



WOMEN'S SOCIO-ECONOMIC DETERMINANTS AND FEMALE SUICIDE MORTALITY: A PANEL DATA ANALYSIS OF 41 COUNTRIES

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ABSTRACT

The problem of female suicide mortality constitutes a great concern in public health. It encompasses socio-economic and demographic aspects that impact women in general. The current research analyses the effect of adolescent fertility and female labor force participation on female suicide mortality by means of panel regression analysis of data for 41 countries during the period from 2000 to 2021. In particular, an unbalanced sample of 902 observations is estimated using Pooled Ordinary Least Squares (OLS), Fixed Effects (FE) and Random Effects (RE). A Hausman specification test is used to identify the appropriate panel regression estimator. According to the results obtained, there exists a positive correlation between adolescent fertility and female suicide mortality, while female labor force participation is negatively related to the dependent variable. The choice of RE is justified by the results of the Hausman test, which shows that country specific effects have no relationship with regressors. At the same time, the diagnostic tests identify the existence of heteroscedasticity and autocorrelation. Using robust standard errors diminishes the significance of the regressors.

Keywords: Female Suicide Mortality, Adolescent Fertility, Female Labour Force Participation, Panel Data Analysis, Women's Well-being

INTRODUCTION

Suicide is a major global public health issue and remains one of the leading causes of premature mortality worldwide. Beyond its individual consequences, suicide imposes substantial social and economic costs on families, communities and national healthcare systems. Although suicide rates are generally higher among men, women experience unique social, demographic and economic challenges that significantly influence their mental health outcomes. Understanding the determinants of female suicide mortality is therefore essential for designing effective interventions and policies.

The mental wellbeing of women is determined by a number of factors that include reproductive behavior, labor force participation, level of education attained, and socio-economic situation. Of all these factors that affect women's mental wellbeing, adolescent fertility and labor force participation have received much focus in demographic and developmental studies. Adolescent fertility is a marker for socioeconomic difficulties that involve education constraints, early marriage, and dependency on men economically. Labor force participation, on the other hand, acts as a determinant of empowerment. Previous studies have shown that labour market opportunities can improve psychological wellbeing through increased income, social interaction and autonomy (Blau & Kahn, 2013). Conversely, early childbearing may generate long-term economic and psychological challenges that adversely affect women's well-being (World Bank, 2012). Despite these findings, limited research has examined the combined influence of fertility and labour force participation on female suicide mortality using cross-country panel data.

The present study seeks to address this gap by analysing the relationship between adolescent fertility, female labour force participation and female suicide mortality across 41 countries during the period 2000–2021.



REVIEW OF LITERATURE

The relationship between socio-economic conditions and suicide has long occupied an important place in social science research. The classical sociological framework developed by Durkheim (1897/1951) argues that suicide is closely linked to social integration and social regulation. Individuals who experience weak social bonds, economic uncertainty or social isolation are more vulnerable to suicidal behaviour.

Economic approaches indicate that employment, income, and economic opportunities have implications for one's mental well-being. Hamermesh and Soss (1974) have argued that people assess the costs and benefits associated with their living situations; this suggests that economic difficulties may raise risks of committing suicide. Other research has found that unemployment, poverty, and exclusion from society remain significant factors affecting suicide rates.

Adolescent fertility can be considered an essential demographic variable connected to socioeconomic standing and prospects for a woman. Childbearing at young ages tends to disrupt education, limit workforce involvement and increase economic dependency. As indicated by the World Bank (2012), early pregnancy contributes to low educational success and decreased lifelong wages. Such circumstances may result in psychological strain.

As revealed by the research of Singh and Darroch (2012), the risk of being socio-economically deprived is higher among teenage mothers than women who choose to delay their pregnancies. Likewise, Patton et al. (2016) claim that reproductive health outcomes in teens can have an impact on overall well-being in the long run. Increased fertility in young girls is often linked to poor healthcare infrastructure, less education for females, and gender disparities.

Female labour force participation has emerged as a key indicator of women's empowerment and economic independence. Theoretical perspectives suggest that labour market participation enhances self-esteem, financial security and social integration. Klasen and Pieters (2015) argue that employment opportunities improve women's bargaining power within households and contribute to greater autonomy.

Several empirical studies have found a positive association between female employment and mental well-being. Participation in paid employment provides income security and social interaction, both of which can reduce psychological distress. However, labour market participation may also expose women to workplace discrimination, wage inequalities and work-family conflicts, creating mixed effects on mental health outcomes (Blau & Kahn, 2017).

Differences among countries also pose an additional challenge for the connection between socio-economic determinants and suicide deaths. Differences in their healthcare systems, education, social protections, and cultural practices could have a huge impact on the results. According to Baltagi (2013), panel data methods provide an adequate analytical tool in this situation by helping the researcher control for differences among countries and take advantage of their cross-sectionalist and time dimensionality. Despite substantial research on fertility, labour force participation and mental health, relatively few studies have simultaneously examined their influence on female suicide mortality within a multi-country panel framework. This study contributes to the literature by addressing this gap through the application of panel econometric methods.

RESEARCH GAP

Most existing literature has been centered on fertility outcomes or labor market outcomes individually. Studies involving female suicides have typically examined issues related to psychology or healthcare, but neglected demographic and labor market variables. In addition, majority of studies use cross-sectional methods without taking into consideration the heterogeneity across countries. This paper seeks to remedy the above problems by examining the combined effect of adolescent fertility and female labor force participation on female suicide mortality.



OBJECTIVES OF THE STUDY

- To examine the impact of adolescent fertility on female suicide mortality.
- To analyse the influence of female labour force participation on female suicide mortality.
- To identify the most appropriate panel data model through the Hausman specification test.
- To evaluate the robustness of the estimated relationships using diagnostic tests and robust standard errors.

DATA AND METHODOLOGY

Data Source

The study employs annual panel data for 41 countries covering the period 2000–2021. The balanced panel consists of 902 observations.

Table 1

Definition of Variables

Variable	Definition	Measurement
Female Suicide Mortality (Dependent Variable)	Female suicide deaths per 100,000 female population	Rate per 100,000 females
Adolescent Fertility Rate	Number of births per 1,000 women aged 15–19 years	Births per 1,000 women aged 15–19
Female Labour Force Participation Rate	Percentage of women aged 15 years and above participating in the labour force	Percentage (%)

Descriptive Statistics

Table 2

Variable	Mean	Minimum	Maximum
Adolescent Fertility	56.513	1.386	169.171
Female Labour Force Participation	49.240	5.155	77.817
Female Suicide Mortality	5.521	0.230	24.680

The descriptive statistics indicate substantial variation across countries. Adolescent fertility exhibits the widest dispersion, reflecting significant differences in reproductive behaviour and socio-economic development across countries. Female labour force participation averages approximately 49 per cent, while female suicide mortality averages 5.52 deaths per 100,000 female population.

Econometric Model

The empirical specification is given by:

$\text{Suicide}_{it} = \beta_0 + \beta_1 \text{Fertility}_{it} + \beta_2 \text{LabourForce}_{it} + \varepsilon_{it}$ where i represents country and t represents year.

The study estimates Pooled OLS, Fixed Effects and Random Effects models. The Hausman specification test is subsequently employed to determine the preferred estimator.

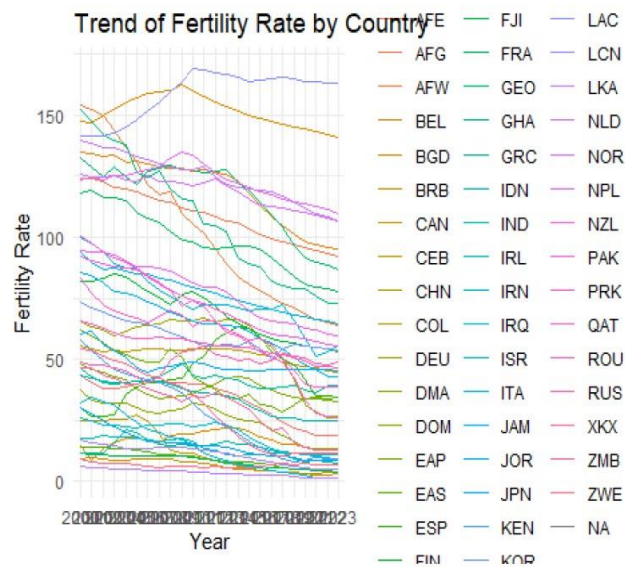


RESULTS AND DISCUSSION

Trend Analysis

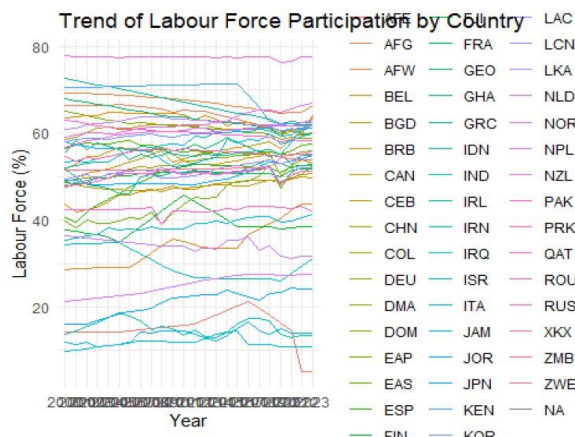
Prior to econometric estimation, graphical trend analysis was conducted to examine the temporal behaviour of adolescent fertility, female labour force participation and female suicide mortality across the selected countries. The trend plots reveal substantial heterogeneity among countries throughout the study period.

Figure 1. Trend in Adolescent Fertility Rate Across Selected Countries (2000–2021)



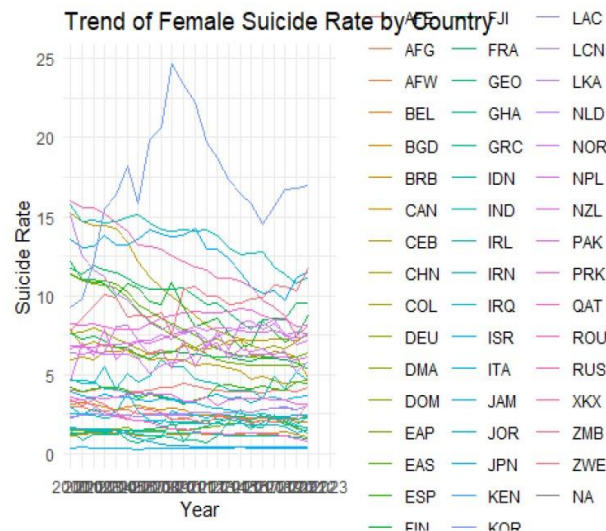
As evident in the fertility trend for adolescents, there is an overall drop in fertility levels among many countries from the year 2000 to 2021 due to advances made in terms of educating women and making healthcare and family planning services available. However, variations persist, as some nations still experience higher fertility rates even during the specified period.

Figure 2. Trend in Female Labour Force Participation Across Selected Countries (2000–2021)



According to the trend analysis on female labor force participation, while some nations demonstrate stability in terms of female labor force participation, others show considerable variation. This can be due to different structural arrangements of the labor market as well as the level of economic development in different countries.

Figure 3. Trend in Female Suicide Mortality Rate Across Selected Countries (2000–2021)



It is evident from the above data that there are many differences in female suicide mortality across nations. Some nations have consistently shown low female suicide rates while other nations show high volatility in such suicide trends. This implies that factors particular to each country may play an important role in influencing mental health conditions among women.

Pooled Ordinary Least Squares Results

Table 3 presents the pooled OLS estimates examining the relationship between adolescent fertility, female labour force participation and female suicide mortality.

Table 3

Pooled OLS Estimates

Variable	Coefficient	p-value
Adolescent Fertility	-0.0070	0.0262
Female Labour Force Participation	-0.0375	<0.001
Constant	7.6562	<0.001
R² = 0.0301		
F-statistic = 13.96 (p < 0.001)		

The pooled regression results indicate that both explanatory variables are statistically significant determinants of female suicide mortality. The coefficient of adolescent fertility is negative and statistically significant, suggesting that higher fertility rates are associated with lower female suicide mortality. Female labour force participation also exhibits a significant negative relationship with female suicide mortality.

However, pooled OLS ignores country-specific heterogeneity and assumes that all countries share identical intercepts. Consequently, the estimated coefficients may suffer from omitted variable bias arising from unobserved institutional, cultural and socio-economic differences across countries.

Fixed Effects Results

To account for unobserved country-specific characteristics, a Fixed Effects estimator was employed. The results are reported in Table 4.



Table 4

Fixed Effects Model

Variable	Coefficient	Standard Error	p-value
Adolescent Fertility	0.0224	0.0043	<0.001
Female Labour Force Participation	-0.0568	0.0196	0.0038
Within R² = 0.0441			
F-statistic = 19.81 (p < 0.001)			

The Fixed Effects model produces substantially different results from the pooled estimator. Adolescent fertility becomes positively associated with female suicide mortality and remains highly significant. Specifically, a one-unit increase in adolescent fertility is associated with a 0.022-unit increase in female suicide mortality, holding other factors constant.

The positive coefficient suggests that increases in adolescent fertility within a country over time may contribute to greater psychological stress, educational disruption and economic vulnerability among women. These factors may subsequently increase susceptibility to mental health problems and suicide mortality.

Female labour force participation continues to exhibit a statistically significant negative relationship with female suicide mortality. The estimated coefficient implies that greater economic participation by women is associated with lower suicide mortality rates. This finding is consistent with theories emphasising the role of employment in promoting financial security, social integration and economic autonomy.

Random Effects Results

The Random Effects model was estimated to utilise both within-country and between-country variation. The results are presented in Table 5.

Table

5

Random Effects Model

Variable	Coefficient	Standard Error	p-value
Constant	6.9682	1.0973	<0.001
Adolescent Fertility	0.0202	0.0041	<0.001
Female Labour Force Participation	-0.0560	0.0175	0.0014
Overall R² = 0.0395			
Chi-square = 36.93 (p < 0.001)			

The Random Effects estimates are broadly consistent with the Fixed Effects results. Adolescent fertility remains positively associated with female suicide mortality, whereas female labour force participation continues to exert a negative effect.

The variance decomposition indicates that approximately 91.9 per cent of unexplained variation arises from country-specific effects, while only 8.1 per cent originates from idiosyncratic within-country variation. This finding highlights the importance of structural, institutional and cultural differences in explaining female suicide mortality across countries.



Hausman Specification Test

The Hausman test was conducted to determine whether the Fixed Effects or Random Effects model is more appropriate.

Table 6

Hausman Test Results			
Test Statistic Degrees of Freedom p-value			
4.0821	2	0.1299	

The null hypothesis of the Hausman test states that the Random Effects estimator is consistent and efficient. Since the p-value exceeds the conventional significance level of 0.05, the null hypothesis cannot be rejected. Therefore, the Random Effects model is selected as the preferred specification.

The result suggests that country-specific effects are not systematically correlated with the explanatory variables, allowing the Random Effects estimator to provide efficient and consistent estimates.

Diagnostic Tests

Before interpreting the preferred model, several diagnostic tests were conducted to assess the validity of the underlying assumptions.

Table 7

Diagnostic Test Results

Test	Statistic	p-value	Interpretation
Breusch–Pagan Test	7.1711	0.0277	Heteroskedasticity Present
Wooldridge Serial Correlation Test	607.43	<0.001	Serial Correlation Present
Shapiro-Wilk Test	W = 0.8431	<0.001	Residuals Not Normally Distributed

The Breusch–Pagan test reveals significant heteroskedasticity in the residuals. Similarly, the Wooldridge test indicates severe serial correlation within panel units. The Shapiro-Wilk test further suggests that the residuals deviate from normality.

These findings imply that conventional standard errors may be unreliable, necessitating the use of robust estimation techniques.

Robust Random Effects Estimates

To address heteroskedasticity and serial correlation, heteroskedasticity-consistent standard errors were estimated using the Arellano covariance matrix.

Table 8

Robust Random Effects Estimates

Variable	Coefficient	Robust Standard Error	p-value
Constant	6.9682	1.8745	0.0002
Adolescent Fertility	0.0202	0.0120	0.0916
Female Labour Force Participation	-0.0560	0.0375	0.1352

The robust estimates reveal that the statistical significance of both explanatory variables weakens considerably after correcting for heteroskedasticity and serial correlation. Although the coefficients



retain their original signs, neither variable remains statistically significant at the 5 per cent significance level.

This finding suggests that the apparent significance observed in the conventional Random Effects model may partly reflect violations of classical regression assumptions. Consequently, the relationship between adolescent fertility, labour force participation and female suicide mortality should be interpreted with caution.

Discussion of Findings

The empirical findings provide evidence that demographic and labour market factors are associated with female suicide mortality. The positive association between adolescent fertility and suicide mortality supports the argument that early childbearing may create long-term socioeconomic disadvantages and psychological pressures that adversely affect women's mental health. Early motherhood often limits educational attainment, reduces labour market opportunities and increases economic dependence, all of which may contribute to psychological vulnerability.

The negative relationship between female labour force participation and suicide mortality is consistent with theories of economic empowerment. Employment may improve women's access to financial resources, social networks and decision-making power, thereby reducing mental health risks. Greater participation in economic activities can strengthen women's autonomy and enhance overall well-being. However, the robust estimation results suggest that these relationships are sensitive to econometric specification. The disappearance of statistical significance after correcting for heteroskedasticity and serial correlation indicates that country-specific institutional and structural factors may be more important determinants of female suicide mortality than fertility and labour market outcomes alone.

Overall, the findings highlight the complexity of female suicide mortality and suggest that demographic and economic variables should be analysed alongside broader institutional, social and healthcare determinants.

CONCLUSION AND POLICY IMPLICATIONS

Conclusion

This study examined the relationship between adolescent fertility, female labour force participation and female suicide mortality using a balanced panel dataset comprising 41 countries over the period 2000–2021. The analysis employed Pooled Ordinary Least Squares (OLS), Fixed Effects (FE) and Random Effects (RE) estimators to investigate the determinants of female suicide mortality.

According to the results obtained, it can be noted that female suicide rates are influenced significantly by adolescent fertility and female labor force participation rates. The Fixed Effects and Random Effects models suggested that there was a positive correlation between adolescent fertility and female suicide mortality, indicating that higher rates of adolescent pregnancies may lead to increased vulnerability in women. However, it should be noted that female labor force participation was negatively correlated with female suicide rates.

The Hausman specification test supported the use of the Random Effects estimator, indicating that country-specific effects are not systematically correlated with the explanatory variables. However, diagnostic tests revealed the presence of heteroskedasticity, serial correlation and non-normality in the residuals. After applying robust standard errors, the statistical significance of the explanatory variables diminished considerably. This finding suggests that although demographic and labour market variables are associated with female suicide mortality, their explanatory power is sensitive to model assumptions and estimation techniques.

Additionally, variance decomposition of the Random Effects model revealed that an impressive amount of unexplained variance could be explained by country-specific variables. This result underlines the significance of institutions, culture, and structure when it comes to explaining the female psychological well-being of women in different nations.



Overall, the study demonstrates that female suicide mortality cannot be fully explained by fertility behaviour and labour force participation alone. Broader socio-economic conditions, healthcare systems, gender norms and institutional arrangements play an equally important role in determining women's mental health outcomes.

Policy Implications

The findings of this study generate several important policy implications.

First, governments should strengthen adolescent reproductive health programmes and expand access to reproductive healthcare services. Reducing adolescent fertility through improved family planning, reproductive education and healthcare access may contribute to better longterm socio-economic and mental health outcomes for women.

Second, policies aimed at increasing female educational attainment should be prioritised. Education not only reduces the likelihood of adolescent pregnancy but also enhances women's labour market opportunities and economic independence. Investments in girls' education therefore have the potential to generate both economic and psychological benefits.

Thirdly, there should be policies in the labor market that promote participation of women in productive employment. This would include increasing job opportunities for women, decreasing discrimination at work and improving working conditions. Economic empowerment can lead to better psychological well-being and hence reduce suicide risk among women.

Fourth, mental health policies should adopt a gender-sensitive approach. Female suicide mortality is influenced by demographic, economic and social conditions that differ substantially from those affecting men. Mental health interventions should therefore incorporate considerations related to reproductive health, caregiving responsibilities and labour market participation.

Finally, policymakers should take into account the significance of the unique national institutional context. As a great part of the variability in suicide mortality among women is determined by the institutional structure of various countries, intervention efforts must be adjusted to national conditions.

Limitations and Scope for Future Research

Nevertheless, there are some drawbacks associated with this research. The empirical analysis contains only two independent variables, which implies that the full set of variables determining female suicide mortality cannot be captured in this case. Factors like income disparity, education level, unemployment rate, expenditure on health care, gender disparity, and social security programs were omitted due to lack of data.

Future studies might enhance the study with the inclusion of more socio-economic and institutional factors. Studies might explore regional differences through comparisons between developed and developing countries. Finally, dynamic techniques of panel data, such as the Generalised Method of Moments (GMM), might reveal further insights about the persistence of female suicides and its determinants.

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