

An Empirical Study on the Relationship between Economic Growth and Public Welfare

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Abstract. This paper investigates the relationship between economic growth and public welfare, where the criticality of this study is to assist governments in issuing policies regarding economic growth to maximise the prosperity and welfare in particular countries. This study adopts a pooled ordinary least squares (OLS) analysis, a regression with year fixed effects as well as a regression with both year fixed effects and country fixed effects, proposing that economic growth has an effect on social well-being. The aspects of welfare researched on are comprised of income inequality, crime severity, national educational level, national healthcare level and carbon emission level, and standardisation method is applied to unify the five welfare variables. In the pooled OLS, a positive coefficient is found with a p-value less than 0.001, while the coefficients perceive an opposite sign with p-values both higher than 0.1 in the latter two regressions. Thus, the growth effect on welfare is significant for the first regression and not significant for the latter two regressions, manifesting that country-specific and year-specific characteristics strongly influence the results. In consideration of the results and analyses of this research, in an attempt to facilitate public well-being, governments should consider the factors specific to countries and years when deciding on economic policies rather than unconditionally prioritise the pursuit of growth in economies.

Keywords: Economic growth, welfare index, fixed effect.

1. Introduction

The economy has been expanding and growing at a continuing and exponential rate since 1960, especially after the advent of the Third Industrial Revolution, where the transformation of production techniques from mechanical and electronic technologies to digital ones, such as computers, semiconductors and the Internet, greatly contributes to the development of the global economy. The rapid and substantial economic growth is reflected in the increase in Gross Domestic Product (GDP) per capita from 456.8 US dollars in 1960 to 12702.9 US dollars in 2022, as shown by the statistics from the data source of the World bank. Vigorous economic growth seems to show a positive sign for an economy in an intuitive sense, which is known to bring about benefits of a higher living standard for citizens in the nation commonly represented by higher incomes, improved living quality, lower unemployment, international trade with better products and services and so on.

However, in recent years, there has been evidence suggesting that higher economic growth is not axiomatically synonymous with improved public welfare, which may not necessarily render the population in a country happier. For instance, research studies perceived GDP as a calculation process for economic growth that does not involve non-monetary benefits, which accordingly cannot be equaled to societal well-being where the gains in human capital ought not to be ignored [1]. Alternatively, higher happiness is observed in Latin America, where this phenomenon appears to be a paradox in the sense that the majority of the countries in that region constitute middle-income ones with relatively high income-poverty rates and inequality, which generates conflicts with the belief of the presence of a theoretically lower degree of happiness in that region [2]. Moreover, it was found that per-capita GDP is inversely log-linearly correlated with adolescent life satisfaction, where microeconomic and macroeconomic approaches were applied and paradoxical results were obtained in this research [3].

Given the previous empirically contradictory findings in the field of welfare economics, this paper will further investigate the relationship between economic growth and public welfare by applying a pooled OLS analysis, a regression with year fixed effects as well as a regression with both year fixed

effects and country fixed effects, where the concept of welfare will be interpreted with quantitative measurements and transformed into an index. This research has unique meaningfulness in a way to assist governments in designing policies concerning the pursuit of economic growth and reconciling the growth policies with other economic policies, such as inflation control, foreign trade and equalisation of incomes and wealth.

There have existed a wide range of studies probing into how economic growth correlates with public welfare. To illustrate, as a prominent aspect of social welfare, substantial attention has been devoted to the field of the correlation between economic growth and inequality. For example, Kuznets curve indicated that the magnitude of inequality varies across distinct levels of development in economies, which would increase initially, reach its maximum, and then decrease when an economy expands gradually [4]. One of the factors leading to this inverted-U shape of the growth-inequality curve is occupational and geographical migration, a situation in which the employees have the tendency to move from agricultural to industrial sectors and from rural to urban areas respectively.

In addition, social security plays another important role in assessing the extent of economic welfare, which attracts curiosity from the academia as well. More illustratively, with regard to the complexity of the impact of social security upon whether economic growth can be sustained, research offered evidence on the link between these two variables, and further explored how this link takes effect by examining the individual influences of demographic characteristics, labour, consumption as well as human capital as the compositions of social security, and analysing the mechanisms of these factors separately on the sustainability of economic growth [5].

Another variable that relates to economic welfare is the population education level, which has a mutual relationship with economic growth in a way that these two components affect each other. Existing studies have exhibited that investments in education function as a driver of economic growth and gradual investments tend to promote the sustainability of economic growth by positively influencing the innovative capacity of human capital and qualification of employees [6]. Reversely, the benefits of strong economic growth in improving public education are revealed in the fact that the majority of highly ranked universities and colleges in the world are concentrated in the US, UK, Australia, Canada, which are all developed countries, and China, the only exception in this list. Nevertheless, despite the current nature of being classified as a developing country, China sees a promising sign of continued increases in GDP and GDP per capita that impress the world.

2. Methodology

In accordance with the literature review, despite a multitude of studies on the relationships between economic growth and the components of economic welfare, observably few ones have illustrated such relationships where the growth effects on respective components are collectively considered to generate results. Therefore, a feature of this research that distinguishes itself from the others is that how economic growth linearly correlates to the respective ingredients of welfare will be reviewed simultaneously. It has been advised that a genuinely comprehensive indicator of economic welfare should be capable of balancing benefits against costs connected with economic growth [7]. Existing research placed weight on leisure as a utility benefit and consumption inequality and mortality as utility costs, with environmental quality and public safety not accounted for [8].

Building on these studies, the welfare components that will be researched on are income inequality, crime severity, national educational level, national healthcare level and carbon emission level, in which case education as well as healthcare denote benefits that conduce to human capital, while inequality, crimes and carbon emissions denote costs that correspond to economic instability, social insecurity and environmental unsustainability respectively.

Given this objective, this paper applies a linear regression model between economic growth and welfare as the methodological approach, where welfare is signified by an index that integrates the data collected for the aforementioned five individual welfare components. The regression methods

consist of a pooled OLS analysis, a regression with country fixed effects as well as a regression with both year fixed effects and country fixed effects. The equation is written as follows:

$$\text{welfare}_{it} = \alpha_0 + \alpha_1 \text{growth}_{it} + \epsilon_{it} \quad (1)$$

$$\text{welfare}_{it} = \beta_0 + \beta_1 \text{growth}_{it} + \beta_2 \text{country}_t + \eta_{it} \quad (2)$$

$$\text{welfare}_{it} = \gamma_0 + \gamma_1 \text{growth}_{it} + \gamma_2 \text{year}_t + \gamma_3 \text{country}_i + v_{it} \quad (3)$$

The equation (1) is considered as the baseline equation. α_1 , β_1 and γ_1 function as the coefficients of the independent variable in these three equations. α_1 constitutes the change in the number of standard deviations for the welfare index linked with 1% increase in the GDP per capita. β_1 and γ_1 indicates the average differences in coefficients between a given country and the baseline country in the regression analysis with country fixed effects, and both year fixed and country fixed effects respectively. The hypothesis proposed is that economic growth has a significant impact on public welfare. The subscripts i and t symbolise countries and time periods correspondingly.

3. Data

In this research, economic growth is the independent variable, and welfare is the dependent variable. Economic growth is measured by Ln GDP per capita (in US dollars), which can relatively accurately reflect growth rates in economics where population sizes vary, and therefore the gradual benefits of economic growth allocated for each individual citizen in the countries. Welfare is assessed by an index that assigns equal weights to the components discussed below. Gini coefficients are used to measure inequality by quantifying the skewness of income distributions. Crime severity is estimated by crime frequency in terms of crimes per hundred thousand population. Tertiary education enrolment ratios serve as an indicator of the national education levels, which are calculated by the number of students enrolled in tertiary education divided by the population in the age cohorts. Healthcare expenditure percentages of the GDP contribute to the assessment of national healthcare levels. Finally, as a measurement unit, metric tons per capita play a role in evaluating the levels of carbon emissions arising from human activities in a country.

The data for this research is gathered from 29 countries in total, residing in Asia, Europe, North America, and South America, with ten of them being developing countries and the other nineteen being developed ones. Examples of developing countries researched on include China, Brazil, Colombia and Costa Rica, while developed ones are comprised of the United States of America (the US), the United Kingdom (the UK), France and Italy. This allows this research to take into account the effect of various development levels of countries when evaluating the relationship between welfare and economic growth, which would help compensate for the impacts of limited sample sizes and improve the reliability and generalisability of results. Time periods for the data for all 29 selected countries range from 2011 to 2018 for eight years. The data are sourced from MacroTrends and the World Bank, which are well-known research platforms that provide reputedly reliable statistical data. The data for Ln GDP per capita, crime frequency, national healthcare level and carbon emission level are obtained from MacroTrends, while the data for income inequality and national education level are obtained from the World Bank.

It deserves attention that this research adjusts the data for the five components by standardisation within each individual year, thus allowing the data to become unit-free. The welfare indices are computed by averaging the standardised data. It should be noted that the standardised data for Gini coefficients, crime frequency and carbon emission levels are multiplied by additional minus ones, as these components are likely to be negatively associated with public welfare.

4. Results

4.1. Descriptive Statistics

From Table 1, there are 232 observations for each variable for the 29 countries over 8 given years, including economic growth rates and the five variables comprising the welfare index, where the data for each observation for welfare ingredients has been standardised. The means are negative for inequality, crime severity and carbon emission level, and are positive for national education level and national healthcare level, which varies from -0.019 to 0.018. In terms of the five welfare components, the standard deviations are centering around 1, and the minimums and maximums range between -4.444 and 3.427. From the perspective of economic growth rates, it can be observed that the discrepancy between the least and most wealthy countries is noteworthy, represented by the minimum of 7.022% and 11.542%, which ensures the comprehensiveness of the data collected. Figure 1 demonstrates a scatter plot between economic growth rates and welfare index, which displays a mildly positive correlation that is consistent with the calculated figure of 0.652. The red fitted line denotes the line for the linear regression between economic growth rates and welfare.

Table 1. Descriptive Statistics

Variable	Mean	St. Dev.	Min	Max
Inequality	-0.019	0.996	-2.373	1.350
Crimes	-0.013	1.000	-4.444	0.466
Education	0.017	0.995	-2.494	1.802
Healthcare	0.018	0.997	-1.657	3.427
Carbon Emission	-0.013	0.999	-2.792	1.343
Growth rate	9.800%	1.068%	7.022%	11.542%

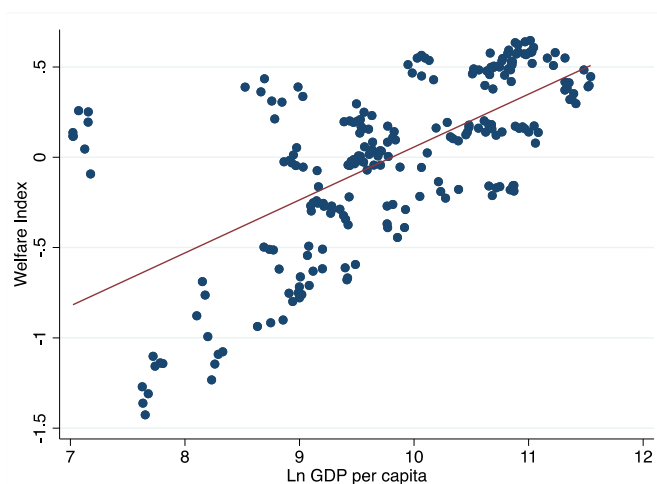


Fig.1 Scatter plot for linear regression

4.2. Regression Results

The three regressions are all conducted for all 232 observations. According to Table 2, the regression coefficient of Ln GDP per capita is 0.293 for the equation (1), displaying a positive association between growth rates and welfare. However, the regression coefficients of the equation (2) and (3) are -0.103 and -0.136, namely negative associations for both of the regression analyses. This signals that controlling country-specific and further year-specific effects will alter the sign of the correlation from positive to negative. The standard errors for the regression coefficient are 0.035, 0.075 and 0.092, where the consecutive increases in the standard error illustrate a higher variability of the regression coefficient arising from the involvement of the country-specific effects and further the year-specific effects, where the sample value of the coefficient deviates more from the true value. The p-value is less than 0.001 for the equation (1) and becomes greater than 0.1 for the equations (2)

and (3), suggesting declines in the significance of the results for the latter two regressions, where the country-specific and year-specific implications are pronounced. The regression adjusted R squares for equation (1) is 0.425, which suggests that a notable extent of the variations in the welfare index cannot be explained by the variations in the growth rates. As regards the regressions for equations (2) and (3), the adjusted R squares are approximated to be 0.974 and 0.975, where the ability of variations in Ln GDP per capita to explain variations in welfare index improves tremendously.

Table 2. Regression Results (Dependent Variable: Welfare Index)

	(1)	(2)	(3)
Ln GDP per capita	0.293*** (0.035)	-0.103 (0.075)	-0.136 (0.092)
Country FE	No	Yes	Yes
Year FE	No	No	Yes
Adj-R2	0.425	0.974	0.975
F-stats	70.54	441.14	374.02

Notes: * $p < 0.1$ ** $p < 0.01$ *** $p < 0.001$. Standard errors in parentheses.

For the regression for the equation (2), the p-values for the majority of the countries are below 0.001, except for seven countries composed of Belarus (0.020), Finland (0.092), France (0.02), Kyrgyz Republic (0.009), Norway (0.286), Slovenia (0.297) and Switzerland (0.102). In comparison, the exceptions of the countries with p-values below 0.001 are the exact same seven countries in the regression for the equation (3), namely Belarus (0.024), Finland (0.090), France (0.011), Kyrgyz Republic (0.012), Norway (0.207), Slovenia (0.225) and Switzerland (0.288). For the year coefficients of the latter regression, the p-values are all visibly insignificant, ranging from 0.462 to 0.978, which can potentially be attributed to the limited sizes selected for sample years.

5. Discussion

In view of the previous findings that promising performance of economic growth tends to lead to higher level of welfare [9], and that extreme economic disruptions can result in non-negligible impacts on economic well-being and development [10], this study sees similarities and differences. Notwithstanding that the relationship between growth rates and welfare is positive in the regression for the equation (1), the incorporation of country specific and year-specific characteristics in equations (2) and (3) presents a reversed relationship. Econometrically, a cause of this phenomenon can be the mitigation of omitted variable bias and heterogeneity, where taking into consideration country fixed and year fixed effects can help reduce the impacts of some unknown variables that are specific to particular countries and years. Realistically, there may exist economic shocks that are unexpected in certain countries and years. For instance, the recession that followed the European crisis in 2012 heavily negatively impacted upon economic growth at that year, and the US government shutdown in 2018 led to adverse implications on industrial performance, consumer confidence and hence economic prosperity. These events are focused on certain regions and years, and their effects are overcome in the regressions for equations (2) and (3) to some extent, which generate more reliable results that contradicted the results in the regression of the equation (1).

6. Conclusion

The paper conducts an empirical study on the relationship between economic growth and public welfare. The cruciality of this study lies in worldwide controversy on whether economic growth necessarily benefits social well-being, which was previously an economic intuition, and this study is meaningful to the policy-making processes of government which may contribute to a more holistic understanding of the interaction between economic growth and social happiness and satisfaction for the academia. The research methods are grounded on previous studies that quantify welfare by

measuring components of income inequality, crime severity, national educational level, national healthcare level and carbon emission level and weight benefits against costs, while the originality of this study lies in the creation of a welfare index that assesses the ingredients of well-being simultaneously through standardisation techniques. The research applies three equations that involve a pooled OLS analysis, regressions with country fixed effects and with country fixed and year fixed effects respectively. From the results of the pooled OLS, the welfare index is positively linked with economic welfare, whereas the coefficient becomes negative in both of the regressions accounting for country fixed effects and country fixed and year fixed effects. The p-values are greater than 0.1 for the latter two regressions, diluting the size of the impact of growth on welfare, which emphasises the significance of country-specific and year-specific attributes. The R-squares are satisfactorily high for the latter two regressions, suggesting an enhanced ability of the variations in economic growth to explain the variations in public welfare, which may be due to the alleviation of omitted variable bias and heterogeneity which copes with country-specific and year-specific factors. The overall indication of this study is that the government ought not to solely concentrate on fostering growth in economies when making economic policies, and need to evaluate country-specific and year-specific characteristics that affect economic prosperity and social well-being.

There are observations displaying abnormalities emerging from the regressions for country fixed effects and for both country fixed effects and year fixed effects, where seven countries see p-values higher than 0.001, namely Belarus, Finland, France, Kyrgyz Republic, Norway, Slovenia and Switzerland. This implies that the abnormal observations might impact upon regression results. Apart from country-related abnormalities, the year coefficients for the regression modelling country fixed and year fixed effects, all of the p-values are insignificant for being discernibly greater than 0.1, which can be ascribed to the limited sizes chosen for sample years. Furthermore, the ways to measure the factors of welfare are not constrained. As an instance, the national education level encompasses primary, secondary and tertiary education levels, while this research merely measures the tertiary education levels. Alternatively, national healthcare levels can be interpreted by maternal mortality rates and life expectancies as well. These limitations will be accounted for by future studies as well via more effective treatment of extreme observations and more thorough measurements of welfare components to optimise the reliability of results.

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