'Women Empowerment' Effects on Global Economics: A Quantum Economic Study

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Abstract

Background: Women's empowerment is a global concern today. But, the effect of women's empowerment on global economics is not studied explicitly. As several governments are focusing on this matter, it is necessary to know the effect of it. To fulfill this need, present research work is conducted.

Objective: In the recent past quantum economics is found very successful to explain the economical problems more accurately. Thus, to solve the problem of women's empowerment related issue mention earlier, we focus to use quantum economic methodology.

Methods: Though quantum economics is as old as 43 years, it is not systematized properly to use for our problem directly. We have transformed various related laws and equations to increase the applicability and accuracy of the method. We have transformed the Maxwell-Boltzmann velocity distribution law to population - income distribution law. We have also constructed the wealth consumption function taking the knowledge of Gaussian type orbital function. These two are used to solve our problem.

Results: We observed that women's empowerment is not always related to the positive growth of society. All three possibilities, positive growth, negative growth and no growth are there. We have mentioned the conditions for which what kind of outcome would be expected.

Conclusion: From the present study, we conclude that women's empowerment would produce positive effect on the global economy if the additional job opportunity is created rather substituting of a male employee by a female employee.

Keywords: Quantum Economics; Women's Empowerment; Economic Growth; Population - Income Distribution Law; Consumption Factor

Introduction and Methodology

United Nations Secretary-General António Guterres emphasized Women's empowerment and gender equality in his massage on the occasion of International Women's Day, 8th March 2019 [1]. According to Guterres, Women's empowerment is extremely essential for global progress. "Gender equality is essential to the effectiveness of our work, and we cannot afford to miss out on the contributions of half of the world's population", Deputy Secretary-General Amina J. Mohammed explained on the same occasion. She also added, "women's equal participation in the labor force would

unlock trillions of dollars for the global development." This is very enthusiastic, particularly for women of countries where gender inequality is extremely high. Unfortunately, the number of such countries is very large in number compared to the opposite. Not only that the situation in the developed countries is not up to the mark. But, a constant effort to increase the sex ratio in the workplace will be fruitful at least a significant amount.

Women's Empowerment definitely will help to increase the economic status of women around the globe, but, its effect on the global economy is not tested yet. In the present research work, we

have focused our study to test the effect of Women's Empowerment on the global economy with the help of computational implementation of quantum economic theories [2-4]. We want to find out conditions for both the positive and negative impact of it. We have modified the theories available in the literature in this field to improve their applicability for our study of interest.

Theory of quantum economics

Quantum economics implies the application of quantum methodologies to explore different economic properties of a system. It is an emerging field of research today. The neoclassical approach to solve and predict the economic state of society has proved to fail during the global economic crisis in the financial year 2007-08. A decade after the financial crisis of 2007-08, economists felt for the urgency of a new approach for an in-depth understanding of the economic nature of a system. Thus, the research and application of quantum economics are accelerated during the last few years though it was proposed for the first time in the year 1978 by Asghar Qadir, a Pakistani mathematician. It got very little attention at that time. From the 1990s onwards, the subject 'quantum economics' got attention due to the extensive work of economist Martin Shubik [5], physicist Martin Schaden [6] and social scientist Emmanuel Haven [7]. They used quantum mechanical formalism to predict the uncertainty of a stock market [5,7]. Then after a number of economists including Paul Samuelson [8] and Bernard Schmitt [9] started working in this new field of research. Bernard Schmitt [9] treated the production as an instantaneous emission in his theory of quantum mechanics.

Income - population distribution function

Recently, a new approach is developed by Bag [2] to compute the DGP of a country using the electronic structure theory of quantum mechanics. In the present research work, the idea of Maxwell-Boltzmann distribution law of gas is transformed to obtain the population distribution of society with respect to individual income. The variables are modified accordingly with proper significance. The transformed equation of population distribution is

$$dn_i = P_T (4/\sqrt{\pi}) \beta^{3/2} i^2 \exp(-\beta i^2) d_i \text{------(1)}$$

Where i is the individual income, dn_i is the number of people exists in the range i and $i+d_i$, P_T is the total earning population. To know about β, we have to compare it with its origin in Maxwell-Boltzmann distribution law. In Maxwell-Boltzmann distribution, β

= m/2kT, where, m is the mass of a gas particle, k is the Boltzmann constant and T is the absolute temperature. In the case of income - population distribution, m is the amount of property created per people, per unit capital income, per second, k is a constant which may be considered as the universal property - income conversion constant, and T is the mobility of market. T may be defined as the rate of exchange of property or capital per person per second. A plot of $1/P_T (dn_i/d_i)$ vs i is presented in figure 1.
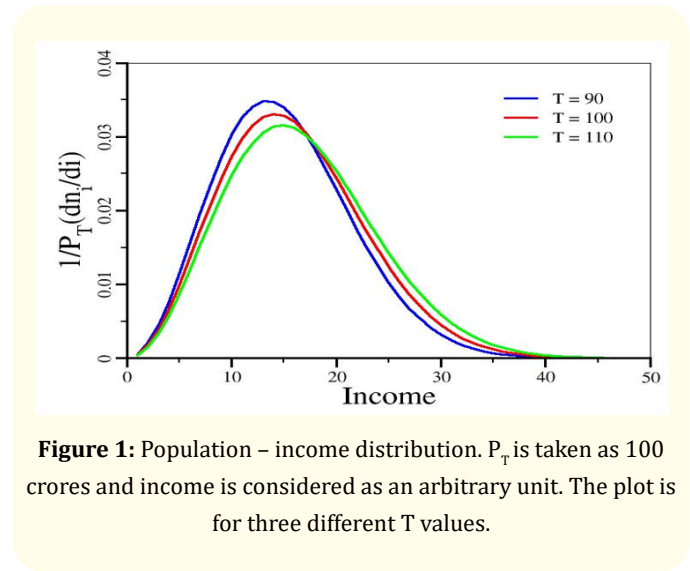

Figure 1: Population – income distribution. P_T is taken as 100 crores and income is considered as an arbitrary unit. The plot is for three different T values.

To construct the fraction of population vs income plot, we have used β = 0.2/T as for an ideal situation m and k, are unity. We plot for three different values for T. As for an ideal case, T is 100 which implies that income and expenditure occur in an equal rate. Any value of T greater than 100 means sustainable development and less than 100 implies slow down of market, i.e., accumulation of property without any production. From figure 1, it is clear that with the increase of T, most populated income shifts towards right side i.e., high-income zone become more and more populated which is consistent with our common experience. We know that for the most populated income, $dn_i/di = 0$. Using this condition we get the most populated income $(I_{maxp}) = \sqrt{2}T$.

Wealth consumption function

Wealth consumption function is the function that describes the consumption of the wealth of a person and at the same time, the income of others. Again, in general, the consumption of wealth of a

person depends on his wealth. Thus, we could write consumption function (C_r) as

$$C_r = \omega_i \, i^{(n-1)} \exp(-\zeta r^2) \text{------------(2)}$$

Here, ω_i is the wealth of a person having income i. r is the amount of consumption and ζ is the consumption coefficient or rate of consumption and n is the nature of consumption. For primary consumption, n = 1, for secondary consumption n = 2 and for the tertiary consumption n = 3. Primary consumption is defined as the primary need of a person like food, medicine, etc., which never produces any kind of income. Secondary income implies the need for luxuries, like mobile, car, etc., which may be used as a source of income on re-sell. A tertiary consumption is, in fact, the conversion of property from one form to another. An example of this kind is purchasing gold, land, flats, etc. For the simplicity of the present study, we only consider the primary consumption. Again, for an ideal case, r = i. But, for the real case r = ηi, where η>1 for the expensive person and η<1 for the stingy person. At present, we only considered r = i. Thus, with these restrictions, we get the expression for the consumption function as -

$$C_r = \omega_i \exp(-\zeta i^2) \text{--------(3)}$$

Development distribution function

Now we want to know how the development or progress of people is related to their income. For this purpose, we consider that the development function would be the product of the income distribution function and the consumption function. But for the development, we have to take the negative value of ζ. Thus we get -

$$dn_\omega = P_T (4/\sqrt{\pi}) \, \beta^{3/2} i^2 \exp(-\beta i^2 + \zeta i^2) \, d_\omega \text{-------(4)}$$

From the above equation we can get the total wealth of society by integration. The total wealth of society is $\Omega_T = P_T \beta^{3/2}(\beta+\zeta)^{3/2}$.

Results and Discussions

So far, we have discussed the formation of methodology to compute the economic development of society using quantum knowledge. Now we implement these methods to study the effect of women's empowerment on global economics. To do this we have to consider different conditions.

Condition-1: Engagement of women in work replacing an equal amount of men

From Equation 1, we observed that dn_i depends on β and P_T. Since P_T is constant for this case, dn_i would only depend on β. We

discussed earlier that β is a function of m and T (k is a constant). But, T does not depend on the person. Thus, the effect of women's empowerment will only depend on m which is the productivity of the person per capital income. Here four different cases may arise.

Case 1

Productivity and income of a male and female are the same. In this case, there would be no change in the value of β. Thus, the distribution curve will remain the same. That means, in a such situation economy of the society would not be influenced.

Case 2

Productivity is the same but the income of a female candidate is less compare to a male candidate. In this situation, m>1 and hence $\beta > \beta_0$ where β_0 is the ideal value of β for m = 1. The effect of this situation on the economy could not be predicted without explicit computation. We have done this computation and the result is presented in figure 2.
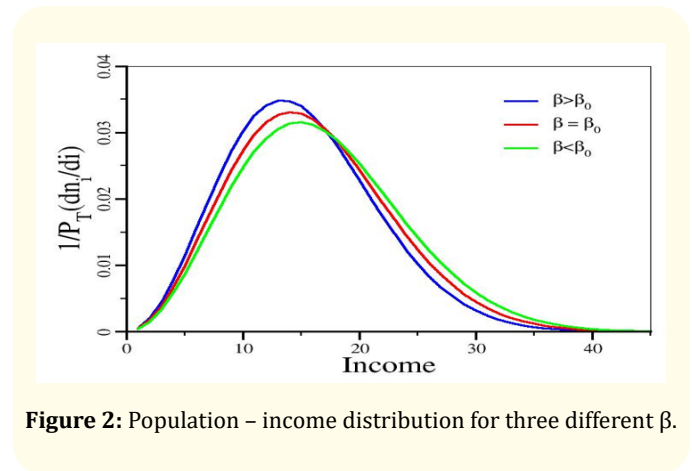

Figure 2: Population – income distribution for three different β.

From figure 2, it is observed that with the increase of β, the peak position is shifted towards the left that implies a negative development of the society. Thus, women's empowerment with a comparatively less salary keeping the total job opportunity fixed, would always do a negative growth of society, ie., increase of poverty.

Case 3

Less productivity with less income. In this situation the effect of women's engagement would depend on the productivity - income ratio. If the ratio becomes 1, there would not be any effect. If the ratio is greater than 1, negative growth will be observed and for a rato less than 1 positive growth would be observed.

Case 4

Less productivity with identical income. In this case $\beta<\beta_0$. Thus, positive growth would be observed.

Here it should be mentioned that all the growth mentioned here are with respect to the income. It is not real growth. To have real growth we have to study the wealth distribution function considering these facts.

Condition-2: Engagement of women in work creating new job opportunity

If women's empowerment is associated with a new job opportunity, i.e., additional workers inform of women are appointed then P_T will increase and hence a right shifting would be observed. Thus, we can expect positive growth.

Conclusions

From the present study we conclude that women's empowerment is not always related to the positive growth of society. We have to follow few conditions to get a positive response. To get a proper positive response we have to create additional job opportunities with identical salary. For other conditions, a negative response or no response would be observed.

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