# The Relationships among Mortality Rates, Income and Educational Inequality in Terms of Economic Growth: A Comparison between Turkey and the Euro Area

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-ABSTRACT-

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**Key words:** *Educational Gini, Income Gini, Mortality Rates, Economic Growth, Panel Data Analysis, Euro Area, Turkey*

This study focuses on the relationships among mortality rates, income and educational inequality in terms of economic growth to investigate similarities and differences between the Euro Area and Turkey. For this purpose, income gini as an indicator of income inequality and education gini as an indicator of education inequality are used in the analyses. The relations among the variables are examined with panel data analysis for the Euro Area and with time series analysis for Turkey by using these coefficients and mortality rates for the period of 1980 and 2006. The results show that access to education is more important than the others for Turkey and the Euro Area. There is also a considerable relation between education inequality and mortality rates of infant and adult.

**JEL Classifications:** I1, I2, I3

# The Relationships among Mortality Rates, Income and Educational Inequality in Terms of Economic Growth: A Comparison between Turkey and the Euro Area

-FULL PAPER-

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## 1. INTRODUCTION

The literature on economic development has recently begun to reexamine the links between inequalities and development. Particularly income inequalities leads to disparities for individual expenditures on education, health etc. Therefore, social utility can not be optimized. At the individual level, it has been established both that richer people have better health because they can afford goods and services (e.g. medical care, better nutrition, sanitation and housing) that promote health. However, people with low incomes may be more likely to face a disease; they are less able to spend money to mitigate its consequences. In this context it has been observed for instance, that poor people generally have higher mortality rates and lower life expectancy than rich people. Moreover, mortality rates tend to be lower in countries with a more egalitarian income distribution (Wilkinson, 1996).

Beside studies finding a relation between income inequality and health indicators at different levels of economic growth (Kaplan et. al (1996), Kennedy et al (1996), Kawachi et al. (1997), etc.), some studies drive attention to associations between income inequality and education (Muller (2002), Galea and Ahern (2005), Rehme (2006), etc). On one hand, income inequality may prevent access to education when education is too costly for the family. On the other hand, improved access to education raises the earning opportunity of the lowest strata and, other things being constant, reduces earning inequality. The possible interaction among income and education inequality and mortality rates is an issue of major concern and has important policy implications.

The purpose of this study is to investigate the relationship between income inequality, education inequality and mortality rates in the context of economic growth. Considering the ambiguous theoretical predictions about the relation between these variables, it is looked for empirical evidence and compared the Euro Area with the case of Turkey. Previous cross-national studies generally have been found relations between only two indicators such as income inequality and mortality rates, income inequality and education, economic growth and mortality rates, etc. Unlike previous studies, this study investigates relations among income inequality, education inequality and mortality rates and effects of these indicators on economic growth using the balanced panel data set for the period of 1980 and 2006 in the Euro Area. For the same period for Turkey, time series has been run to compare with the Euro Area.

In the next section it has been presented a review of studies which have been established relations among income inequality, mortality and education. In section 3, it has been discussed the data and explained the methods. In section 4, it has been presented results the empirical evidence and finally the last section concludes.

## 2. A REVIEW OF LITERATURE

### 2.1. Income Inequality and Mortality

Studies on the health effects of income inequality have generated great interest. In a recent literature *Wilkinson (1996)* pointed out that while the first moment of income is protective, at least at the individual level, the second moment is a health hazard, so that income inequality raises mortality, if not at the individual level at least in populations or large subpopulations. He postulates that inequality itself is a health hazard and that it is less healthy for both rich and poor to live in a more unequal society. The original empirical support for the Wilkinson hypothesis comes from Wilkinson's cross-country comparisons within the OECD, where some measures of inequality are much more closely related to mortality levels and mortality changes than is either the level or rate of growth of national income.

There are also a number of studies using aggregated data that found a relationship between income inequality and mortality as a health indicator. For example, *Kaplan et al. (1996)* used as their measure of income distribution the share of total income earned by the bottom 50 percent of households in each state in United States. If incomes were perfectly equally shared, the bottom half of households should account for exactly half of the aggregate income. They found that variations between states in the inequality of the distribution of income are significantly associated with variations between states in a large number of health outcomes and social indicators and with mortality trends. Considering the effects of income inequality on mortality *Laporte and Ferguson (2003)* suggested that in Canada, income inequality is less important than other factors in determining the overall mortality rate.

In another study by *Kennedy et al. (1996)* the findings suggested that policies deal with the increasing income inequalities may have an important impact on the health of the population. *Kawachi et al. (1997)* hypothesized that income inequality is related to

reduction in social cohesion and that disinvestment in social capital is in turn associated with increased mortality; as a result they found that income inequality was strongly correlated with both per capita group membership and lack of social trust and group membership were associated with the total mortality as well as rates of death from coronary heart disease, malignant neoplasm, and infant mortality. *Lynch et al. (1998)* examined associations between income inequality and mortality in 282 US metropolitan areas and found higher income inequality is associated with increased mortality at all per capita income levels. Moreover they explored that in age specific analyses, income inequality was most evident for infant mortality and for mortality between ages 15 and 64. *Deaton (2001)* explored the connection between income inequality and health in both poor and rich countries and asserted there was no direct link from income inequality to ill-health; individuals are no more likely to die if they live in more unequal places.

However, studies using individual level data may not be able to find a link between income inequality and mortality rates. For example, *Daly et al. (1998)* failed to find significant links between inequality and mortality, except in the case of those with middle incomes between the ages of 25 and 64. The results were not consistent with the analysis of the association between the Kaplan measure and mortality in another cohort that is representative of the US (Fiscella and Franks 1997). In this latter study, it was found no effect of state level income inequality on individual five year mortality rates using data from the Panel Study of Income Dynamics, in other words, the relationship was no longer significant when it was adjusted for individual income.

The finding of a link between income inequality and health begs the question of the mechanisms by which this association operates. At least three plausible mechanisms have suggested (Kawachi and Kennedy, 1999: 220): (a) that income inequality is linked to disinvestment in human capital; (b) that income inequality leads to the erosion of social capital; and (c) that income inequality leads directly to ill-health via stressful social comparisons.

### 2.2. Income Inequality, Mortality, Education and Economic Growth

Individual health is affected by many things other than individual income and it is possible that the relationship between health and income itself is spurious, with income standing proxy for some other variables. An obvious candidate for such a variable is education.

On this ground, *Muller (2002)* said that income inequality might reflect the effects of other socioeconomic variables that were also related to mortality; among those variables, the contribution of formal education deserved most attention since it typically preceded work and income and also related to mortality. He explored that income inequality effect disappeared when percentage of people without a high school diploma was added to the regression models and the fit of the regression significantly improved when education was added to the model.

*Galea and Ahern (2005)* examined the relations between education distribution, income distribution and specific health indicators in New York City. They studied the association between distribution of education, measured with the education Gini coefficient, and rates of 8 health indicators in 59 neighborhoods in NYC. The results showed that neighborhoods with more poorly distributed education had better population health indicators that might plausibly be associated with short-term changes in the social environment (e.g., homicide and infant mortality rate); there was no association between education distribution and health indicators more likely to be associated with long-term accumulation social and behavioral stressors.

*Erdem and Çoban (2005)* demonstrated that there was a negative relation between educational inequality and economic development in a cross-provinces comparison for Turkey for the quinquennial and decadal periods. Moreover they found that education inequality of provinces measured by education gini was associated with the results in Survey of Development of Socio-Economics Ranking. They construed that the more equal education was, the more developed provinces were.

In another study, *Rehme (2006)* focused on the dual role of education in explanations of how income inequality and economic growth were associated. In this model, education directly affects income inequality and growth; increases in education first increase and then decrease growth as well as income inequality, when measured by the Gini coefficient. There is no clear functional relationship between growth and measured income inequality. If one conditions on inequality and human capital in growth regressions, the estimated effect of inequality on growth may be spurious, but may still provide important information on the nonlinear relationship between growth and education.

## 3. Data and Methods

Data on income gini as a measure of income inequality have been compiled from World Income Inequality Database (WIID). The gini coefficient is an effective measure of inequality for two reasons. First, it is the most common variable used in economic and inequality research, permitting more accessible comparisons with prior research. Second, the gini coefficient has an intuitive interpretation for those that are not familiar with the technical details of inequality measures.

Gini coefficients of education as a measure of the education inequality have been calculated by using formula constructed by Thomas, Wang and Fan (2000). Educational attainment data set from Barro and Lee (2000) has been used to calculate this formula and after 2000 it is assumed that there is no change because of data unavailable. This measure is selected because it was an improvement over other indicators of educational inequality used in the past, such as the standard deviation of educational attainment.

Data on mortality rates (infant, female and male adults over 25) as a health indicator have been collected from World Bank's database of Health, Nutrition and Population (HNP) statistics. The natural log of GDP per capita (in US Dollars, in linear form) and growth rate of GDP (in national currency, constant prices, OECD based year, millions) are used as the variables for economic development and growth as in common in the literature. The data of these variables retrieved from United Nations Statistics and OECD, respectively.

The education gini formula as a measure of educational inequality used by Thomas, Wang and Fan (2000) is shown in following equation.

$$E_G = \left(\frac{1}{\mu}\right)\sum_{i=2}^{n}\sum_{j=1}^{i-1} p_i \left| y_i - y_j \right| p_j$$

Where, $E_G$ is the education gini based on education attainment distribution; $\mu$ is the average years of schooling; $p_i$ and $p_j$ stand for the proportions of population with certain levels of schooling; $y_i$ and $y_j$ are the years of schooling at different education attainment levels; $n$ is the number of levels/categories in attainment data and $n = 7$ in this paper. The population is divided into seven categories including no-schooling (or illiterate), partial primary, complete primary, partial secondary, complete secondary, partial tertiary and complete tertiary. Education gini could be used as one of the indicators of welfare, complementing health and nutrition, income per capita and other indicators of welfare.

This study focuses on the relationship among income inequality, education inequality and mortality rates based on economic growth. It investigates the effects of income and education inequality on mortality rates; the effects of education inequality on income inequality; the effect of log per capita income, income inequality and education inequality on GDP growth. On this ground the following panel regressions have been estimated for the Euro Area including Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Portugal, Spain and The Netherlands (Luxembourg is included for Model 4):

(1) $INFANT_{i,t} = \alpha_0 + \alpha_1 INGINI_{i,t} + \alpha_2 EDGINI_{i,t} + \alpha_3 LPERCAP_{i,t} + \varepsilon_{i,t}$

(2) $INFANT_{i,t} = \beta_0 + \beta_1 LPERCAP_{i,t} + \beta_2 EDGINI_{i,t} + \varepsilon_{i,t}$

(3) $INFANT_{i,t} = \delta_0 + \delta_1 INGINI_{i,t} + \delta_2 EDGINI_{i,t} + \varepsilon_{i,t}$

(4) $MR_{i,t} = \phi_0 + \phi_1 INGINI_{i,t} + \phi_2 LPERCAP_{i,t} + \varepsilon_{i,t}$

(5) $INGINI_{i,t} = \eta_0 + \eta_1 EDGINI_{i,t} + \varepsilon_{i,t}$

(6) $GGDP_{i,t} = \varphi_0 + \varphi_1 LPERCAP_{i,t} + \varphi_2 INGINI_{i,t} + \varphi_3 EDGINI_{i,t} + \varepsilon_{i,t}$

For a comparison with the Euro Area, the following time series regression models also have been estimated for Turkey from 1980 to 2006:

(7) $INFANT_t = \alpha_0 + \alpha_1 INGINI_t + \alpha_2 EDGINI_t + \alpha_3 LPERCAP_t + \varepsilon_t$

(8) $INFANT_t = \beta_0 + \beta_1 LPERCAP_t + \beta_2 EDGINI_t + \varepsilon_t$

(9) $INFANT_t = \delta_0 + \delta_1 INGINI_t + \delta_2 EDGINI_t + \varepsilon_t$

(10) $MR_t = \phi_0 + \phi_1 INGINI_t + \phi_2 LPERCAP_t + \varepsilon_t$

(11) $INGINI_t = \eta_0 + \eta_1 EDGINI_t + \varepsilon_t$

(12) $GGDP_t = \varphi_0 + \varphi_1 LPERCAP_t + \varphi_2 INGINI_t + \varphi_3 EDGINI_t + \varepsilon_t$

Where, *INFANT* is mortality rate per live 1000 births; *INGINI* is gini coefficient of income as a measure of income inequality; *EDGINI* is gini coefficient of education as a measure of education inequality; *LPERCAP* is the log form of per capita income; *MR* is total mortality rate of female and male over age 25; *GGPD* is growth of GDP. The subscripts *i* and *t* index countries and periods, respectively. The data set is balanced panel for which data are annual from 1980-2006.

## 4. Empirical Results

The analysis performed here addressed the relations among infant and adult mortality rates, income and education inequality, GDP per capita and economic growth. A panel data analysis is used for the Euro Area from 1980 to 2006 with annual intervals. Because of being able to compare with the Euro Area, the same models are used in time series regression models which are constructed for Turkey. The implications of findings for Turkey may be restricted because the data availability is limited. The findings are shown in Table 1 for the Euro Area and in Table 2 for Turkey.

**Table 1: Results of Panel FEM for the Euro Area**

| Dependent Variable >> | Model 1<br>**INFANT** | Model 2<br>**INFANT** | Model 3<br>**INFANT** | Model 4<br>**MR** | Model 5<br>**INGINI** | Model 6<br>**GGDP** |
|---|---|---|---|---|---|---|
| Constant | **0.0247**<br>(0.0022) | **0.0225**<br>(0.0000) | **-0.0005**<br>(0.0631) | **0.4040**<br>(0.0000) | **0.2446**<br>(0.0000) | **-0.1431**<br>(0.0631) |
| INGINI | **-0.0031**<br>(0.3190) | | **0.0129**<br>(0.0000)* | **0.0504**<br>(0.0255)** | | **-0.0646**<br>(0.0337)** |
| EDGINI | **0.0394**<br>(0.0000)* | **0.0398**<br>(0.0000)* | **0.0127**<br>(0.0000)* | | **0.1904**<br>(0.0000)* | **0.0738**<br>(0.0783)*** |
| LPERCAP | **-0.003**<br>(0.0001)* | **-0.0028**<br>(0.0002)* | | **-0.0211**<br>(0.0001)* | | **0.0169**<br>(0.0214)** |
| R-squared | 0.87 | 0.87 | 0.71 | 0.91 | 0.23 | 0.58 |

Model 1: Two-way fixed effects

Model 2: Two-way fixed effects

Model 3: One-way individual fixed effect

Model 4: Two-way fixed effects

Model 5: One-way period fixed effect

Model 6: Two-way fixed effects

*p values < %1

**p values < %5

***p values < %10

Note: Since this study focuses on a specific country group, the fixed effect model seems theoretically proper choice. To test individual and time fixed effects, F-test is applied.

**Table 2: Results of OLS for Turkey**

| | Model 7 | Model 8 | Model 9 | Model 10 | Model 11 | Model 12 |
|---|---|---|---|---|---|---|
| Dependent Variable >> | **INFANT** | **INFANT** | **INFANT** | **MR** | **INGINI** | **GGDP** |
| Constant | 0.1637 (0.0281) | 0.1388 (0.0581) | -0.0274 (0.1600) | 0.9509 (0.0000) | 0.4059 (0.0000) | -0.0693 (0.0092) |
| INGINI | **-0.0563** (0.1421) | | **-0.0540** (0.2107) | **-0.0607** (0.3676) | | **0.3013** (0.1578) |
| EDGINI | **0.1636** (0.0000)* | **0.1603** (0.0000)* | **0.2351** (0.0000)* | | **0.0728** (0.3549) | **0.3807** (0.0288)** |
| LPERCAP | **-0.0200** (0.0097)* | **-0.0197** (0.0121)** | | **-0.0688** (0.0000)* | | **0.1022** (0.0138)** |
| R-squared | 0.30 | 0.91 | 0.89 | 0.83 | 0.03 | 0.31 |
| $LM_{SC(1)}$ | 6.08 [0.21] | 5.66 [0.02] | 3.50 [0.07] | 23.02 [0.00] | 4.27 [0.04] | 2.31 [0.14] |
| $LM_{SC(2)}$ | 2.93 [0.07] | 2.79 [0.08] | 1.92 [0.16] | 12.07 [0.00] | 3.82 [0.03] | 1.54 [0.23] |
| $ARCH_{(2)}$ | 1.36 [0.27] | 0.47 [0.62] | 2.04 [0.15] | 4.62 [0.02] | 0.96 [0.39] | 0.16 [0.84] |
| $WHITE_{het}$ | 2.38 [0.06] | 0.13 [0.96] | 1.18 [0.34] | 0.88 [0.48] | 5.43 [0.01] | 3.48 [0.01] |
| $FF$ | 1.62 [0.21] | 2.69 [0.08] | 2.24 [0.12] | 0.99 [0.38] | 0.08 [0.76] | 1.53 [0.23] |

*p values < %1 **p values < %5 ***p values < %10

Note: $LM_{SC(1)}$ and $LM_{SC(2)}$ are the Breusch–Godfrey Lagrange Multiplier test statistics for the null of no first and second-order serial correlation, respectively; *FF* is the Ramsey's test statistic for the null of no functional misspecification; $WHITE_{het}$ is the White's test statistic to test for the null of homoskedasticity; and *ARCH* is the Engle's test statistic for the null of no autoregressive conditional heteroscedasticity. Numbers in parentheses and brackets are the corresponding *p*-values, respectively.

>Diagnostic checking shows that there are no significant problems in the estimation of the models.

When the variables are considered in Model 1 for the Euro Area, except coefficient of income gini, can affect infant mortality. A positively significant coefficient for education gini implies increased education inequality tends to increase infant deaths. Also a negatively and marginally significant log GDP per capita means that decreased per capita income lowers health expenditures and increases infant deaths. However, income gini is statistically insignificant in this model. Education distribution seems to be more important than per capita income, because per capita income becomes less important the richer is the country. When the variables are considered in Model 7 in comparison to Model 1, the findings show that the coefficients of income gini and education gini for Turkey are relatively higher in this model. Especially the coefficient of EDGINI and LPERCAP are considerably high respect to the Euro Area. Due to lower per capita income and lower

educational attainment level, the effects of these indicators on infant mortality rates are more obvious in Turkey. Income gini is excluded in Model 2 and in Model 8, but there is no important change for both the Euro Area and Turkey.

Also in Model 3 and Model 9, log per capita income is excluded, the coefficient of income gini has become positive and statistically significant in Model 3, but it is still negative and statistically insignificant in Model 9. So it can be said that if income and education inequality decrease infant mortality will decrease in the Euro Area. The coefficient of EDGINI is positive and has a high explanatory power in Model 9 (0.23). This suggests inequality of education, other things are being constant, has a large effect on infant mortality in Turkey.

When the variables are considered in Model 4, income inequality can affect mortality of adults over 25. The coefficient of log per capita income is significant statically. In Model 10, the both coefficients are negative and the coefficient of INGINI is statistically insignificant and the coefficient of LPERCAP is significant and plausible for Turkey. In the Model 5 it seems that education inequality affects income inequality. However, a significant relation between income gini and education gini can not be constructed in Turkey (Model 11). Seeing that education is an input into both health and production and since the rate of return to education is higher at lower than at higher levels of education, the positive effects of redistribution will be farther enhanced. If households increase the total percentage of children in school, distribution of income will be more equal and the society will be more egalitarian in the Euro Area.

In the Model 6 for the Euro Area and in the Model 12 for Turkey, it is tried to find a relation between economic growth and social variables such as income and education distribution and per capita income. According to Model 6, income inequality affects economic growth negatively. Therefore, an increase in income inequality may lead to a decrease in the growth of GDP. The coefficient of education inequality and per capita income is negatively significant for the Euro Area. However these coefficients are considerably high for Turkey (0.38 and 0.10, respectively) but model 12 does not seem theoretically plausible. For the Euro Area it can be said that because of the importance of human capital in economic growth, it can be strongly suggested that the more equal education the higher economic growth is.

## 5. Concluding

The findings of this study show that for the all sample if education inequality increases infant mortality and income inequality raises. The relation between income inequality and education inequality is more considerable for the Euro Area than for Turkey. It is observed that educational inequality was associated with health indicators (e.g. infant mortality, mortality rate of adults over 25). However, like previous studies (e.g. Deaton 2001), this study also has been found no effect of income inequality on mortality for the Euro Area. According to results for Turkey, (like findings by Kennedy et al. (1996), Kawachi et al. (1997)) income inequality has an effect on mortality rates of infant and adults over 25. As a whole, the results seem reasonable and there is some evidence in the literature that confirmed the observed relationships. Although differences in income inequalities and per capita income explain a small part of the differences in economic growth for the Euro Area, especially in Turkey education has considerable effects on infant mortality.

Income and education are often considered fundamental determinants of health and primary indicators of socioeconomic status. Education is an important variable since a more literate society has greater awareness of affecting health and is therefore better placed to take preventive measures, or seek medical assistance when ill. When the average education level in the population is low, there are very few highly educated people who are likely to obtain high salaries. At the same time, there are no incentives for the creation of new jobs for skilled jobs. More people earn higher wages, and as a consequence income inequality may start declining. Moreover increasing in well educated people in a country like Turkey can increase human capital and so the economic growth can be higher.

A lesson emerges from these results for policy makers that besides improving macroeconomic indicators, making policies to eliminate inequalities will be important to increase economic performance of both the Euro Area and Turkey. At the very least, the results presented in the previous section of the paper present a persuasive argument that the reduction in inequality would not have an adverse economic effect. We should care about inequality because of its consequences for human well-being, and its broader consequences for the nature of society.

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