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Why is the Correlation between Women's Labor Force Participation Rate (WLFPR) and Total Fertility Rate (TFR) Positive in Developed Countries?

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Abstract

This study explores the unexpected positive correlation between women's labor force participation rate (WLFPR) and total fertility rate (TFR) observed in developed countries. Using secondary data from the World Bank series (2011-2021) for the top 20 developed countries based on Human Development Index (HDI) ranking, we analyze the correlation between these two variables. The results reveal a statistically significant positive correlation between WLFPR and TFR in developed nations, suggesting that women's increased participation in the workforce is not directly associated with declining fertility rates as observed in developing countries. This finding challenges the traditional view that economic empowerment leads to lower fertility and highlights the nuanced relationship between work and family in developed contexts.

Keywords: *Labor Force Participation Rate, Total Fertility Rate, Developed Countries.*

Introduction

The relationship between women's economic participation and fertility rates is a complex and widely debated topic. In developing countries, a common assumption is that as women become more economically empowered, they tend to have fewer children. This assumption is supported by a generally observed negative correlation between women's labor force participation rate (WLFPR) and total fertility rate (TFR) in these regions.

However, this study presents a counterintuitive finding: a positive correlation between WLFPR and TFR in developed nations. This unexpected result suggests thatthe link between women's economic roles and fertility decisions in developed countries might be more nuanced than previously understood. Our analysis, based onWorld Bank data from 2011-2021 for the top 20 developed countries based on Human

Development Index (HDI) ranking, aims to explore this unexpected relationship and shed light on the factors that may be contributing to it.

Theoretical Reviews

Concept of TFR and its Implications

Total Fertility Rate (TFR) is a measure used to estimate the average number of children a woman is expected to have during her lifetime, assuming she experiences a specific fertility level at each age throughout a given period (Zegers, et al., 2017). It is also a measure that aggregates fertility rates across all age groups in a given year and is expressed as the number of children per woman (Roser, 2024). TFR is a crucial indicator in demography because it provides a general picture of the level of

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reproduction within a population.

One of the key factors influencing the population dynamics of a country or region is population fertility, or birth rate. This has a direct impact on population growth or decline and, in turn, affects various economic, social, and environmental aspects (Gu,et al., 2021). Pourreza et al. (2021) identifies five main factors contributing to TFR decline: health care-related, cultural, economic, social, and political. However, it is noteworthy that their analysis did not consider WLFPR as a primary factor in social or economic contexts, particularly in the Middle East and North Africa region.

Fertility Analysis and Population Control

Fertility analysis plays a crucial role in population control, enabling governments andpolicymakers to create and implement strategies for sustainable population growth (Bloom et al., 2000). Population fertility, or birth rate, is a key driver of population dynamics, directly impacting growth or decline and, in turn, influencing economic, social, and environmental aspects.

Several important aspects of fertility analysis in the context of population control include:

- Understanding TFR: TFR represents the average number of children a woman is expected to have during her lifetime, assuming she experiences the age- specific fertility rates prevalent in a particular year (Schoen, 2004; Harnett, 2016). A high TFR indicates potentially rapid population growth, while a low TFR suggests potential population decline. Population control policies often aim to optimize TFR, achieving levels that balance economic and environmental needs.

- Factors Influencing Fertility: Several factors contribute to changes in fertility levels:

Economic Conditions: Lower fertility levels are often associated withstrong economic conditions, as individuals and families may prioritize career and education over expanding their families (Suwarni, 2023). However, this relationship is complex and subject to debate in the context of macroeconomic systems. McDonald (2006) argued that sustained low fertility can reduce productivity due to a shortage of labor, posing a serious problem for future economic growth.

Education: Higher levels of education, especially for women, are typically linked to lower fertility. Education empowers individuals withknowledge about family planning and contraceptive methods (Liu & Raftery, 2020).

Government Policies: Government policies, such as family planning programs, economic incentives, and regulations, can significantly influence individual and family decisions about family size. For instance, Indonesia has implemented a policy limiting government employees to a maximum of two children, with no government supportfor additional children beyond this limit.

Social and Cultural Norms: Social and cultural norms within a societyalso play a role in shaping decisions about family size.

Impacts of Population Growth

a. High Fertility: Extremely high fertility levels can lead to overpopulation, straining resource availability, putting pressure on infrastructure, and exacerbating environmental problems.

b. Low Fertility: Conversely, low fertility levels can contribute to population aging, potentially placing a greater burden on younger generations to support older populations.

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- *Population Control Strategies*

Family Planning: Promoting education about family planning and ensuring access to contraception are essential components of effectivepopulation control.

Government Incentives: Governments can incentivize smaller families or provide support to families with more children, depending on a country's demographic needs.

Investing in Education and Health: Improving access to education and health services, particularly for women, can significantly contribute to lower fertility rates.

- *Conclusion*

Fertility analysis is a crucial tool in planning and implementing demographic policies.

Achieving sustainable population growth and social well-being requiresa comprehensive approach to managing population fertility, considering economic, social, cultural, and political factors. This approach must be flexible and adaptable to changing conditions and theresults of implemented policies.

Uses of TFR

Total Fertility Rate (TFR) is a valuable tool for understanding and managing population dynamics. It has numerous applications in various fields, including:

- Planning and Policy: TFR assists governments and organizations in planningeducational, health, and other social services, particularly those related to young populations and population growth.

- Demographic Change Analysis: TFR enables the observation of population trends and the dynamics of social change. For example, a decline in TFR can indicate urbanization, increased female education, and shifts in family values.

- Comparative Studies: TFR allows for the comparison of fertility rates acrosscountries or regions, providing valuable insights for comparative studies in population and reproductive health policies.

Calculating TFR

TFR is calculated by summing the age-specific fertility rates (ASFR) over a specific period, usually one year, and then multiplying this sum by the age interval in years. The formula is:

$$TFR = \sum (ASFR \times 5)$$

where:

- ASFR is the average number of live births per 1,000 women in a given agegroup.

- 5 represents the width of the age group interval (e.g., 15-19, 20-24, etc.).

This calculation provides the average number of children a woman is expected to haveduring her lifetime based on that year's fertility rate.

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Interpreting TFR

- Replacement Level Fertility (TFR 2.1): This is considered the fertility level required to maintain a stable population without accounting for migration. The exact replacement level can vary depending on the mortality rate in a particular country or region.

- Below Replacement Level (TFR < 2.1): A TFR below the replacement level indicates a potential population decline in the long term.

- Above Replacement Level (TFR > 2.1): A TFR above the replacement level suggests a tendency for population growth.

Influence of Socioeconomic Factors

TFR is influenced by a wide range of socioeconomic factors, including:

- Education: Higher levels of education, particularly for women, are often associated with lower TFRs, as women may choose to delay pregnancy or havefewer children.

- Economic Status: Economic factors, such as income, employment opportunities, and access to resources, can impact fertility decisions.

- Availability and Use of Contraception: Access to and use of effective contraception can play a significant role in influencing fertility rates.

- Social and Cultural Norms: Social and cultural norms, including traditional gender roles, family values, and societal attitudes towards family size, can significantly influence fertility decisions.

- Government Policies: Government policies related to family planning,economic incentives, and social support systems can also impact TFR.

Methods

This study utilizes secondary data obtained from the World Bank website. The data includes serial records of TFR and WLFPR from 2011 to 2021. To ensure a focus on developed countries, we selected the top 20 countries based on their Human Development Index (HDI) rankings. Subsequently, we analyzed the relationshipbetween TFR and WLFPR using correlation analysis.

Correlation analysis is a statistical technique used to measure and determine the strength and direction of the relationship between two quantitative variables (Purba& Purba, 2022). Excel was used to perform the correlation analysis due to the relatively small dataset.

Understanding Correlation

Correlation is measured on a scale from -1 to +1:

- Positive Correlation (+1): Indicates a perfect positive relationship where asvariable X increases, variable Y also increases.

- Negative Correlation (-1): Indicates a perfect negative relationship where asvariable X

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increases, variable Y decreases.

- No Correlation (0): Indicates no predictable relationship between the twovariables.

Results

The analysis included data on WLFPR and TFR from 2011 to 2021 for the top 20 developed countries based on their HDI rankings. The descriptive statistics (Table 1) show that the average WLFPR across these countries was 58.66%, with a standard deviation of 6.74%. The average TFR was 1.57, with a standard deviation of 0.25.

Table 1. Descriptive Statistics for WLFPR and TFR

Variable	Mean	Std. Deviation	N
WLFPR (LFPPerfemale)	58.66	6.74	214
TFR	1.57	0.25	220

The correlation analysis (Table 2) revealed a statistically significant positive correlation ($r = 0.387$, $p < 0.01$) between WLFPR and TFR in developed countries. This finding indicates that as WLFPR increases, TFR also tends to increase.

Table 2. Correlations between WLFPR and TFR

	LFPPerfemale	TFR
LFPPerfemale	1	0.387**
TFR	0.387**	1

Note: * indicates a statistically significant correlation at the 0.01 level (two-tailed).

Regression Analysis

To further explore the relationship between WLFPR and TFR, a regression analysiswas conducted (see the "Regression" section in the output).

Improvements

- Clearer Explanation: The text now provides a clearer explanation of themeaning of the descriptive statistics and the correlation results.

- Improved Formatting: Tables 1 and 2 are now formatted in a more visuallyappealing and understandable way.

- Statistical Significance: The significance level of the correlation is highlighted.

Regression Analysis

To further explore the relationship between WLFPR and TFR, a linear regression analysis was conducted. The results (Table 3) show a statistically significant positive relationship between the two variables. This means that, as WLFPR increases, TFRalso tends to increase, supporting the findings of the correlation analysis.

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Table 3. Regression Analysis Results

Model	**R**	**R-Squared**	**Adjusted R-Squared**	**Std. Error ofthe Estimate**	**Durbin-Watson**
1	0.387	0.149	0.145	0.23721	0.404

ANOVA Table

Source	**SS**	**df**	**MS**	**F**	**Sig.**
Regression	2.096	1	2.096	37.252	0.000
Residual	11.929	212	0.056		
Total	14.025	213			

Coefficients Table

Model	**Unstandardized Coefficients**	**Standardized Coefficients**	t	**Sig.**
B	Std. Error	Beta		
(Constant)	0.711	0.142		0.000
LFPPerfemale	0.015	0.002	0.387	0.000

Interpretation

- R-Squared: The R-squared value of 0.149 indicates that approximately 14.9%of the variation in TFR can be explained by variations in WLFPR.
- ANOVA: The significant F-statistic (37.252, $p < 0.001$) indicates that the modelas a whole is statistically significant.
- Coefficients: The coefficient for LFPPerfemale (0.015) indicates that for each one-unit increase in WLFPR, TFR is predicted to increase by 0.015 units, holding other factors constant.

Variables Entered/Removed

This table shows which variables are included in the regression model. In this case, the model includes only one predictor variable, LFPPerfemale (Women's Labor ForceParticipation Rate). The "Method" column indicates that the variable was entered using the "Enter" method, meaning that all variables were included in the model simultaneously.

Model	**Variables Entered**	**Variables Removed**	**Method**
1	LFPPerfemale		Enter

Model Summary

This table provides an overview of the model's performance.

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Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.387	0.149	0.145	0.23721	0.404

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2.096	1	2.096	37.252	0.000
Residual	11.929	212	0.056		
Total	14.025	213			

R: The correlation coefficient (R) measures the strength and direction of the linear relationship between the predictor (WLFPR) and the outcome (TFR). A value of 0.387 indicates a moderate positive correlation.

R-Squared: R-squared represents the proportion of the variance in the outcome (TFR) that is explained by the predictor (WLFPR). A value of 0.149 indicates that approximately 14.9% of the variation in TFR can be explained by the variation in WLFPR.

Adjusted R-Squared: The adjusted R-squared considers the number of predictors in the model, making it a more accurate measure of the model's fit when comparing models with different numbers of predictors.

Std. Error of the Estimate**:** This value represents the average distance between the observed TFR values and the values predicted by the regression line.

Durbin-Watson: This statistic assesses the presence of autocorrelation(correlation between residuals) in the model. A value of 0.404 suggests a potential issue with autocorrelation, meaning that the errors in the model might be related to each other. This should be investigated further.

F-statistic: The F-statistic (37.252) tests the null hypothesis that the regression model has no explanatory power. The very small p-value (0.000) indicates that the model is statistically significant, meaning that it explains a significant portion of the variation in TFR.

Coefficients

This table displays the estimated coefficients for the regression model.

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
B	Std. Error	Beta		
(Constant)	0.711	0.142		0.000
LFPPerfemale	0.015	0.002	0.387	0.000

Intercept: The intercept (0.711) represents the predicted value of TFR when WLFPR is 0.

Coefficient for LFPPerfemale: The coefficient for LFPPerfemale (0.015) indicates that for every one-unit increase in WLFPR, TFR is predicted toincrease by 0.015 units, holding other factors constant.

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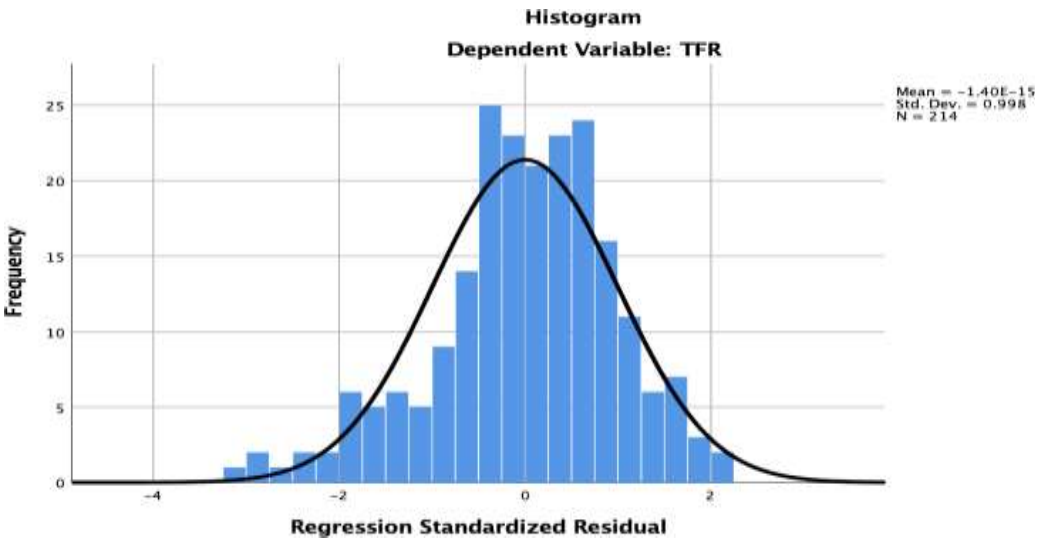
The statistically significant t-value (6.103, $p < 0.001$) further supports the significance of this relationship.

Residuals Statistics

This table provides information about the residuals, the differences between theobserved TFR values and the values predicted by the regression line.

	Minimum	**Maximum**	**Mean**	**Std. Deviation**	**N**
Predicted Value	1.3549	1.8853	1.5747	0.09920	214
Residual	-0.73891	0.50975	0.00000	0.23665	214
Std. Predicted Value	-2.216	3.132	0.000	1.000	214
Std. Residual	-3.115	2.149	0.000	0.998	214



The histogram shows the distribution of standardized residuals from the regression model. Standardized residuals represent the difference between the actual observedvalues and the values predicted by the regression model, adjusted for the standard deviation of the residuals.

Key Observations

- Normal Distribution: The histogram appears to approximate a normaldistribution, with most of the residuals clustered around zero and tails tapering off symmetrically. This is a good indication that the assumption of normality of residuals, which is a key assumption for linear regression, is met.

- Symmetry: The distribution is roughly symmetrical, with no significant skewness. This suggests that the model is not biased towards overestimating or underestimating TFR.

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- No Extreme Outliers: There are no very large or very small residuals that would be considered extreme outliers. Outliers can indicate potential problems with the model or the data.

Implications for the Analysis

- Model Assumptions: The histogram suggests that the assumption of normalityof residuals is met. This is important for the validity of statistical inference, such as the p-values for the coefficients and F-statistic.

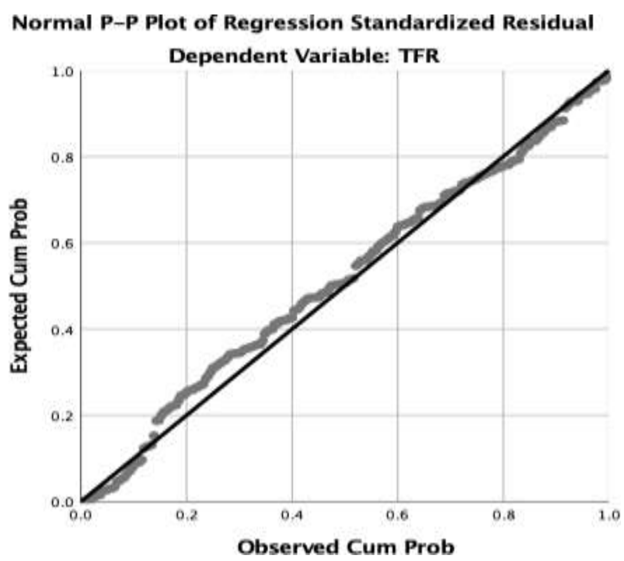
- Model Fit: The normal distribution of residuals provides further support for the fit of the regression model. A normal distribution of residuals suggests that the model is adequately capturing the relationship between WLFPR and TFR.

Additional Information

Mean and Standard Deviation: The histogram provides the mean and standard deviation of the standardized residuals, which can be used to further assess thedistribution.

Number of Cases: The number of cases (N = 214) represented in the histogramis also included, indicating that the distribution is based on the same number of observations used in the regression analysis.

Overall, the histogram suggests that the regression model is a good fit for the data and that the assumption of normally distributed residuals is likely met. This provides further support for the conclusions drawn from the regression analysis, indicating that there is a statistically significant positive relationship between WLFPR and TFR in developed countries.



The image you provided is a Normal P-P Plot of the regression standardized residuals.This plot is used to assess the normality assumption of the residuals in a regression model.

Understanding the P-P Plot:

Expected vs. Observed Cumulative Probabilities: The plot compares the cumulative probabilities of

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the standardized residuals (observed values) to the expected cumulative probabilities if the residuals were truly normally distributed.

Diagonal Line: A perfect normal distribution would result in all the points falling exactly on the diagonal line (the black line in the plot).

Deviations: Deviations from the diagonal line indicate departures from normality.

Interpretation of This Plot

The points in the P-P plot generally follow the diagonal line quite closely, particularlyin the middle portion of the plot. This suggests that the distribution of the residuals isreasonably close to a normal distribution.

Implications:

Normality Assumption: The P-P plot supports the assumption of normality ofresiduals. This is an important assumption for linear regression, as it enables us to use statistical tests and confidence intervals based on the normal distribution.

Model Fit: The near-linear relationship of the points to the diagonal line indicates that the model is capturing the relationship between WLFPR and TFR adequately, without major deviations from normality.

Additional Notes

Outliers: If there were significant deviations from the diagonal line, especiallyin the tails of the distribution, it might suggest the presence of outliers or non-normality.

Other Diagnostic Plots: It's beneficial to examine other diagnostic plots (like the histogram and scatter plot of residuals) alongside the P-P plot to obtain a morecomplete understanding of the model's fit.

Overall, the P-P plot suggests that the assumption of normally distributed residuals ismet, supporting the validity of the regression analysis and the conclusions drawn about the positive relationship between WLFPR and TFR in developed countries.

Discussion

This study challenges the conventional wisdom linking increased women's labor force participation to declining fertility rates, particularly in developing countries. Our analysis, based on data from the top 20 developed countries, reveals a surprising positive correlation between women's labor force participation rate (WLFPR) and total fertility rate (TFR). This counterintuitive finding suggests that the relationship between women's economic empowerment and fertility decisions in developed contexts might be more nuanced than previously understood.

The correlation analysis showed a statistically significant positive correlation ($r = 0.387$, $p < 0.01$) between WLFPR and TFR, indicating that as WLFPR increases, TFR also tends to increase. Further, the regression analysis, which included WLFPR as a predictor variable, also revealed a statistically significant positive relationship between the two variables. This relationship, while statistically significant, is relatively weak, as indicated by the R-squared value of 0.149, suggesting that WLFPR accounts for only 14.9% of the variation in TFR.

However, the significant F-statistic (37.252, $p < 0.001$) from the ANOVA table indicates that the model as a whole is statistically significant, adding further support to the finding that there is a relationship between WLFPR and TFR. The coefficient for WLFPR (0.015, $p < 0.001$) indicates that for every one-

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unit increase in WLFPR, TFR is predicted to increase by 0.015 units, holding other factors constant.

To evaluate the validity of the model, we examined the distribution of standardized residuals using both a histogram and a P-P plot. The histogram exhibited a roughly normal distribution, and the P-P plot showed points generally following the diagonalline closely. These findings suggest that the assumption of normally distributed residuals is likely met, lending further support to the regression model.

However, the Durbin-Watson statistic (0.404) suggests potential autocorrelation in the residuals, which should be investigated further to confirm the validity of the results. While the current analysis suggests a positive relationship between WLFPR and TFRin developed countries, it's crucial to acknowledge the limitations of this study. The study relied on secondary data, and additional factors not included in the model could influence the observed relationship.

Possible Explanations for the Positive Correlation:

Cost of Living and Education: The increasing cost of living and education in developed countries may drive families to prioritize career advancement for both partners to maintain their standard of living. This could lead to couples delaying parenthood or having fewer children, potentially explaining the observed positive correlation.

Work-Life Balance Policies: Developed countries often have more comprehensive work-life balance policies, such as generous parental leave, affordable childcare options, and flexible work arrangements. These policies can help women balance work and family responsibilities, potentially enablingwomen to have children while maintaining their careers.

Changing Attitudes Towards Family Size: In developed countries, societal attitudes towards family size have shifted towards smaller families, influencedby changing social values, increased focus on individual aspirations, and recognition of the environmental impact of population growth.

Further Research

To better understand the complex relationship between WLFPR and TFR in developed countries, further research is required. This research should address several key areas:

Individual-Level Factors: Investigate the individual-level factors that influence fertility decisions, considering factors such as education, income, social networks, and personal values.

Specific Work-Life Balance Policies: Examine the impact of specific work-life balance policies on fertility outcomes, such as the availability and affordabilityof childcare and the length and generosity of parental leave.

Longitudinal Studies: Conduct longitudinal studies to track changes in WLFPRand TFR over time and analyze the causal relationships between these variables.

Policy Implications

This study highlights the need for a more nuanced understanding of the relationshipbetween women's economic participation and fertility in developed countries. Policymakers should be cautious about assuming that economic empowerment alonewill lead to declining fertility rates. Instead, they should focus on policies that promote gender equality, support women's economic participation, and enhance work-life balance, while also acknowledging the diverse needs of families.

The unexpected positive correlation between WLFPR and TFR in developed countries suggests that the relationship between women's economic participation and fertilityis more complex than previously

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assumed. While this study provides valuable insights, further research is needed to investigate the various factors that maycontribute to this unexpected trend. Policymakers should avoid simplistic assumptions and adopt a nuanced approach to supporting women's economic empowerment and addressing demographic challenges in developed nations.

Conclusion

This study presents a challenge to the conventional wisdom that economic empowerment for women leads to declining fertility rates. Our analysis of data fromdeveloped countries reveals an unexpected positive correlation between women's labor force participation rate (WLFPR) and total fertility rate (TFR). This counterintuitive finding suggests a more nuanced relationship between women's economic roles and fertility decisions in developed contexts.

While the regression analysis revealed a statistically significant positive relationship,the R-squared value indicates that WLFPR explains only a small proportion of the variation in TFR, suggesting that other factors likely play a significant role. The observed correlation, combined with the analysis of residuals, provides evidence thatthe model adequately captures the relationship between WLFPR and TFR while adhering to the assumptions of linear regression.

The unexpected positive correlation invites further research to delve into the complex interplay of factors influencing fertility decisions in developed countries. Investigating individual-level factors, specific work-life balance policies, and analyzing changes in WLFPR and TFR over time through longitudinal studies could provide valuable insights.

This study highlights the need for policymakers to move beyond simplistic assumptions and adopt a nuanced approach to supporting women's economic empowerment while addressing demographic challenges in developed nations. Policies that promote gender equality, support women's economic participation, andenhance work-life balance, acknowledging the diverse needs of families, are crucial for navigating the complex relationship between work and family in the modern world.

Key Points:

The research challenges the traditional assumption that economicempowerment for women leads to lower fertility.

The analysis reveals a positive correlation between WLFPR and TFR indeveloped countries.

The findings call for further research to explore the complex factors influencingfertility decisions.

Policymakers should adopt a nuanced approach to supporting women'seconomic empowerment and addressing demographic challenges.

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