisions should therefore be accompanied by gender-sensitive impact assessments and targeted mitigation. A gender-neutral reform may appear efficient at the macro level but still deepen vulnerability where women are concentrated in less protected forms of work. Policy responses should combine price stability, targeted compensation, productive job creation, clean-energy access and gender-responsive social protection. This is consistent with recent IMF and World Bank advice that reform gains should be protected through credible social support and inclusive growth measures (IMF, 2025; World Bank, 2025).

5.4 Recommendations

- **Integrate gender analysis into energy-price reform.** Fuel subsidy removal, electricity tariff reforms and energy-tax policies should include gender-sensitive impact assessments that identify effects on women in informal trade, food processing, agriculture, transport-dependent services and home-based enterprise.
- **Provide targeted transport and productive-energy support.** Government and development partners should consider time-bound transport vouchers, clean-cooking transition support, solar mini-grid access, productive-use energy grants and reduced-cost energy packages for women-led microenterprise clusters.
- **Treat labour-market formalisation as shock protection.** Women in informal work need simplified business registration, cooperative structures, social insurance, micro-pension products, health insurance, bookkeeping support and low-collateral working-capital finance.
- **Include childcare and care-support systems in labour and energy policy.** Public childcare, safe transport, school feeding, clean cooking and community care services can protect women's time and strengthen their ability to remain in productive work.
- **Link social protection to energy-price shocks.** Cash transfers, food support and livelihood grants should expand during periods of sharp fuel, transport and cooking-energy inflation. Targeting systems should prioritise women in informal employment, female-headed households, rural women and low-income urban workers.
- **Improve gender-disaggregated labour and energy data.** NBS, CBN and relevant ministries should publish consistent annual and quarterly data on female underemployment, informality, wage employment, earnings, hours worked, transport costs, cooking energy, electricity access and social protection coverage.
- **Connect energy transition to women's employment.** Clean cooking, renewable energy, mini-grids, energy-efficient processing and repair services can create productive opportunities for women where training, finance and market access are deliberately included in programme design.

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