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DOES BETTER INCOME DISTRIBUTION REDUCE INFANT MORTALITY? THE CASE OF TURKEY

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ABSTRACT

While the linkage between economic conditions and health indicators is largely discussed previously, much less is known about how income inequality affects the infant mortality rates (IMR) in Turkey. This study contributes to the literature by exploring the impact of income distribution on the infant mortality rates in Turkey Using a province - level data from 2014 to 2019 estimates the impact of income inequality and socio-economic factors on infant mortality rates. To identify what factors are associated with the IMRs, the ordered probit, the random effect, and the fixed effect approaches are used. An endogeneity problem between the IMRs and independent variables which are related to medical factors is predicted. To tackle down the endogeneity problem, an instrumental variable approach is used. The estimation results show that income inequality is an important factor which has an impact on infant mortalities. The results confirm that there is an inverse association between health service availability and infant mortality rates.

Keywords: *Healthcare, Panel Data Analysis, Health Economics, Infant Mortality.*

Jel codes*: I15, C23, I14.*

GELİR DAĞILIMININ BEBEK ÖLÜM HIZI ÜZERİNE ETKİSİ: TÜRKİYE ÖRNEĞİ

ÖZET

Ekonomik koşullar ve sağlık göstergeleri arasındaki bağlantı daha önce büyük ölçüde tartışılırken, gelir eşitsizliğinin Türkiye'deki bebek ölüm oranlarını (IMR) nasıl etkilediği hakkında görece sınırlı sayıda çalışma yer almaktadır. Bu çalışma, Türkiye'de gelir eşitsizliğinin IMR üzerindeki etkisini tahmin etmeyi amaçlamaktadır. Bu doğrultuda, 2014-2019 yılları arasında il düzeyinde bir veri setinin kullanılması ile gelir eşitsizliği ve sosyo-ekonomik faktörlerin bebek ölüm oranları üzerindeki etkisini analiz etmektedir. Bebek ölüm oranları üzerinde hangi faktörlerin ilişkili olduğunu belirlemek için Probit, Rassal etki ve sabit etki yöntemleri kullanılmaktadır. Bebek ölüm oranları ile bağımsız değişkenler olarak modelde yer alan tıbbi faktör arasında bir içsellik sorunu tahmin edilmektedir. İçsellik sorununun çözümü için araç değişken yaklaşımı kullanılmaktadır. Tahmin sonuçları, gelir

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eşitsizliğinin sağlık sonuçları üzerinde etkisi olan önemli bir faktör olduğunu göstermektedir. Sonuçlar, sağlık hizmetlerine erişim ile bebek ölüm oranları arasında negatif bir ilişki olduğunu doğrulamaktadır.

***Anahtar Kelimeler**: Sağlık sistemi, Panel Veri Analizi, Sağlık Ekonomisi, Bebek Ölümleri.*

Jel sınıflandırılması*: I15, C23, I14.*

1. INTRODUCTION

The relationship between economic indicators and health outcomes is well established in the literature. The common expectation refers to that health indicators will be better with an increase in the individuals' income level. According to a recent study conducted in 2020, income inequality at the county level was associated with increased odds of infant mortality in the United States (Ehntholt et al., 2020: 775). The inverse linkage between income inequality and health outcomes is also confirmed for the European countries. By using multiple regression models, the inverse relationship between income inequality and the population health is confirmed (Detollenaere et al., 2018).

In addition to the empirical evidence for the European countries and the United States, one can see similar findings for Turkey (Çukur and Bekmez, 2011: 40; Koçoğlu and Belgin, 2009: 152). According to the statistics provided by the World Bank, the IMR rate in Turkey was 171.4 in 1960. The last available statistics show that the average IMR in Turkey was 8.1 in 2020 (Graph 1). While there is a significant decrease in the IMR, Turkey has one of the highest IMR rates among the OECD countries. The latest available province-level data on the child health in Turkey are for 2019. In this year, the IMR varies from 3 (Karabük) to 14.2 (Kırşehir). The literature clearly states that economic development is one of the principal factors associated with the decline in the IMR (Goli and Jaleel, 2014: 362). For example, income inequality, the income level, the public health expenditures, and the unemployment rate have a stronger statistically significant association with IMR (Barenger et al., 2017: 26 ; Jaba et al., 2014: 114 ; White et al., 2017: 27).

To understand the impact of income inequality on the reduced population health, the Gini coefficient is commonly used as a measure of income equality. The Gini coefficient ranges from zero to one hundred. A coefficient of zero indicates that there is a complete equality. The coefficient of one hundred indicates that there exists a complete inequality. According to the statistics reported from the World Bank, the Gini coefficient for Turkey varies from 38.4 to 41.9 since 2002 (The World Bank, 2021).

While the linkage between the economic conditions and the health indicators is largely discussed previously, much less is known about how income inequality affects the mortality rates in Turkey. It is important to identify the specific economic factors and policy changes that affect the infant mortality rates to have better public health outcomes. This study aims to estimate the impact of income inequality on the IMRs in Turkey. Additionally, this study contributes to the literature by reviewing the recent

empirical articles on the relationship between income inequality and health outcomes. To best of our knowledge this is the first study examining the impact of income inequality on infant mortality rates in Turkey with the recent dataset.

The remainder of this study is organized as follows: Section 2 discusses the literature on the infant mortality rate and the income distribution problem. Section 3 presents the econometric methodology and defines the variables included in the model. Section 4 explains the results. Finally, the findings are discussed in the conclusion section.

2. WHY INCOME DISTRIBUTION IN INFANT MORTALITY MATTER: A REVIEW

The Center for Disease Control and Prevention (CDC) defines infant mortality as the death of an infant before his or her first birthday. The infant mortality rate (IMR) shows the number of infant deaths for every 1,000 in a group younger than one year of age (Mortality in the United States, 2019). The IMR is considered a major public health problem in developing countries. Gonzales and Gilleskie (2019) states that the IMR is often considered as an indicator of the overall welfare of a country. Therefore, it is important to understand the causes of infant deaths. Studies highlight that several major causes of infant deaths are birth defects, preterm birth, and injuries (Mortality in the United States, 2019).

In addition to be a public health problem, the infant mortality is considered an economic problem. Firstly, the prevalence of health problems for infants leads to an enormous economic burden (Kirigia et al., 2015: 6). Moreover, the prior studies prove the evidence of the association between the economic indicators and the IMRs (Fritzell et al., 2015; Avendano, 2012; Kanamori et al., 2021: 7). Improvements in economic indicators, especially in the income inequality indicators are associated with the IMR in developing countries (Macinko et al., 2004: 284, 285; Szwarcwald et al., 2002: 2088).

Reno and Hyder (2018) conduct a systematic review to identify the extent to which research has provided evidence on the determinant of infant mortality. By including 89 studies; poverty, economic inequality, public health expenditure, and the Medicaid spending are discussed as the economic factors related to the IMRs. The authors highlight that due to the complexity of the issue, additional research is needed to explore the determinants of the IMRs.

Navarro et al. (2006) utilized the Theil index to conduct a cross-country comparison to determine the relationship between income inequality and IMRs. The findings support a statistically significant impact of the income inequality on the increased IMRs.

Siddiqi et al. (2015) focus on the infant mortality in the US. Their findings show that persistent income inequality was related to the higher IMRs rather than was initial income inequality. A follow-up study is conducted by the authors to investigate whether income inequalities were associated with racial disparities in infant mortality. This study provides of no evidence on racial disparities in infant mortality and income inequality (Siddiqi et al., 2016: 52-53).

It is important to state that while the complexity of determinants of infant mortality has been extensively acknowledged in the developed countries, unfortunately, there exists a limited number of research to investigate the impact of income inequality on IMRs. This study aims to contribute the literature by providing the empirical evidence on the association between the infant mortality rate and the socioeconomic indicators, especially the income inequality.

3. DATA

Data are drawn from the Turkish Statistical Institute (TÜİK) and the Republic of Turkey Ministry of Health, Annual Health Statistics Report. A province-level panel dataset from 2014 to 2019 including the 81 provinces in Turkey is employed. As a dependent variable, the number of infant mortalities during the first 364 days since the born is employed. Moreover, five economic indicators are used as the independent variables: (1) income inequality, (2) unemployment rate, (3) labor force participation, (4) per capita income level, and (5) per capita income level (squared). Four more variables are employed as the medical indicators: (1) number of hospitals per 100,000 people, (2) number of doctors per 100,000 people, (3) number of nurses per 100,000 people, and (4) number of hospital beds per 100,000 people. Table 2 presents the summary statistics. Additionally, data definitions and sources are documented in Table 2.

3.1. Dependent Variable

Measures of infant mortality rate are collected from the TÜİK database. Infant mortality shows the number of deaths for every 1,000 live births under one year of age. According to the statistics obtained from the TÜİK province-level database, Tunceli has the lowest number of infant mortalities from 2014 to 2019 (3.08). The highest infant mortality rate is seen in Kilis in 2014 (24.5). Overall, the mean value for Turkey is 9.77.

3.2. Independent Variables

The explanatory variables can be classified into two categories: Medical factors and economic factors. The number of hospitals per 100,000 people, the number of doctors per 100,000 people, the number of nurses per 100,000 people, and the hospital beds per 100,000 people are included as medical factors. These statistics are obtained from the Republic of Turkey Ministry of Health. The number of hospitals includes both private and public health centers in each province. The dataset shows that Kilis has only one hospital in 2014 and 2015. After 2016, the number of hospitals reached to 2. Hence, the number of hospitals per 100,000 was seen in Kilis until 2016 (0.76). The highest number of hospitals per 100,000 people is seen in Tunceli. The rate is about 7.29 per 100,000 people. Another independent variable is the number of medical doctors per 100,000 people. The statistics show that Hakkari has the lowest number of doctors in 2014 in Turkey (72.38). Hakkari is followed by Şırnak and Iğdır. The highest number of doctors per 100,000 people is also seen in Ankara (314.8)(TÜİK 2021).

For the economic variables, to estimate the income inequality, the Gini coefficient is used. Additionally, the unemployment rate, the labor force participation rate, the average individual income level, and per capita income squared are used. The economic independent variables are assembled from the TÜİK database. The key explanatory variable used in the analysis of the IMRs is the Gini coefficient. The Gini coefficient is an indicator of the income distribution. The Lorenz curve is used to calculate the Gini coefficient (Su et al., 2011). For the cities in Turkey, the Gini coefficient ranges from 0.29 to 0.44. Istanbul has the highest income inequality among the Turkish provinces between 2014 and 2019 (0.44). The lowest income inequality is seen in Bayburt, Erzincan, and Erzurum (0.29). (Table 2)

In addition, the income level and the labor force participation rate are included in the sample. The income statistics are provided by TÜİK in two categories: (1) in Dollars and (2) in Turkish Lira. Due to higher inflation rate in the period, the income level in Dollars is employed in the present study. The labor force participation and the employment rate statistics are obtained from the TÜİK province level database. The average unemployment rate is 9.8 in Turkey. Also, Igdır, Ağrı, and Ardahan have the lowest unemployment rate in 2014. The highest unemployment rate is seen in Batman, Siirt, Şırnak, and Mardin in 2016 (28.3).

4. MODEL

To identify what factors, influence the health outcomes a basic model is conducted as a function of economic (stress) factors and the availability of health providers. Specifically, the following model is estimated:

$$IMR_{it} = \beta_0 + \beta_1 HP_{it} + \beta_2 D_{it} + \beta_3 N_{it} + \beta_4 HBD_{it} + \beta_5 G_{it} + \beta_6 U_{it} + \beta_7 LF_{it} + \beta_8 Inc_{it} + \beta_9 (Inc)_{it}^2 + \varepsilon_{it} \quad (1)$$

Where IMR_{it} denotes health outcomes in year t and province i, HP_{it} stands for the number of hospitals per 100,000 people, D_{it} shows the number of doctors per 100,000 people, N_{it} shows number of the nurses per 100,000 people. HBD_{it} shows number of hospital beds per 100,000 people. G_{it} presents Gini coefficients in year t and province i. U_{it} shows unemployment rates, LF_{it} shows labor force participation rate. Inc_{it} and $(Inc)_{it}^2$ are the vectors of per capita income and income squared.

Equation (1) is estimated with the ordered probit, the random effect, and the fixed effect methods. The hypothesis in the present study is that the IMRs in Turkey are positively associated with income inequality (β_6>0). We expect an endogeneity problem between the health outcomes and independent variables which are related to medical factors. To tackle down the endogeneity problem, an instrumental variable approach is used. The tax income by each province is employed as an instrumental variable. The reason is the Turkish Ministry of Health has a leading role in healthcare policies. The Turkish healthcare system has three main financing sources: (1) the government budget (tax revenues), (2) the

out-of-pocket payments, and (3) the contributions of individuals. The financing from tax revenues has the largest share by more than 75 percent.

In sum, the present study aims to explore the relationship between the income inequality and the IMRs by using province-level panel data and employing three different approaches: (1) the ordered probit, (2) the fixed effect, and (3) the random effect. The first econometric approach, ordered probit approach, provides several advantages: (1) as the dependent variable consists of highly discrete values, the ordered probit approach might be a favorable option (Kockelman and Kweon, 2002). (2) as the current study includes several categorical variables, the orders probit model was an appropriate estimation method (Batoolet al, 2018:15 ; Greene and Hensher, 2010:137).

As a robustness check, this study also used alternative econometrics techniques (i) the fixed-effect model, where the dependent variable is the number of infant mortalities per 1,000 infants in each province to measure the impacts of the same factors; (ii) another econometric technique, random-effect approach is used to estimate Equation 1.

Additionally, three tests are applied: (1) the joint significance, (2) the Breusch-Pagan test, and (3) the Hausman test. The p-values by orderly are (1) 0.01, (2) 0.05, and (3) 0.10. The outcomes are likely to confirm that the fixed effect approach is a more suitable approach than the pooled Ordinary Least Squares regression (OLS). As a result, the fixed effect approach is chosen to estimate Equation 1.

5. RESULTS

Three estimations of equation (1) are conducted for the Turkish cities from 2014 to 2019. Table 3 shows the estimation results from the ordered profit approach, the fixed effect approach, and the random effect approach. Column 1 contains the ordered profit estimations of regression, Column 3 contains the random effect estimation of equation (1), and lastly, Column 5 contains the fixed effect estimations of regression. The column 2, 4, and 6 report the robust standard errors.

The very early results confirm that there is an association between income inequality and infant mortality rates. As another economic factor, income level has a statistically significant impact on the IMRs.

The results indicate that the income distribution problem is associated with an increase in infant mortalities across the study regions. For example, row 3 in Table 2 shows that one additional increase in the Gini coefficient is associated with the increase of IMRs in each estimation applied in the present study (coefficients of 3.914, 8.846, and 9.131 respectively the ordered profit, random effect, and fixed effect approaches). Comparing these findings with the literature, one can see that the income distribution varies and has an impact on the infant mortality rates, which is consistent with the results in the present study (Ehntholt et al., 2020: 775; Pabayo et al., 2019: 5). Detollenaere et al. (2018), indicate that to

reduce the income distribution problem as well as its adverse impact on individuals' wellbeing, public policies should focus on strengthening the primary care systems.

Table 3 also shows that unemployment rates and labor force outcomes are negatively related to the IMRs. For example, based on the findings from the fixed effect estimation, a relatively high unemployment rate is negatively associated with the IMRs (coefficient of -0.13). One can see similar trends in the labor force participation rate. As seen in Table 3, an increase in the labor force participation rate is likely to decrease the number of infant mortalities per 1,000 births. (OP: coefficient of -0.085 and RE: -0.187).

In addition to the socio-economic indicators, several medical factors are included in the present study. Table 3 rows 8 to 12 presents the estimation results related to the impact of health service availability and the IMRs. The results indicate that an increase in the number of hospitals per 100,000 population is decrease the number of infant mortalities significantly (OP: coefficient of -0.241 and RE: -0.656). It is expected to see a negative relationship between the number of health providers and better health outcomes such as a decrease in the IMRs. The existing literature provides several studies to confirm the negative association between the number of hospitals and the IMRs (Gruber et al., 2014: 105-106; Çelik et al., 2012: 34).

Surprisingly, we could not find any evidence about the association between the number of doctors and any health outcomes. On the other hand, findings support that an increase in the number of nurses results in a decrease in infant mortality rate (OP: coefficient of -0,007 and RE: -0.009).

This study confirms the inverse relationship between the income distribution and the IMRs during the period of 2014 -2019 in the provinces of Turkey. Provinces with the higher Gini coefficient have tendency for the high rates of infant mortality. The findings are in line with the existing literature (Çelik et al., 2012: 34; Ehntholt et al., 2020: 775).

6. CONCLUSION

The impact of economic indicators on health outcomes is well established in the literature. Particularly, while the complexity of determinants of infant mortality has been extensively acknowledged in the developed countries, there exists a limited number of research to analyze the impact of income inequality on the IMRs in the developing countries. This study investigates how income distribution, employment status, and the socioeconomic factors affect the infant mortality rates in Turkey. A province-level dataset from 2014 to 2019 is used to analyze the factors related to IMRs. The estimation is conducted by employing three different approaches.

The key explanatory variable, the Gini coefficient, shows statistically significant impact on IMRs in each econometric approach. It is expected to see that an increase in the Gini coefficient is like to

increase the number of infant mortalities per 100,000 population. Among the economic indicators, the Gini coefficient has relatively higher impact than other variables.

The present study may conclude that medical factors (such as access to health services and number of doctors / nurses per 100,000 population) and a better income distribution are the significant factors of lower IMRs. An increase in the number of health providers may help reduce the number of infant mortalities in the population. Tangible movements related to income distribution and number of health workers should be taken by policymakers and governmental organizations to target lower infant mortalities. At the same time, the dynamic role of women cannot be ignored. Therefore, community health information programs in each local area might be an efficient option to have better health outcomes.

As previously discussed in the literature, the availability of health services is an important factor to acquire better health outcomes (Cesur et al., 2017: 75). Thus, the nurse in the Family Medicine Centers FMC plays an important role to decrease infant mortality rates in Turkey. Since 2010, the FMCs have existed in almost each neighborhood. It is free of charge and on a walk-in basis. The estimation findings confirm that an increase in the number of nurses per 100,000 population is very important to reduce the IMRs.

Ideally, longitudinal research would have a better explanation power to estimate the relationship between the income inequality and infant mortality rates in the developing counties. Future research might address this limitation.

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TABLE AND FIGURES

Table 1. Data Definitions and Sources

Variable	Definition	Source
Dependent Variables		
Infant mortality rate	Per 1,000 live births	The Turkish Statistical Institute
Medical Factors		
Number of hospitals	Number	Republic of Turkey-Ministry of Health
Hospitals (per 100,000)	Per 100,000	Republic of Turkey-Ministry of Health
Number of doctors	Number	Republic of Turkey-Ministry of Health
Number of doctors (per 100,000)	Per 100,000	Republic of Turkey-Ministry of Health
Number of nurses	Number	Republic of Turkey-Ministry of Health
Number of nurses (per 100,000)	Per 100,000	Republic of Turkey-Ministry of Health
Number of beds (per 100,000)	Per 100,000	Republic of Turkey-Ministry of Health
Socio-economic Factors		
Gini coefficient		
Unemployment rate	Percentage	The Turkish Statistical Institute
Labor force participation	Percentage	The Turkish Statistical Institute
Income level (Dollar)	Thousand Dollar	The Turkish Statistical Institute
Population	Number	The Turkish Statistical Institute

Table 2. Summary Statistics

Variable	Mean	Median	S.D.	Min	Max
Dependent Variables					
Infant mortality rate	9.77	9.18	2.96	3.08	24.5
Medical Factors					
Number of hospitals	18.8	12	27.7	1	238
Hospitals (per 100,000)	2.44	2.17	0.99	0.765	7.3
Number of doctors	1790	713	3900	105	33,100
Number of doctors (per 100,000)	155	143	44.7	72.4	315
Number of nurses	1,990	1,070	3,430	146	34,500
Number of nurses (per 100,000)	206	202	46.9	89.5	364

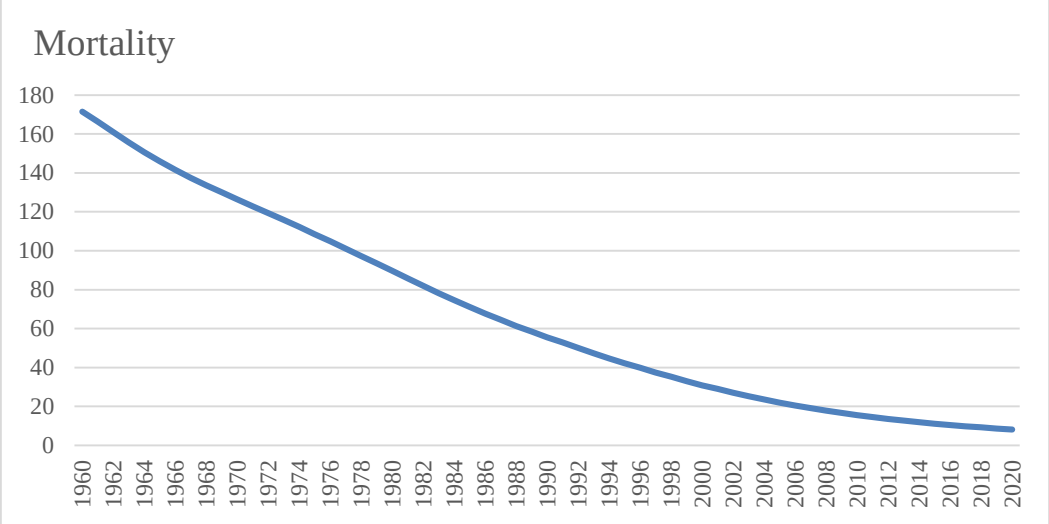
Number of beds (per 100,000)	271	254	85.2	120	655
Socio-economic Factors					
Gini coefficient	0.349	0.35	0.0281	0.29	0.44
Unemployment rate	9.58	8	5.06	3.4	28.3
Labor force participation	50.9	51.5	4.51	37.1	59.7
Income level (Dollar)	8,200	7,800	2,910	3,200	19,957
Income level (Squared)	67,240,00	60,840,000	8,468,100	10,240,00	398,281,849
Population	985,000	527,000	1,780,000	78,600	15,100,000

Table 3. Estimation Results of Infant Mortality Rates

	Ordered Probit		**Random Effect**		**Fixed Effect**	
Variable	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Constant			18.143***	4.299	8.179	6.092
Economic Indicators						
Gini Coefficient	3.914**	0.064	8.846*	4.617	9.131*	5.222
Unemployment rate	-0.0003	0.002	-0.045903	0.034	-0.133***	0.044
Labor force participation rate	-0.0851***	0.002	-0.187***	0.052	-0.072	0.061
Income level	-0.000***	0.001	0.000	0.000	0.0002	0.000
Squared income level	0.000	0.000	0.000	0.000	0.000	0.000
Medical Indicators						
Number of hospitals per 100,000	-0.241***	0.064	-0.656***	0.211	-0.571	0.758
Number of doctors per 100,000	0.0007	0.002	0.001	0.006	0.002	0.013
Number of nurses per 100,000	-0.007***	0.002	-0.009**	0.004	0.006	0.007
Number of beds per 100,000	0.001*	0.001	0.000	0.003	-0.009**	0.004
Number of provinces	81		81		81	
Number of observations	486		486		486	

*** p < 0.01, ** p < 0.05, * p < 0.1.

Graph 1. Infant mortality Rate between 1960-2020 in Turkey (per 1,000 live births)



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