

Research on the Relationship Between Gender Equality and Economic Development

Chuqi Zhang^{1,a,*}, Meixuan Li², Zhiqing Qiu³

¹*Qingdao NO.2 Middle School, Qingdao, 266061, China*

²*Zhengzhou Foreign Language School, Zhengzhou, 450000, China*

³*Nanjing Foreign Language School, Nanjing, 210000, China*

a. jiangsuihan2023@163.com

** corresponding author*

Abstract: Inspired by the correlation between the development of feminism in history and economic prosperity, this paper aims to discover the inert relationship between them using mathematics methods and figuring out the future trend in feminism development. This paper used the ratio of female labor to male labor and the ratio of female payment to male payment as indicators for feminism development, and GDP per capita for each country in 2021 as indicators for economic development. Polynomial Fitting Analysis and the R2 value test are applied to further study the correlation between feminism and economic development. The result shows that there exists a neutral, beneficial relationship between the development of the economic situation and the development of feminism, and the division between the two indicators demonstrates that the further development of feminism in each country requires not only economic promotion but also revolutionizing some cultural norms, based on biological facts. Finally, we tailor specific solutions to problems we displayed, such as some particular improvements in regulations and work-life balance for women.

Keywords: feminism, polynomial regression, GDP per capita

1. Introduction

Citizens, critics, and even authorities in some nations may ponder the meaning of gender equality, asking why we shouldn't maintain the status quo and why we should alter gender roles. The fact that Charles Fourier coined the term "feminism" in 1837, immediately following the first industrial revolution, may suggest a connection between economic growth and gender equality. Based on this background, this research aims to prove the relationship between the development of feminism and economic prosperity.

2. Research Background and Significance

2.1. Research Background

Research shows that economic development can free up women's time, which can be used for market activities or other things, thereby empowering women [1]. An essay by Tiago V. de V. Cavalcanti and José Tavares argues that the decline in the price of home appliances causes a 10% to 15% of the

increase in the female labour force participant rate[2]. Carroll Pursell discussed the influence of the Electrical Association for Women(EAW) on women: it encouraged women to get access to electricity from 1924 to 1986[3]. This evidence can be used to speculate that economic development will promote the development of women's rights. However, the advent of the modern era unleashes a series of dramatic changes, So we don't know whether this conclusion holds now. In that case, we choose lists of data that reflect the gender equality level and the economic growth level, and the relationship can be shown by the equation fitting the data. And thus, the answer to the previous questions may be better [4]. As was already proposed, the Industrial Revolution, which changed gender roles, is related to the first-wave feminism movement [5]. Therefore, we must consider labor as a factor while evaluating gender equality.

According to Marxism, the superstructure is determined by the economic foundation. Given that the degree of gender equality is a significant and enduring component of the "superstructure," from a broader perspective, financial status affects the degree of gender equality. According to their theory, gender inequality will eventually be attained after the globe transitions to a communist system, albeit they did not specify how.

2.2. Research Significance

This research aims to prove a positive relationship between gender equality and economic growth and study the particular feminist situations in countries beyond our examination, which has important theoretical and practical significance for improving the feminist situation and economic forecast.

3. Data Source and Model Construction

3.1. Data Source and Variable Selection

This paper utilized the World Bank's Gender Data Portal [6], which makes the latest gender statistics accessible through compelling narratives and data visualizations to improve the understanding of gender data and facilitate analyses that inform policy choices. In addition, a dataset provided by the International Monetary Fund (IMF) about GDP per capita for each country in 2021 is also utilized. Based on the focus on labor, this paper examined the ratio of female payment to male payment and the ratio of female labor force to male labor force as indicators of gender equality and GDP per capita for each nation as indicators for economic situations.

3.2. Model Construction

Polynomial Regression Analysis is adopted in this paper, and the R2 value test was further carried out. For the complexity of the gender problem, the models, such as logistic growth, may not fit the data perfectly; however, polynomial regression is able to determine the curve calculated, depending on its flexibility. The basic formulas of the model can be expressed as follows, where $f_1(x)$ is the labor curve and $f_2(x)$ is the payment curve:

$$f_1(x) = -7.464 \times 10^{-20}x^4 + 1.567 \times 10^{-14}x^3 - 1.116 \times 10^{-9}x^2 + 3.204 \times 10^{-5}x + 0.641 \dots (1)$$

$$f_2(x) = 3.275 \times 10^{-20}x^4 - 6.103 \times 10^{-15}x^3 + 3.151 \times 10^{-10}x^2 - 1.019 \times 10^{-6}x + 0.693 \dots (2)$$

Viewing the two equations, the coefficient of x^4 is in the same magnitude in $f_1(x)$ and $f_2(x)$, whereas the coefficient of x^3 and x^2 in $f_1(x)$ is substantially bigger than $f_2(x)$, indicating that the $f_1(x)$ curve may be less linear and more vertical.

4. Results Analysis

As shown in Figure 1, for most countries whose ratios of female payment to male payment are between 0.82 to 1.1, the real GDP per capita for each country is above 40000 dollars. Moreover, for those countries whose payment ratio is exactly 1 (plus or minus 0.15), the real GDP per capita for each country is above 52000 dollars, and are categorized as Developed Countries according to the standard of GDP per capita for developed countries in 2021 (released by IMF, International Monetary Fund) [7].

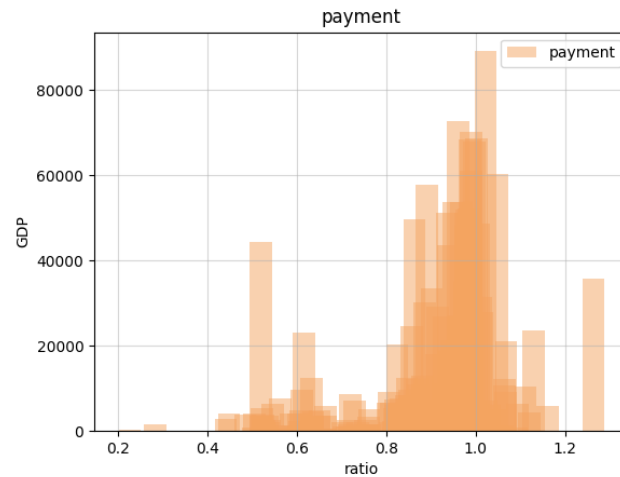


Figure 1: Ratio of payment.

Similar results could be obtained from Figure 2. For the developed countries whose GDP per capita is above 52000 dollars, the ratio of female labor to male labor is between 0.81 to 1.0. This proves the theory that the feminism and women's rights best ensured in most developed countries where there is a bright economic situation.

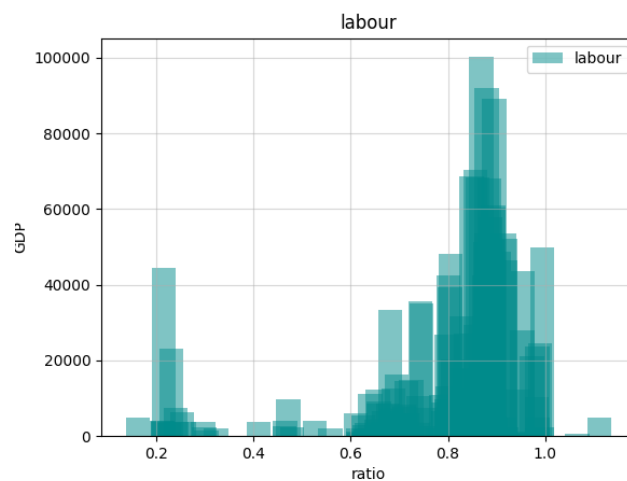


Figure 2: The ratio of the labour force.

As shown in the graph, the payment curve shows a larger change in growth rate, satisfying the equation. The labor force curve exhibits a more linear way to increase, showing that it may also relate

to other factors other than economics. However, the two curves' overall trends are essentially the same: rising and remaining stable at about 1.0.

By calculating the derivative of the two equations, $f_1(x)$ and $f_2(x)$, we can determine that (1) Lithuania (2021GDP = 23723.3 dollars) is the country where the derivative for the payment curve becomes almost zero, and (2) New Zealand (2021GDP = 48781.1 dollars) is the country where the derivative for the labor curve becomes nearly zero. As a reference, the requirement of a developed country is 20000 dollars per capita.

According to the regression diagram, most points for both ratios between 0.8 and 1.0 fall on the regression lines, respectively. As further shown in Figures 3 and 4, the value of R2 is approximately 0.58, suggesting that there's a strong relation between the development of economic and the development of feminism. In addition, as GDP per capita is increasing, both regression lines suggest a growth trend approximating to 1.0. From the derivative of the two equations, it is obvious that a higher GDP is necessary to keep the labor ratio steady at about 1.0. Nevertheless, the GDP per capita required to reach this target is much higher than 20000 dollars in developed countries. If we consider the threshold of a developed country to be reasonable, the development of gender equality may alternatively correlated to other factors as well. For instance, the permanent gender roles maintained by the in-group may also decide what kind of workmen or women should do and how much they should be paid.

Even so, this result indicates that a bright economic situation is beneficial for a country's feminist development and the safeguarding of its women's rights. The reason for this, as shown in relevant research from the perspective of employment rate, is that a country tends to create more available job opportunities for women as its economy develops. Therefore, the requirement for women in the labor force will increase, giving more women a chance to be part of the country's economic progress instead of being housewives. The ability to be financially independent enables them to gain a higher position and more attention in overall society. On the contrary, ensuring women's rights allows them to construct the country from several perspectives including education, medicine, economic, and scientific research, which further ensures the country's brighter economic forecast.

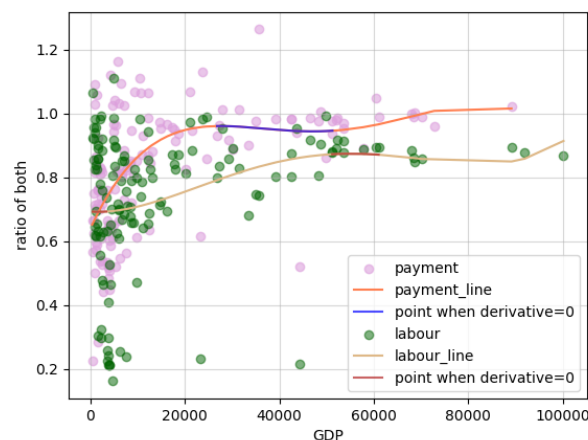


Figure 3: Regression result.

```
In [30]: err4 = sm.r2_score(train_y, pred_train_y)
          err4
Out[30]: 0.5779757350406678
```

Figure 4: R2 value.

5. Discussion

Countries that have developed economies rely less on manual labor and more on managing, developing, and designing. During this process, nations learn about the enormous potential of women, who also show a desire for and aptitude for labor comparable to men's. As a result, they may make the same amount of money as males when working in social services. Women may also improve the world since they view various things from diverse perspectives. Following the development of society and its increasing attention on the female portion, scholars and feminists have been searching for methods to create an environment where men and women have equal rights. Under this circumstance, we managed to utilize the Polynomial Fitting and discover that economic development plays an important role in ensuring sexual equality, using two indicators, including the ratio of labor and payment between men and women.

A country's economic prosperity allows a bright development of feminism. From the labor perspective, during WWI and WWII, the significantly altered social structure allows women to devote themselves to the construction of society while also becoming financially independent and earning more attention. Combining the changes brought about by the Industrial Revolution----the use of machines, which spurred economic development----it is now simpler for women to participate in the labor force. Feminism will continue to grow as long as women demonstrate that they can work as hard as men. Beginning in imperialist countries and spreading to the rest of the world, feminism empowers women in developing countries to fight for their rights and demonstrate their abilities to work. As a result, as the economy grows, the focus of work will change from physical to mental labor, allowing women the opportunity to pursue equality. It will enable women to devote themselves to the construction of society and become financially independent, gaining more attention in society as well. From the payment perspective, increasing the development of the economy or the increase of GDP per capita ensures a higher wage for the citizens. As suggested in the regression diagram, the payment line shows a growth trend, indicating that women receive a similar wage as men do. Therefore, it proves that women's position is becoming higher. In the regression analysis diagram (fg1), some outliers are far from the regression line. Here is the further analysis for these outliers:

5.1. Outliers

For the labor regression line, several countries, including Saudi Arabia, the United Arab Emirates, Greece, Czechia, Chile, etc., have a comparatively low ratio of labor between men and women despite a relatively high GDP per capita. The reasons vary from country to country. For instance, although the United Arab Emirates has increasing attention to sexual equality and a gradual improvement in its feminism, women only make up 30% of the country's total population, suggesting that there exists sexual inequality in the labor market in the first place. On the contrary, other countries such as Saudi Arabia have a long history where women are treated unequally, where men are in leading positions, and women receive unequal treatment from family to workplace, where polygamous family is still legal in Saudi Arab where a man can have up to four wives, where men are not required to sign a legal document in a divorce while women have to, and where women are not allowed to drive a car in the country, even though such legislation does not exist. Such tradition not only restricts women's personal freedom but also takes away their position in the workplace.

However, Italy, for instance, has a ratio of 1.263 for payments, whereas their ratio of labor is only 0.743. To explain this, we find other data: in EIGE, the ratio of payment in 2021 equals 0.85. One hypothesis is that women can only work in high-paying jobs without being pregnant or married; otherwise, they would probably opt to stay at home. In contrast, men are required to work regardless of pay. However, when counting the labor force, such low-paid males are taken into account, while housewives----and 'jobs' similar to housewives----are not. Additionally, this might also help to

explain why some nations pay women more than males, despite the fact that men still outnumber women employees in each of these nations. Therefore, even in a country as developed as Italy, when given an opportunity to make choices, people from different genders are still making different choices. Nonetheless, the average IQ is almost equal in different genders, and we nowadays depend less on physical work; female infants have overall advantages over male infants [8]. The reason why the gender difference is still maintained may be the in-group bias, which generates gender roles such as pink for girls and blue for boys, and the maternal wall, which asserts that women have their biggest disadvantages: at least a year of pregnancy and caring for children.

5.2. Suggestions

There exists a beneficial relationship between the development of the economic and the development of feminism. As a result, suggestions for the optimization of both will be proposed from two different perspectives.

5.2.1. Economic

Governments should diminish or alleviate poverty to improve the position of women in society. It has been proposed that poverty and the lack of job opportunities will lead to sexual inequality [1]. Specifically, through improving social security and constructing more infrastructure, such as ensuring medical insurance and unemployment insurance, people in poverty will have less financial burden. Women in poor areas will be motivated to work a job instead of being housewives or unemployed. After women devote themselves to labor, the discrimination and violence against them will diminish as well, according to the example of Hebei Province in China [9].

Additionally, governments should devote more money to educating students and the general public. A brighter economic situation ensures a higher level of education, generally. Therefore, the importance of women's part in society will be spread to a more general public. Specifically, educational institution should begin their gender education at an early age so that children will have the knowledge that men and women are born equal. General education to the public through methods including lectures, social media, etc., will gradually abolish those conventions that put women in discrimination.

5.2.2. Feminism

Promoting gender equality and empowering women is necessary to further realize gender equality and improve a country's economic situation. Previous research showed that women have different policy preferences when compared to men.

Adding positions for women in parliament and other political circumstances will also add a different perspective, proposing every potential problem in each political issue [10]. Therefore, more holistic and reliable policies can be established as women join politics.

Regulations ensuring equal rights for men and women should be established in society and the workplace. For instance, companies should not deliberately decrease women's wages due to pregnancy and other physiological reasons. Besides, the chance of promotion should depend on one's working ability and efficiency instead of gender. In addition, in countries where social conventions cause inequality between two genders, laws should be established to abolish traditions such as polygamy, and more attention should be paid to female violence incidence. With proper regulations, women will have more confidence and motivation to devote themselves to the country's economic optimization.

Specifically, eliminating the difference between genders is the primary thing to do. If the stereotype cannot be changed, even though the genders are free to choose, we will not have equality

in the result. Methods to achieve this may be changing the way of educating children in a gender-equal way, redefining gender characters, and giving women more chances to speak.

6. Conclusion

This essay discussed the relationship between economic development and gender equality. As one of the most significant factors promoting the development of the world, the economy dramatically influences both the salary and the participation rate of women. Furthermore, the difference between the two factors may indicate that the barrier to women in working areas is still an important issue.

References

- [1] Duflo, Esther. "Women empowerment and economic development." *Journal of Economic literature* 50.4 (2012): 1051-1079.
- [2] De V. Cavalcanti, T. V., & Tavares, J. (2008). Assessing the "Engines of Liberation": Home Appliances and Female Labor Force Participation. *The Review of Economics and Statistics*, 90(1), 81–88. <http://www.jstor.org/stable/40043126>
- [3] PURSELL, C. (1999). Domesticating modernity: The Electrical Association for Women, 1924–86. *The British Journal for the History of Science*, 32(1), 47-67. doi:10.1017/S0007087498003483
- [4] Samyukta Lakshmi. (2023) *Why The Future Of Economy Is Female*. https://twentythirty.com/article/why-the-future-of-economy-is-female?gclid=Cj0KCQjwl8anBhCFARIsAKbbpyT1K9Pl_J9jm_LwawdnU7_zgcNpcmS00pZMY8I1hmgNf5g4I6KzVnMaAnvqEALw_wcB
- [5] *Women Roles Change In WWI*. (2022). Edubirdie. Retrieved July 27, 2023, from <https://edubirdie.com/examples/women-roles-change-in-wwi/>.
- [6] The world bank. (2023) <https://genderdata.worldbank.org/>.
- [7] INTERNATIONAL MONETARY FUND. (2023) <https://www.imf.org/en/Publications/WEO/weo-database/2022/April/weo-report>
- [8] Ingemarsson I. Gender aspects of preterm birth[J]. (2023) [https://doi.org/10.1016/S1470-0328\(03\)00022-3](https://doi.org/10.1016/S1470-0328(03)00022-3).
- [9] Jing Wang. (2021) Poverty alleviation and protection of women's rights and interests. https://www.cntheory.com/dxlt/xskj/202110/t20211009_21948.html
- [10] Chattopadhyay, Raghabendra, and Esther Duflo. (2004) "Women as policy makers: Evidence from a randomized policy experiment in India." *Econometrica* 72.5: 1409-1443.)