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# The Relationship between Socioeconomic Differences and Economic Uncertainty: Analysis of Infant and Child Mortality in Turkey

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**Abstract**

The purpose of this study is to examine the relationship between socio-economic differences and short term economic fluctuations in terms of infant and child mortality. Underestimation of macroeconomic factors on demographic behaviors of different socio-economic characteristics in previous studies, and regional differentials in infant and child mortality were the main reasons that motivated me to study this topic. To overcome deficiency in the literature for Turkey, I have employed an approach that has the capability to analyze individual level demographic responses in times of economic stress. More specifically, combining micro demographic data with macroeconomic data as a time varying covariate in a life event analysis framework has given me the ability to examine infant and child mortality among different characteristics. By using this approach, I have gained new perspectives in examining the possible determinants of infant and child mortality.

**Keywords:** Infant mortality, Child mortality, Turkey, Short term economic fluctuations, Micro approach

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## 1. Introduction

From early ages to today, the relationship between economic factors and demographic behaviors has attracted numerous authors' attentions. This relationship has been studied from many perspectives for a long time. Not only demographers but also economists and historians contributed to the literature with their valuable findings. However, causal links between various factors were quite broad, so it has not been possible yet to study this relationship with limited sources. Therefore, followers of different disciplines have mastered in their instruments but left the other perspectives unexplained.

An early attempt to explain this relationship came from Malthus (1803) with his "An Essay on the Principles of Population" study. Due to the time period, he defined the quantity of resources as a limitation on population growth. From an economist's point of view, Malthus saw poverty as a positive check on population growth. Therefore, due to his findings, while wage levels were increasing, mortality levels could be expected to decrease.

Until the 1980s, the relationship between long term economic factors and demographic behaviors was the main concern of scholars. After the 1980s, several studies (Lee 1981, Bengtsson and Ohlsson 1958, Galloway 1988) have been conducted to examine the short term economic effects on demographic behaviors. It has been found that demographic responses differentiate among contemporary and historical populations (Lee 1990) and short term economic shocks affect the particular age groups and sexes differently (Bengtsson and Ohlsson 1985). Unfortunately, analyzing the aggregated level data gives no information about the divergences in demographic responses among socio-economic characteristics. Therefore, Bengtsson (1993) developed the idea of analyzing the micro demographic data and macroeconomic data in a framework where event history analysis and time-series approaches are combined. Bengtsson's approach has given us the ability to examine the differentiations in demographic behaviors in times of economic stress.

From the aspect of Turkey, the high levels of infant mortality have been defined as a Turkish Puzzle, due to the uncorrelated relationship between GNP per capita and infant mortality rates (Aksit and Aksit 1989). As a result, neither the GNP per capita nor the other criteria of development seem to explain the high incidence of infant deaths in Turkey (Adlakha 1970). Therefore, numerous studies (Goldberg and Adlakha 1969, Cerit 1975, Tezcan 1985, Tuncbilek 1989, Eryurt and Koc 2009) have been carried out to show these obvious divergences in infant and child mortality among socio-economic groups. Unfortunately, besides the studies which demonstrate differentiations in demographic behaviors among socio-economic characteristics, no study has been conducted to analyze the differences in demographic responses of different socio-economic groups in times of economic stress. Therefore, to overcome this deficiency from the aspects of infant and child mortality; the approach developed by Bengtsson has been employed in

this study. With this approach, it has become possible to examine the divergences in infant and child mortality responses in times of short term economic fluctuations in Turkey.

### 1.1 Research Question and Aim

One of the main issues in the rationale of this study was the opportunity to examine the relationship between socio-economic differences and economic factors from the aspects of infant and child mortality in Turkey. To analyze this relationship; this thesis aims to explain several questions. Precisely, this study is focusing on answering these questions:

- Do economic factors at family level affect the levels of infant and child mortality?
- Do economic fluctuations have effects on the levels of infant and child mortality?
- How do economic factors at family level affect the levels of infant and child mortality in times of economic fluctuations?

Several processes will be followed to explain the relationship between socio-economic differences and economic fluctuations. Since the relation between economic conditions of families and levels of infant and child mortality has been studies several times, examining the second and third questions will determine the differences between this study and the previous researches.

Furthermore, to demonstrate the relationship between socio-economic differences and economic variations, micro demographic data and macroeconomic data will be used. By using micro demographic data, we will be able to define demographic responses among socio-economic and other characteristics. In addition to the benefits of using micro demographic data, using macroeconomic data will allow us to analyze variations in price levels which in turn will enable us to examine divergences in responses of different socio-economic characteristics in times of economic stress. For this purpose, I will prepare two concepts of price levels. In the first one, the effects of price variations at the time and before the time of death for infant and child mortality will be examined. The rationale for the study of economic variations from this aspect is to examine the paths followed by different socio-economic characteristics to economic uncertainty. As a second concept, early life effects on child mortality will be analyzed by including the price and IMR levels at foetal and infancy stages. With this model the specific focus will be on the vulnerability of parents to economic and environmental factors.

In addition, the approach employed in this study requires micro level demographic data to research the infant and child mortality responses at individual levels. Therefore, the 1993, 1998

and 2003 Turkey Demographic and Health Surveys have been used to gather individual, family and community level information. Considering the determinants of infant and child mortality, information in Demographic and Heath Survey is rich enough to apply the desired method.

### 1.2 Outline of Thesis

In chapter 2, the economic background of Turkey will be given to comprehend the relationship between economic factors and demographic behaviors from the foundation of Turkish Republic to today. In addition, fluctuations in major economic indicator will also be given to illustrate possible economic shocks that individuals have faced overtime. At the same time, developments in infant and child mortality will be demonstrated with the help of several statistics and findings from previous studies.

Chapter 3 mainly focuses on the rationale behind the model. Therefore, previous studies with different approaches will be reviewed in order to clarify the model selection. Also, previous studies especially based on infant and child mortality will be reviewed for countries that have different characteristics. With this way, we will be able to have different perspectives in terms of contemporary and historical periods.

In chapter 4, several theoretical frameworks will be given to define the determinants of infant and child mortality. In this section, statistical models will be formed by using available information in the dataset.

In chapter 5, first the source of demographic data will be given. Following, descriptive statistics of demographic data will be examined to illustrate socio-economic, demographic and other characteristics. In addition, infant mortality rates in Turkey will be shown and the preparation process for statistical analysis will be demonstrated. After that, the definition of economic data will be given. As well the relation between variations in price levels and population will be interpreted in this chapter.

In chapter 6, the statistical model that is employed in this study will be explained by defining the parameters of the model. Furthermore, variables and expectations from these variables will be stated by indicating the several reasons behind these expectations.

In chapter 7, results of statistical models will be presented and after that interpretations of the coefficients will be performed. In addition to this, unexpected results will be examined briefly to prevent misleading interpretations.

In chapter 8, possible limitations and summary of results will be stated. In addition, findings from estimated results will be discussed by comparing the finding of previous researches in order to draw reliable and consistent conclusions. Regarding to the conclusion, prospects for future research will be discussed.

## 2. Background

In this section, first; economic background of Turkey from the foundation of the Turkish Republic to today will be reviewed to demonstrate the economic conditions and secondly, the patterns of infant and child mortality will be considered. As well several studies will be briefly reviewed in order to illustrate several perspectives.

### 2.1 Economic Background of Turkey

#### 2.1.1 An Overview of Economic Development

After the foundation of the Turkish Republic, several economic development strategies were carried with the aim of achieving a stable and self sufficient economy. In the 1920s, the economy was generally based on agriculture. However after the foundation of the Turkish Republic in 1923, liberal policies and encouraging legislations were applied to improve the condition of the economy. Despite of the effects of new policies and legislation, the industrialization started only after the beginning of the 1930s. From 1930 to World War II, identical policies were followed to move the economy from agriculture to an industrialized economy. While the industrialization process was continuing, effects of World War II slowed down the economic growth. Therefore, liberal policies were fortified by mixed statist economic policies to sustain economic growth.

After the 1950s, to achieve steady economic growth, a series of five year development programs were prepared from the beginning of 1960s. The rationale of these programs was to remove the negative effects of unplanned and uncontrolled policies that were carried out in the 1950s. With the assists of these development programs, from the 1960s to the 1980s an economic policy based on the substitution of imports was followed by protecting the industries with custom tariffs and other taxes. On the other hand, in the 1980s, the early economic policies were changed completely. Governments established new economic growth policies based on an export-oriented strategies. More specifically, the economy shifted from a statist system to a more private sector, market based economy. Therefore, as a response to stagnation in the 1970s, considerable economic growth has been seen in the 1980s due to increasing levels of foreign direct investments and exports. However, the high rates of economic growth did not last too long. Lack of additional fiscal reforms, combined with large and growing public sector deficits and widespread corruption, resulted in high inflation, a weak banking sector and increased macroeconomic volatility (OECD Reviews of Regulatory Reform – Turkey: crucial support for economic recovery, 2002).

During 1990s, the government attempt to overcome the economy's problems through privatization policies. Most of the state enterprises, even the profitable ones, have been sold to multinational companies. We have been observing that the policies that were performed after

1980s, made the high inflation rates steady, brought volatility into GDP growth rates and consequently, made the economy vulnerable and highly dependent to external economic shocks.

Nowadays, Turkey has the world's 15th biggest GDP (PPP) (The World Bank: World Economic Indicators Database GDP (PPP) 2008), with a 2009 GDP per capita level around USD9000 (World Economic Outlook Database - April 2010, International Monetary Fund). In terms of economic sectors, the Turkish economy is dependent on industry, mostly located in the Western part of the country. On the other hand, in the less developed parts, dominant effects of agricultural sector are still continuing. However, when we check the sectoral distribution in whole country, the proportion of the agricultural sector accounts for 8.9% while the other sectors' contributions to GDP are 30.8% for industry and 59.3% for the services sector (CIA Fact-book).

### 2.1.2 Fluctuations in the Economic Indicators

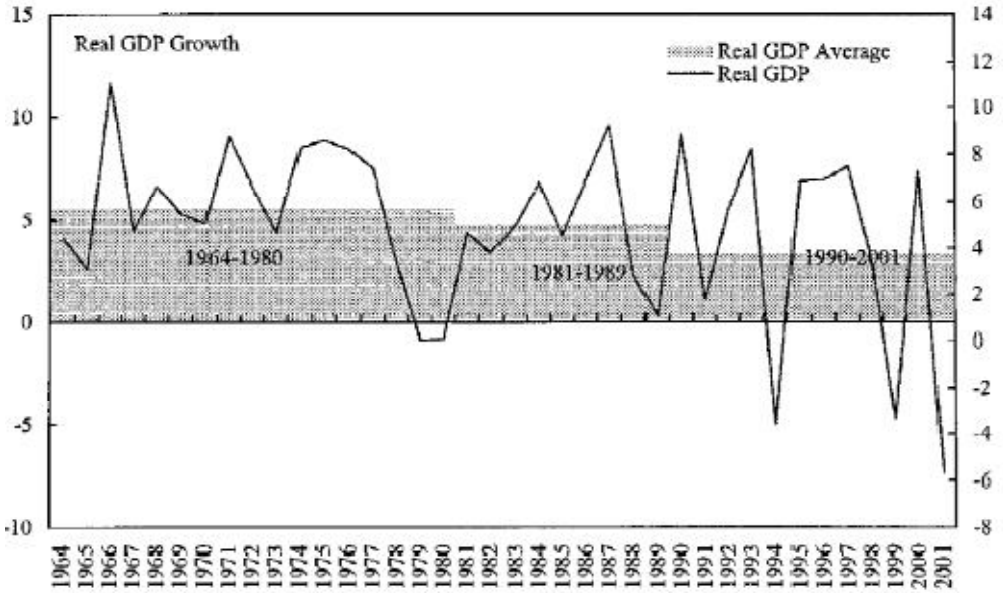
This part demonstrates the economic instability of Turkey by presenting the fluctuations in the major economic indicators such as; GDP and inflation rate. Basically, GDP is an indicator of the economic output of a country. In addition, it is the market value of final outputs and services that were made within the country's borders in a year. Therefore, it is a reflective indicator of economic conditions for measuring the productivity in the economy year by year. On the other hand, inflation rate is a measurement of fluctuations in the price levels of goods and services in the economy from one year to another. Since the inflation rate is used to define price volatility in goods and services, the effects of variations in inflation rates can be both positive and negative to individuals. For instance, high inflation rates could cause to degradation in the real value of money. And policy makers might not react to increasing inflation rates rapidly to adjust the wage levels. Therefore, unadjusted wage levels could decrease the purchasing power of people while the prices of goods and services are increasing. Consequently, fluctuations in inflation rates can be used to measure demographic behaviors when related indicators such as, wage levels are taken into account.

The figure below demonstrates the GDP growth rates of Turkey between 1964 and 2001. As you can see the GDP growth rates are quite volatile due to the economic uncertainties over the years. While the early policies and growth strategies were providing steady level of GDP growth, after the energy crisis in the mid 1970s, the GDP growth became more volatile. After the 1980s, the shift in the economic system mainly caused instability in the economy and made the economy vulnerable to economic crisis. Kibritcioglu (2001) defines the several reasons behind the economic crisis by the insufficient and continually decreasing employment levels and points out the shrinkage in the outputs of goods and services. He also states that the importance of the relationship between political instability and macroeconomic crisis could not be underestimated.

As it has been demonstrated in the figure considerable fluctuations after mid the 1980s not only caused economic instability but they also decreased the average level of GDP and consequently,

made the forecasting process of economic growth and inflation even harder (Leigh and Rossi, 2002).

*Figure (1): Real GDP Growth in Turkey; 1964 - 2001*




*Source: Leigh and Rossi (2002)*

Regarding the inflation rate, volatility is not different from the volatility of GDP growth rates. Therefore, from the difference between time periods, one can see that the economic policies prior to the mid 1970s were able to hold the inflation rate under 10%. However, changes in economic policies, which intended to decrease inflation rates and to transform the economy into a more market based economy, caused high levels of inflation rates and numerous economic crisis after the 1980s.

The economic condition of Turkey was quite instable that the levels of inflation rates took place at the same level as the highest inflation rates – for countries that have had the highest inflation rates at national level – in the world. In addition, we have also seen that the deflation trend in the world after mid 1990s could not be followed by Turkey. According to Kibritcioglu (2002), the reason behind the divergence from the deflation trend in the world can be explained by several factors that have led the country to financial crisis. More specifically, declines in the balance of payments, high interest rates and low exchange rates have made the Turkish economy highly addictive to hot money. And despite of the financial crisis (December 1993 - April 1994) that caused by increasing amounts of debts, the same economic strategies continued to be followed by policy makers. Therefore, chronic inflation has been seen due to consistent increases on price

levels during this period. In the following years, economic condition in Turkey worsed and several banking (November – December 2000) and currency crisis (February – March 2001) occurred (Kibritcioglu, 2002).

*Figure (2): Inflation rates in the World, in the USA, in developing countries and in Turkey*


*Source: Kibritcioglu (2001)*

On the other hand, in terms of the effects of economic fluctuations on demographic behaviors, rather than the steady ones, having the volatile macroeconomic indicators is important in order to analyze demographic and economic relations. In terms of this study, the cost of living index has been used to indicate economic conditions in Turkey. Further information is given about this indicator in the data section.

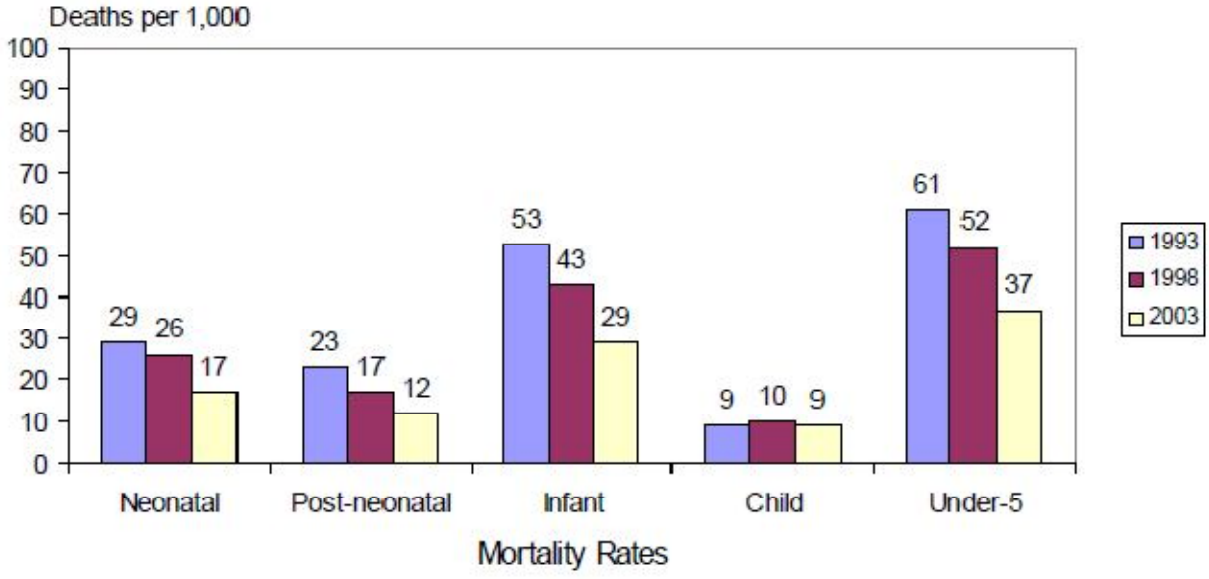
## 2.2 Infant and Child Mortality in Turkey

For a considerable amount of time, Turkey has been considered a country that has had quite high infant and child mortality. From 1940s until 1980s, the infant mortality rate was decreasing very slowly from 274 deaths per 1000 to 100 deaths per 1000 (Turkish Statistical Institute, Turkish Population; 1923 – 1994, 1995). Several scholars (Aksit and Aksit 1989, Gursoy-Tezcan 1992) defined these unexpected high infant and child mortality rates as a Turkish Puzzle. In addition, in order to highlight the problem; Aksit and Aksit (1989) compared Sri Lanka and Turkey with

reference to the levels of GNP per capita rates and infant mortality rates. They state that although "they are aware that the historical relationship between income and mortality during economic development can be highly variable, yet it is puzzling that Sri Lanka with one-third of the Turkish per capita GNP has half the Turkish infant mortality" (Aksit and Aksit, 1989; 571). Therefore, several studies have been carried out to analyze the determinants on infant and child mortality in Turkey. While some studies (Gursoy-Tezcan 1992, Aksit and Aksit, 1989) focus in the general determinants explaining the high rates of infant and child mortality, others (Eryurt and Koc 2009, Yuksel 2004) analyze the specific factors, such as: wealth status of households and gender inequality. Today, we have seen that the Turkish Puzzle has been solved by looking at the infant mortality rate, which is around 29 deaths per 1000 (TDHS 2003).

In the figure below, declining trends in infant and child mortality rates as well as neonatal, post-neonatal and under-5 mortality can be seen. However, one should indicate that since these mortality rates were taken from the 1993, 1998 and 2003 Turkey Demographic and Health Surveys, there might be divergence between these rates and national level mortality rates. The mortality rates in the figure below might not be as same as national level mortality rates. Nevertheless, it can be used as a source to reflect the improvement in infant and mortality rates basically. As it can be seen, from 1993 to 2003, neonatal and post-neonatal mortality dropped by almost 30% and 45% respectively. At the same time, the decline in infant mortality is around 38%.

*Figure (3): Trends in infant mortality; Estimations for TDHS – 1993, TDHS – 1998 and TDHS – 2003*




*Source: Report of Turkey DHS 2003*

Furthermore, according to Eryurt and Koc (2009), these improvements in infant mortality rates could not reflect the differences among socio-economic and regional groups. By analyzing the relation between infant mortality and socio-economic characteristics in the 2003 Turkey Demographic and Health Survey, they have found that the risk of death for infants who are in the poorest classification is 4.7 times more than the ones in the richest group.

In a further research, it has also been shown that individuals in the poorest groups are more likely to have lower education and not be able to benefit from health services due to their economic conditions. Findings of early studies (Goldberg and Adlakha 1969, Adlakha 1970) on the relation between education level and infant mortality also support the outcomes of Eryurt and Koc (2009). In addition, Aksit and Aksit (1989) also state the importance of the education levels of parents in infant and child mortality by adding modernization and urbanization factors as the proxies for infant and child mortality.

In the context of this study, besides the effects of being in different demographic and socio-economic groups on infant and child mortality, the analysis will also go further and include variations in the economy. Therefore, we will also be able to gather information about the infant and child mortality responses among different demographic and socio-economic characteristics in times of economic stress.

## 3. Previous Researches

In this section, previous researches in terms of demographic responses to economic factors will be reviewed in order to understand development process of approaches and to clarify the expectations from this study. With reviewing the previous studies, we will not only be able to understand the relationship between demographic behaviors and economic factors but we will also be able to gather information about this relationship from the aspects of different characteristics of countries as well as different time periods. Unfortunately, in terms of the relationship between demographic behaviors of different characteristics of groups and macroeconomic factors in Turkey, finding an early research in the literature is not possible. While most of the previous studies for Turkey are mainly focusing on the demographic transition and the determinants of demographic indicators, the relationship between demographic behaviors of different characteristics of groups and macroeconomic factors have been left unexplained.

To overcome this problem, several studies for countries that have similar economic conditions as Turkey, will be reviewed. This way, at least we will be able to understand the basic pattern in the relationship between demographic behaviors and socio-economic as well as other characteristics from the aspects of several developing countries.

There have been many scholars and authors that have studied the relationship between demographic behaviors and economic factors with different types of methods. Despite of

different methods, the main outcomes from these studies were mostly similar. Moreover, these studies have shown that the relationship between demographic behaviors and economic factors is obvious and consequently, any fluctuations in economic indicators have positive and negative effects on demographic behaviors.

While the authors of very early studies were using basic statistical tools to show the demographic responses to fluctuations in economic indicators, an important method (Lee 1981) have been developed in the last quarter of 20$^{th}$ century. Lee's method gave researchers the ability to measure the magnitude and lag structure of demographic responses to fluctuations in economic indicators. At that time, this method attracted attentions of many scholars who rapidly adopted it in their studies (Lee 1990, Galloway 1988, Ortega 1996) measuring the magnitude and lag structure of demographic responses for different characteristics of countries and different time periods. Bengtsson and Ohlsson (Bengtsson and Ohlsson 1985), on the other hand, use spectral analysis and distributed lag models in order to analyze the demographic responses to short-term economic stress for historical periods of Sweden. In following years, Bengtsson improved distributed lag models, and with this improvement, differences in demographic responses could be measured for groups of ages and sexes (Bengtsson and Ohlsson 1985). However, studying the relationship between fluctuations in economic indicators and demographic responses of different socio-economic groups was still impossible with aggregated level analysis methods. While most of the aggregated level studies were showing clear links between demographic behaviors and economic factors, and demonstrating the magnitudes and lag structures of demographic responses to short term economic fluctuations; they generated bigger question marks in our minds. It is obvious that the outcomes of these studies helped us to gain significant information in order to explain demographic behaviors in different time periods for different countries. However, when we consider the main purpose of these studies – to measure the magnitudes and the lag structures of demographic responses to short term economic stress – they were insufficient and left the most important question unexplained "Who are the most vulnerable ones to economic stress?". Today, we have seen that, with the help of Bengtsson's micro approach (Bengtsson 1993) we can properly demonstrate the demographic responses for specific characteristics of individuals, occupation groups, etc. in times of economic stress. Basically, to study demographic responses to economic fluctuations at individual or household level, Bengtsson combined a time series and an event history approach within a Cox regression framework (Bengtsson 1993). After the introduction of this method, it has been used in many studies for different characteristics of countries from the aspects of historical and contemporary periods.

### 3.1. Different Methods on Measuring the Demographic Responses to Economic Fluctuations

From on, the relationship between population movements and economic factors attracted scholars' attention. We have seen that Malthus (1803/1992) was using one of the important approaches to explain the factors that affect population growth at long term period. In addition,

Malthus introduced the idea of limited resources as a controller of population growth by defining the positive checks like; increase in mortality rates and preventative checks like; decrease in fertility rates. According to Malthus, positive growth in population size could be explained by increasing wage levels, which causes increase in fertility levels while mortality levels are decreasing. However, as it was indicated before, growth in population size was limited by positive and preventative checks. In following years, studies of Malthus have been used and improved by many scholars. Not only theoretical foundations of Malthus have been improved but statistical approaches have also been developed and employed by many scholars in order to support theoretical foundations.

In this section, several statistical approaches in measuring the demographic responses to economic fluctuations will be reviewed to show how different approaches have been used and what these specific methods focus on.

It has been seen that in the studies before the 1980s, mostly basic statistical tools were used to show the link between economic factors and demographic behaviors. However, in 1981, Lee (1981) developed a statistical approach which allows scholars to measure the magnitudes and lag structures of demographic responses to economic crisis. One could indicate that this statistical approach concerned mainly the effects of short term economic fluctuations on demographic behaviors. The main reason to study short term fluctuations was to gather information about population action related to mortality and fertility behaviors. According to Lee, analyzing the effects of short term economic fluctuations might lead to entirely different outcomes in terms of long term behaviors but he also indicated that "the study of short run fluctuations has the advantage of requiring very little data and being highly resistant to problems of poor data, under-registration, lack of reliable denominators for rates and so on." (Lee, R.D. 1990, pp. 2). At that time, this model was very successful that it attracted many scholars' interests and in following years, it was employed for different characteristics of countries (Galloway 1988, Langsten 1980). For analysis purposes, necessary data should include time series of birth rates, death rates and grain prices. In addition, the series should also be at least 30 years long. More specifically, to analyze short term fluctuations in prices, it was essential to remove the long term variation from the indicators. For that reason, de-trended demographic and economic data were analyzed by scholars within a distributed lag regression framework. Since the model was used to measure the magnitude and lag structure of demographic responses "it is likely that the dependent variable is affected not only by the impact of the contemporary explanatory variable, but also by previous values of the explanatory variable." (Galloway, P. R. 1988, pp. 282). This kind of approach was necessary while the reactions of demographic behaviors to fluctuations in price levels might not be instant and it might take some time to respond to the new circumstances. In Lee's studies (Lee 1981, 1990), pre-industrial periods of Europe and contemporary periods of developing countries have been studied with distributed lag models. Lee's findings have shown that in terms of mortality response for European countries, after drastic increase in prices high mortality level continues for two years. On the other hand, from the aspect of developing countries, the mortality

response is not only larger but the effect of mortality response is intensified in the first year. Estimations of demographic responses with distributed lag models have shown that in early studies, misleading results have been reported due to missing lagged patterns of demographic responses. However, Lee also indicated that "the models estimated here are very stripped down, and it would be preferable to include a wider range of variables, such as temperature, identifiable non-economic epidemics and political and military disturbances" (Lee, R.D. 1990, pp. 13).

The same approach has been also used by Galloway (1988) for a number of pre-industrial European countries. The basic patterns of Galloway's findings were not different from Lee's estimations. However, Galloway's study included many countries in a comparative setting. By comparing several European countries at different time periods, Galloway found that the magnitude and the timing of mortality response to fluctuations in prices are different for different characteristics of countries and it has also been observed that the differences in the magnitude and the timing of mortality response depend on the industrialization, urbanization and income levels of the countries. As it was indicated before, it is a significant concern for scholars to measure the reliability of their approaches by finding supports for their estimations in terms of theoretical foundations. According to Galloway, his findings were fulfilling the expectations of theoretical foundation. He indicated that "among the countries analyzed, the positive check was found to be the major determinant of differences in the magnitude of change in the population growth rate resulting from high prices. The strength of the positive check relative to the preventive check appears to diminish with economic development." (Galloway, P. R. 1988, pp. 298).

Benefits of distributed lag models were high compared to early methods however, according to Lee, it still needed to be improved for deeper analysis. For that reason, Bengtsson (Bengtsson and Ohlsson 1985) used distributed lag models and spectral analysis in order to measure the demographic responses to short term economic fluctuations in terms of age and sex differences. In their study, to explain the shift in standard of living, mortality responses to short term fluctuations in wage levels have been studied for Sweden between 1750 and 1860. The major improvement in Bengtsson study was to combine distributed lag model with spectral analysis by "assessing the parameters of a distributed lag model where an autoregressive element (AR1) was incorporated, estimating the parameters for the model" (Bengtsson and Ohlsson, 1985, pp. 320) and to measure the mortality responses through the age groups. This way it became possible to interpret the most vulnerable age group to economic fluctuations. As a result, Bengtsson and Ohlsson's study showed that fluctuations in real wage levels have quite strong effects on mortality behavior of persons aged 20 and more. However, the relationship between mortality and real wages for other age groups has occurred less sensitive. According to Bengtsson and Ohlsson, this means fluctuations in real wages are not so important compared to other factors for some age groups. This finding also showed that how necessary and significant it is to analyze the demographic responses of different age groups.

After the 1980s, many kinds of methods in the analysis of demographic time series have been developed by other scholars (Bengtsson and Ohlsson 1985, Lee 1981, Eckstein, Schultz, and Wolpin, 1985). However, development of these methods also caused new problems. It was vital to know which method was more reliable and best for the analysis of demographic responses to short term economic fluctuations. To solve this problem, Bengtsson and Brostrom (1997) prepared a study that compared different time series methods to measure the demographic responses to short term economic fluctuations. Their study showed that using distributed lag model sometimes gives misleading results in terms of lag structure and magnitude of demographic responses. To overcome this problem, Bengtsson and Brostrom suggested that using less restrictive models such as VAR and VARMA models would be more suitable in the analysis of demographic responses to short term economic fluctuations.

When we consider the basic concept of distributed lag models, it has been a significant improvement to measure the demographic responses through age groups. However, this kind of aggregated level analysis still does not give any information about the demographic responses of different socio-economic groups. According to Bengtsson, the analysis of aggregated level economic and demographic time series also has its pitfalls. One problem comes from the high levels of aggregation. They have covered the whole population of England, France, Sweden, or other countries. They show the average demographic responses for large populations and cannot reflect the various age, gender, or social differences within the populations (Bengtsson, Campbell, Lee, et al. 2004). To overcome this problem, Bengtsson developed a method that combines a time series and an event history approach within a Cox regression framework (Begntsson 1993). Combining the micro demographic data with macro economic data has allowed us to study the relationship between short term economic fluctuation and socio-economic status at individual or household level. His approach has attracted many scholars' interest and it has been used in various studies in terms of historical and contemporary periods. In Bengtsson's studies, this approach has been used to measure many demographic behaviors such as mortality, fertility and nuptiality. It is important to focus on short term economic fluctuations since Bengtsson defined measuring the concept of standard of living as the ability to overcome short term economic stress (Bengtsson, Campbell, Lee, et al. 2004). In one of his study with Dribe (Bengtsson and Dribe 2002), micro level demographic data from four parishes in southern Sweden have been used to measure the standard of living by employing the micro approach. The main concern of this study was to analyze the standard of living by measuring fertility and mortality responses of different characteristics of socio-economic groups to short term economic stress. To show the actual living circumstances at different time periods, dataset was split to three periods; pre-transformation (1766 – 1815), transformation (1815 – 1865) and industrialization phase (1865 – 1895) and most importantly, infants and elderly individuals were not included to the model estimations. According to Bengtsson and Dribe, the reason behind this elimination is; these groups of individuals are considered as the most vulnerable ones to economic stress, thus to overcome the sensitiveness of these groups' mortality responses, the analysis have been done for the ages between 1 – 15 and 25 – 55. As a result, it has been found that there are very strong

effects of short term economic stress on the mortality of children and adults who belong to landless group. Due to micro level analysis, important information was gathered about individuals' resistance levels to economic stress. In order to measure standard of living, this way of approach seems very valuable for providing significant information about living conditions at early periods. Today we have seen that Bengtsson's method have been employed by many scholars in their studies and outcomes from this type of studies are quite significant and informative in terms of demographic behaviors in times of economic stress as well as to explain the improvements in standard of living overtime.

### 3.2. Studies on Measuring the Effects of Socio-Economic Status on Infant and Child Mortality

In this section, mainly studies on relation between infant and child mortality and economic factors will be focused on. As it has been indicated in the previous section, various types of methods have been used to measure the effects of several factors on infant and child mortality. Similar to adult mortality responses to economic factors, aggregated level analysis gave no information about the mortality responses of different socio-economic classes. According to Bengtsson, it is also very difficult to get an idea of the casual mechanism between economic fluctuations and mortality (Bengtsson 1999, pp 120).

One of the study that analyze the relationship between child and infant mortality and economic factors has been done by Bengtsson (1999) for a parish locates in the central Sweden and called Vastanfors. Necessary micro demographic data has been gathered from the family reconstitution data for Vastanfors. The main rationale of this paper is to overcome the deficiency of micro studies in the literature by analyzing infant and child mortality responses to short term economic stress in terms of socio-economic differences. Consequently, outcome of this study enlighten the many casual links between economic fluctuations and mortality and also, provide valuable information about the living conditions in historical periods. In the study, two separate models have been prepared for infant and child mortality responses since the dependency of these groups to economic factors are quite different. Analysis of the models has been done by a method that was introduced by Bengtsson (1993) and consequently, it has been found that for children over the age of one, economic fluctuations and socio-economic status of parents have direct effects on mortality. In addition, it has been also indicated that these effects are even harsher in times of poor harvest. On the other hand, for infants, no direct effects of economic fluctuations on mortality responses have been found for historical periods of Vastanfors. Furthermore, any significant effect of socio-economic status on infant mortality could not be found in the empirical analysis of this study. Nevertheless, the risk of death is higher for infants, children are much more dependent on economic stress. Since Bengtsson indicated the differences in dependencies of infants and children to economic factors earlier in the study; insignificant effects of economic factors on infant mortality was not unexpected. He also suggested that to clarify the possible

explanations of infant mortality, the relation should be analyzed by including several determinants that could explain the patterns between wealth and infant mortality.

Unlike the study of Bengtsson, other studies (Trussell and Hammerslough 1983, Bhuiya and Streatfield 1991, Jatrana 2005, Kembo and Ginneken 2009) were carried out for contemporary periods of different countries. Therefore, when the time periods of these studies is considered, reviewing the outcomes will give us new perspectives about several determinants of infant and child mortality that have been affected by demographic and economic characteristics in a developing country. However, one drawback in these studies is; the absence of macroeconomic data. Lack of macroeconomic data as time varying covariate makes it impossible to measure the effects of economic fluctuations on infant and child mortality. Since only the differences in infant and child mortality among demographic and socio-economic characteristics have been analyzed in these studies, we will not be able to review the effects of macroeconomic factors on infant and child mortality.

One of the early example of individual level study has been carried out for Sri Lanka (Trussell and Hammerslough 1983) by using hazards model analysis. However, since this study is a basic example of hazards model analysis, fluctuations in macroeconomic indicators have not been considered in order to measure infant and child mortality responses. Therefore, the authors of this study used social, economic and demographic characteristics as covariates to demonstrate the differences in infant and child mortality. Regarding to analysis, the data was gathered from World Fertility Survey of Sri Lanka in 1975 for this study. As a result, it has been found that education levels of mother and father cause significant divergence on mortality probability. In addition, type of toilet facility has also been considered as a factor that defines differences in mortality probability. Nevertheless, one could argue that to use of type of toilet facility covariate with education levels of parents in the same model could cause several problems, since the education level of parents can be considered as socio-economic status and type of toilet facility is related to the income level of household, the causal effects between type of toilet facility and education levels of parents might lead the authors to biased interpretations.

Another study (Jatrana 2005) has been carried out for a small region of India to identify the determinants of infant mortality. According to Jatrana (2005), this study is an attempt to examine some of the demographic, cultural, socio-economic and environmental determinants of infant survival at micro level in a backward region of India with the use of multivariate analysis (Jatrana, 2005, pp. 187). As he demonstrated, there has been an impressive decline in the infant mortality rates from 1975 to 2001. On the other hand, according to Jatrana, due to the size of the country; there might be differences in living standards through regions. Accordingly, author selected the Mewat region, which is one of the poor and underprivileged region in India to study mortality conditions. The author gathered the data from a field survey dated between 1996 and 1997. Descriptive statistics states that dataset includes 950 children, 83 of them had died in infancy and others had survived after their first birthday or censored by survey date. As an analysis method, Jatrana employed Cox proportional hazards regression to demonstrate the

differentiation in mortality among different socio-economic and demographic characteristics. After estimation of models, Jatrana found that estimating the relative risks by controlling all factors suggested that being in high socio-economic status has no advantage in terms of children survival. As a result, compared to other studies this outcome was unexpected and therefore to explain this unexpected outcome, Jatrana suggested that the reasons might be the low level of literacy rate in the region as well as the small sample size of the dataset.

In this section, several studies have been reviewed in order to understand the relationship between socio-economic factors and infant and child mortality. Besides Bengtsson's study (Bengtsson 1999), other studies (Trussell and Hammerslough 1983, Jatrana 2005) were carried out for contemporary periods of developing countries however, due to absence of macroeconomic indicators, the effects of short term economic stress on infant and child mortality among socio-economic groups have remained unexplained. Therefore, this study, which analyzes the contemporary periods of Turkey by using micro level demographic data and macroeconomic data, will be a beneficial example for a developing country in the literature.

## 4. Theoretical Background

Throughout the literature (Mosley and Chen 1984, Millard 1994), scholars have followed different approaches to identify the determinants of infant and child mortality from the aspects of social, biological, economic and demographic differences. For instance, Meegama (1980) introduced a method to identify the determinants by using the effects of the socio-economic and demographic differences on mortality. However, according to Mosley and Chen; this kind of social science approach as well as medical science approach left the link between socio-economic factors and mortality unexplained.

Therefore, Mosley and Chen (1984) followed an analytical framework to study the determinants of child mortality. The idea of using proximate determinants in an analytical framework was first introduced by Davis and Blake (1956) on fertility studies. However, according to Mosley and Chen, analyzing the mortality was far more difficult than fertility.

The reason behind developing a new analytical framework lied on the insufficiency of traditional methods. More specifically, previous studies on child mortality have focused on the relationship between socio-economic characteristics and mortality by generating causal conclusions about mortality determinants. However, these approaches left the mechanism between the effects of socio-economic differences and differentiations in mortality unexplained (Figure 1). Therefore, the new analytical framework has been based on the idea that all social and economic determinants of child mortality necessarily operate through a common set of biological mechanisms, or proximate determinants, to exert an impact on mortality (Mosley and Chen, 1984, pp. 140).

– Figure 1a –

What Mosley and Chen did to develop the idea of analytical framework of child mortality is to identify the proximate determinants that have direct effects on mortality. According to the authors, all social and economic determinants must operate through these variables to affect child survival. These proximate determinants are mainly:

- Maternal factors: age; parity; birth interval.
- Environmental contamination: air; food/water/fingers; skin/soil/inanimate objects; insect vectors.
- Nutrient deficiency: calories; protein; micronutrients (vitamins and minerals).
- Injury: accidental; intentional.
- Personal illness control: personal preventive measures; medical treatment.

(Mosley and Chen, 1984; pp. 141)

In figure 2, Mosley and Chen demonstrated how these proximate determinants work in terms of child survival. More specifically, five groups of proximate determinants are defined by the socio-economic characteristics of individuals, followed by the first four determinants of an individual's health condition defined in terms of being sick or healthy. However, from the aspect of fifth proximate determinant, the level of being healthy or the level of sickness can be defined by treatment and prevention. Specific states of sickness are basically transitory; ultimately there is either complete recovery or irreversible consequences manifested by increasing degrees of permanent growth faltering and/or death (Mosley and Chen, 1984; pp. 142). As a result, it seems like the unwanted "black box" between socio-economic determinants and mortality has been overcome with this analytical framework. In addition, after 19 years from the development of the analytical framework, Hill indicated that the Mosley-Chen model has stood the test of the time remarkably well, and still provides, explicitly or implicitly, the conceptual basis for many studies of child survival (Hill, 2003; pp. 81).

– Figure 2a –

In the following years, a modified version of Mosley and Chen's analytical framework was presented by Bicego and Boerma (1993). The modifications were done due to the limitations and structure of the DHS data. In Bicego and Boermo's study, the effect of maternal fertility on child mortality was analyzed in a comparative study for 17 countries. What the authors did is to define the socio-economic determinants and intermediate variables in terms of DHS data characteristics. The differences in the framework were the definition of socio economic determinants. As well, maternal education and household economic conditions are used in order to measure the survival of child in the first phase. Furthermore, in terms of intermediate variables, type of residence is defined as a crude proxy for physical access to modern heath services.

In addition, Mosley and Chen not only defined the proximate determinants of child mortality but they also examined several socio-economic determinants that have been defined by early scholars (Caldwell 1979, Schultz 1979, Palloni 1981) and have effects on the level of growth faltering and mortality indirectly. They suggested that the task of delineating and scaling the impact of the socio-economic variables on the proximate determinants of child health and mortality falls to a wide range of social science disciplines, both those that observe populations and institutions at large and those that quantify economic transactions and the effects of income factors on family goals and outcomes (Mosley and Chen, 1984; pp. 144).

As an alternative approach, Millard (1994) designed a causal model that focuses on traditions of child care and emphasizes the theoretical consideration of causality in child mortality (Millard, 1994; pp.253). Millard's casual model is partially based on Davis and Blake's (1956) framework. However, in Millard's model instead of defining biological causes as proximate determinants, she defines behavioral factors in order to analyze child mortality. In comparison to Mosley and Chen's framework, Millard's model has some similarities in terms of the relationships between levels of causes and the importance of economic factors. However, Millard's model differs by incorporating three tiers of causes of child mortality in order to emphasize parental behavior and traditions of child care and to locate them in the broader economic, social, cultural, political and ecological context (Millard, 1994; pp.257).

Figure 3 demonstrates the relations of ultimate, intermediate and proximate tiers with each other to define the casual links and consequently the factors that cause child mortality. More specifically, the ultimate tier defines the broad economic, social and cultural processes and structures that cause high rates of child mortality. This tier incorporates part of what Mosley refers to as social synergy (Millard, 1994; pp. 256). Millard indicates that social stratification by class, gender and ethnicity is also included in this tier due to the interaction of social stratification among economic, social and cultural characteristics. Therefore, the influence of social stratification on child mortality was taken into account by defining the availability of resources among different economic characteristics of households.

Furthermore, the intermediate tier mainly focuses on the differentiations in general living conditions, which identify the proximity of children to proximate causes. For instance, several

incidents like insufficient frequency of feeding, presence of seasonal variation, etc. leads to inadequate children's diet, which as a result leads to children's death. According to Millard, the intermediate tier factors are all tied to child care practices in a broader sense (Millard, 1994; pp. 254) Consequently, defining the intermediate tier makes it possible to examine the child care practices which lead to child mortality. At last but not least, the proximate tier defines the immediate biomedical causes of child death that includes malnutrition, measles and other infections. Basically, what this tier does is to show the interaction between malnutrition and infection that results in child death. To sum up, Millard suggests that understanding the bulk of high rates of child mortality depends on tracing the links of causality from social stratification and major institutional relationships affecting economic status, on the ultimate tier, to effects on children's nutrition and their exposure to pathogens on the intermediate tier, to direct medical causes of death on the proximate tier (Millard, 1994; pp.265).

– Figure 3a –

## 5. Data

### 5.1 Demographic Data

In order to study the effects of short term economic stress on infant and child mortality among different socio-economic and regional characteristics, it is essential to use individual or household level data. For that reason, I had to find a source that includes personal information in terms of demographic and economic characteristics. Therefore, I decided to gather information from three different Demographic and Health Surveys of Turkey. One could ask the reason behind selection of Demographic and Health Surveys. The reasons are simple; since economic status of household and education level of parents are important determinants of child mortality, according to Bicego and Boerma (1993), the DHS data contain information that allows a measure of control over the perturbing influence of these variables on estimation and inference (Bicego and Boerma, 1993, pp. 1208). In addition, considering the absence of micro level demographic data in Turkey, it is necessary to study with DHS data. However, it needs to be indicated that this necessity of using DHS data will not be a problem in terms of reliability of the study, since the DHS are a rich source of data on developing countries (Kembo and Ginneken, 2005, pp. 371).

In order to create a wider perception on infant and child mortality responses and to analyze a longer time period, information from three different demographic and health surveys has been combined into one pooled dataset. Regarding to combining process; 1993, 1998 and 2003 Turkey Demographic and Health Surveys have been used to gather individual information of parents as well as information of children. In following sections, first, characteristics of demographic and

health surveys will be reviewed and then descriptive statistics of my combined dataset will be given separately.

### 5.1.1 The 1993, 1998 and 2003 Turkey DHSs

Considering number of participants into each survey, it has been seen that amounts of households and individuals have increased over the years. Regarding to this, in the 1993 survey; 8619 households with 6419 women, who are younger than 50 years old, have been interviewed between the dates of August to October in 1993. In terms of 1998 survey, the study carried out for 8059 households with 8576 women aged between 15 and 49. On the other hand, 2003 survey covered 10836 households with 8075 women at reproductive ages (15-49).

The table below indicates the number of households, number of interviews and response rates to the 1993, 1998 and 2003 surveys. Response rates showed that data collecting processes have been successfully completed. Furthermore, all three surveys include information about economic and demographic characteristics of individuals, however since individuals in different surveys were randomly selected, it is not possible to follow the improvements and degradations in socio-economic, demographic and other characteristics of individuals.

An important limitation of this study is that children's death is related to characteristics of the family at the time of the survey (Jatrana, 2005, pp. 193). Thus, socio-economic characteristics and living standards of families could change overtime and consequently the event (death of infant and children) could occur in a different set of socio-economic circumstances. To overcome this problem, in Jatrana's study (Jatrana 2005); the sample has been limited to births in last three years from the survey year. Due to insufficient numbers of events in infant and child (1 – 15) category after limitation of their studies' sample, there will be no alternative models to eliminate the possibility of occupational mobility. In addition, since education levels of husbands have been used as an indicator of socio-economic status in this study, it is very unlikely to encounter with mobility when the characteristic of Turkey is considered.

*Table (1): Number of Households, Number of Interviews and Response Rates*

| | ***1993*** | | | ***1998*** | | | ***2003*** | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Urban* | *Rural* | *Total* | *Urban* | *Rural* | *Total* | *Urban* | *Rural* | *Total* |
| ***Household interviews*** | | | | | | | | | |
| *Dwellings sampled* | *7065* | *3566* | *10631* | *6989* | *2981* | *9970* | *9754* | *3295* | *13049* |
| *Households found* | *5752* | *3148* | *8900* | *5938* | *2658* | *8596* | *8718* | *2941* | *11659* |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *H. interviewed* | *5491* | *3128* | *8619* | *5480* | *2579* | *8059* | *7956* | *2880* | *10836* |
| *Response rate* | *95.50%* | *99.40%* | *96.80%* | *92.30%* | *97.00%* | *93.80%* | *91.30%* | *97.90%* | *92.90%* |
| ***Individual interviews*** | | | | | | | | | |
| *Eligible women* | *4344* | *2518* | *6862* | *6322* | *3146* | *9468* | *6259* | *2188* | *8447* |
| *Eligible women interviewed* | *4125* | *2394* | *6519* | *5702* | *2875* | *8576* | *5976* | *2099* | *8075* |
| *Response rate* | *95.00%* | *94.50%* | *95.00%* | *90.20%* | *91.40%* | *90.60%* | *95.50%* | *95.90%* | *95.60%* |

*Source: Reports of Turkey DHS 1993, 1998 and 2003*

The following table has been given to measure the ability of the surveys to reflect the real age distribution in Turkey. In the table, the given ratios for surveys demonstrate the age distribution of interviewed households. Therefore, comparisons between age distribution of surveys and censuses show that there is no significant problem in terms of the surveys' ability to reflect the real age distribution in whole country.

*Table (2): Age Distribution in Surveys and Population Censuses*

| ***Age Group*** | ***CP 1990*** | ***TDHS-1993*** | ***TDHS-1998*** | ***CP 2000*** | ***TDHS-2003*** |
|---|---|---|---|---|---|
| *Less than 15* | *35.00%* | *33.00%* | *31.50%* | *29.80%* | *29.10%* |
| *15 - 64* | *60.70%* | *61.40%* | *62.60%* | *64.50%* | *64.00%* |
| *65+* | *4.30%* | *5.50%* | *5.90%* | *5.70%* | *6.90%* |
| *Total* | *100.00%* | *100.00%* | *100.00%* | *100.00%* | *100.00%* |
| | | | | | |
| *Median Age* | *22.2* | *23.1* | *24.3* | *24.8* | *24.7* |
| *Dependency Ratio* | *64.7* | *62.7* | *59.7* | *55.1* | *56.3* |

*Source: Report of Turkey DHS 2003*

### 5.1.2 Descriptive Statistics of Combined Dataset

By combining individual information from three particular demographic and health surveys, it will become more beneficial to have wider perception to relationship between demographic responses and economic factors by adding more individual and socio-economic characteristics and longer time period. As a result, with merging the datasets, number of women reached to 23170 and number of children reached to 55986. In the table below, distribution of children in the dataset, as well as distribution of died infants and children by particular surveys are shown. Considering the percentages, most of the infant deaths seem to be occurred in 1993 survey, which reflects older time periods compared to other surveys. However, we have seen that with the

improvements in standard of living, urbanization and increasing level of education, the infant mortality has been influenced negatively over the years. Infant mortality rates reduced over time.

*Table (3): Number of Children in the dataset, Number of Infants and Children (1 – 15) Died by Surveys*

| Survey | Number of Children | % | Number of Infants died | % | Number of Ch. Died | % |
|---|---|---|---|---|---|---|
| **1993** | 18390 | 32.85 | 1653 | 40.17987 | 252 | 35.74468 |
| **1998** | 16552 | 29.56 | 1203 | 29.24161 | 216 | 30.6383 |
| **2003** | 21044 | 37.59 | 1258 | 30.57851 | 237 | 33.61702 |
| **Total** | 55986 | 100 | 4114 | 100 | 705 | 100 |

*Source: Own Estimations, data gathered from TDHS 1993, 1998 and 2003*

Before estimation of statistical model, it is valuable to demonstrate the view of the dataset in terms of groups of variables. In this study, differences in socio-economic and demographic characteristics of individuals and families will be taken into account. Thus, in the table below, percentage distributions of covariates have been demonstrated for the individuals in risk groups (infants and children (1 – 15)) as well as all individuals in the dataset.

Unlike the distributions of mother's age at birth and education level groups, I did not encounter with troublesome distribution for other covariates. In terms of mother's age at birth and education level groups, unwanted situations are; in the mother's age at birth group; the proportion of third group (35 – 49) is quite low than others. And this high difference might cause problems in statistical estimation process. In addition, from education level group aspect, proportion of university level education seems also low, however compared to other education levels these percentage differences can be tolerated. On the other hand, one could argue the dominant proportion of primary level education in the education level group. However, since socio-economic condition is defined by the level of education, merging the different levels of education and using them as the same level education could be problem to measure divergences in infant and child mortality responses among socio-economic classes. Therefore, to prevent this possibility; education level groups will be left the same in the statistical analysis. Furthermore, when we check the distributions of socio-economic and demographic characteristics for risk groups, it seems like the ratio of groups that have low amounts of individuals have increased. Since the individuals in risk groups will be analyzed, negative effects of the groups that have low ratios will be lower.

*Table (4): Averages of Individual and Family Covariates for Population at Risk*

| | All | 0 - 1 Years | 1 - 15 Years |
|---|---|---|---|
| Birth Year | 1986.608 | 1999.07 | 1990.174 |
| Sex (F) | 48.55 | 48.22 | 48.52 |
| Sex (M) | 51.45 | 51.78 | 51.48 |
| Age at Birth | | | |
| Mother's Age (15 - 24) | 55.82 | 42.8 | 49.07 |
| Mother's Age (25 - 34) | 39.58 | 46.4 | 44.49 |
| Mother's Age (35 - 49) | 4.6 | 10.8 | 6.44 |
| Education Level | | | |
| No Education | 11.1 | 8.09 | 10.77 |
| Primary | 56.27 | 50.98 | 55.08 |
| Secondary | 12.15 | 13.47 | 12.39 |
| High | 13.36 | 19.55 | 14.51 |
| University | 4.13 | 8.33 | 7.55 |
| Region | | | |
| West | 23.29 | 18.62 | 21.74 |
| Central | 19.99 | 17.63 | 18.61 |
| South | 17.55 | 16.37 | 17.65 |
| North | 13.6 | 10.9 | 12.73 |
| East | 25.56 | 36.48 | 29.27 |
| Type of Residence | | | |
| Urban | 64.43 | 63.52 | 63.47 |
| Rural | 35.57 | 36.48 | 36.53 |

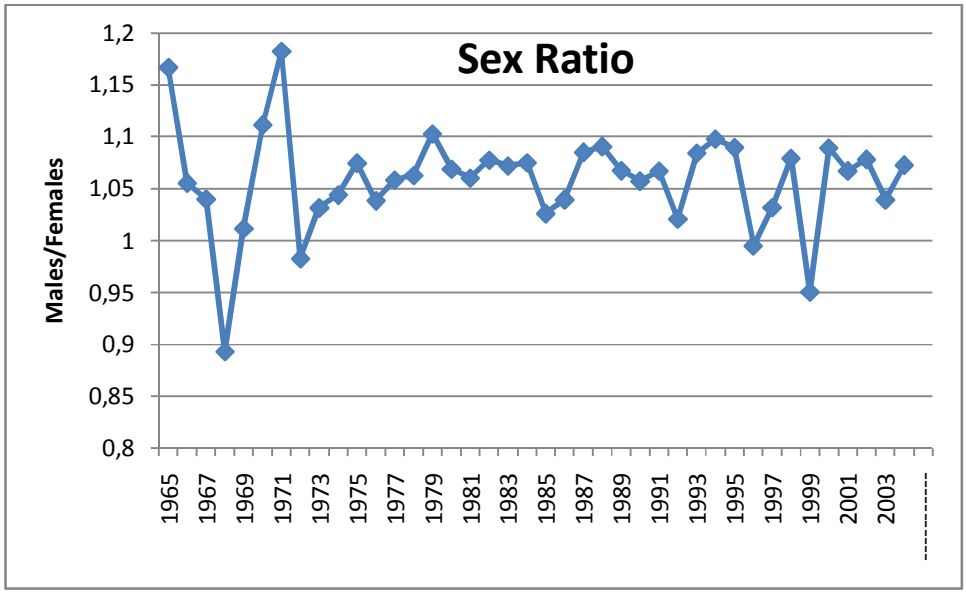
*Source: Own Estimations, data gathered from TDHS 1993, 1998 and 2003*

Sex ratio has been defined as the ratio of the males and females in the population. Commonly accepted secondary sex ratio is 1.05 (Number of Males/Number of Females) for humans. In order to measure the quality of data, the sex ratios at birth for selected time period can be analyzed. By revising the sex ratio at birth, we can gather information about inaccurate recordings of births as well as the infant deaths. For example, the one-child policy in China has caused underreports of female children and consequently, increased the sex ratio to 1.1 (CIA – The World Factbook 2010).

Considering the estimations of infant mortality differentials from the 1983 Turkish Fertility, Contraceptive Prevalence and Family Health Survey has revealed that the sex ratio in neonatal period had been 1.66, declining to 1.26 in the post-neonatal period and for the entire first year the

same ratio being 1.42. Rural and urban differentials on the other hand, are estimated 1.61 for rural and 1.04 for urban areas. Nonetheless, this is not to be taken as an indicator of discrimination against male infants (Aksit and Aksit 1989; pp. 574). According to Tuncbilek (1988) it is likely to be the consequence of discrimination against female infants through failures in recollection and registration of female infant births and hence under-reporting of female infant mortality, especially in rural areas.

*Figure (4): Sex Ratio at Birth, 1965 – 2004*



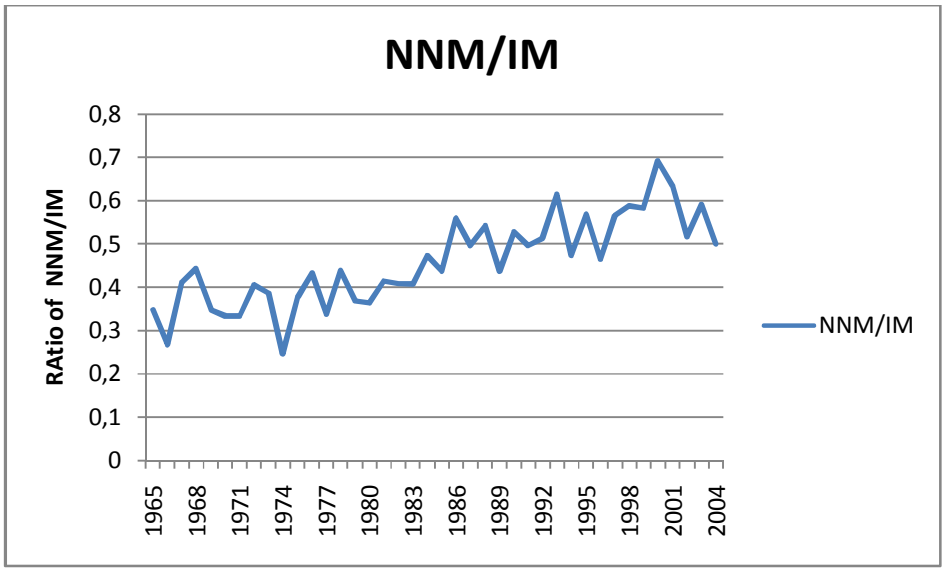

*Source: Own Estimations, data gathered from TDHS 1993, 1998 and 2003*

In terms of the sample, I have came across with some fluctuations for the time period between 1965 and 1972. After checking the data, I have seen that low amount of births for the years between 1965 and 1972 causes these variations in the sex ratio. On the other hand, since the sex ratio over the entire period is 1.057, I could not detect any under or over reporting in terms of sex differences. In addition, further analysis has been done to detect any sex discrimination on registration in terms of sex ratio at death. Estimated sex ratio at death is 1.17 for both urban and rural areas. Furthermore, to detect any discrimination by rural and urban differentials, particular sex ratios at death have also been calculated. Therefore, I could not find any obvious discrimination since the sex ratios occurred 1.183 for rural and 1.16 for urban areas.

I also calculated the ratio between neonatal mortality and infant mortality to examine the quality of the data. In addition, the ratio in the dataset should be at least more than 0.30 not to encounter possible under-registration problems. The figure below demonstrates the ratio between neonatal

mortality rates and infant mortality rates for combined dataset through the time period. The ratio has also been calculated separately for particular surveys. According to estimation, the NNM/IM ratio among surveys differs between 0.43 and 0.47.

*Figure (5): Ratio of Neonatal Mortality to Infant Mortality, 1965 - 2004*




*Source: Own Estimations, data gathered from TDHS 1993, 1998 and 2003*

Figure 5 shows that except the values 1966 and 1974, I could not see a considerable problem in terms of data quality. For further concerns, data could be examined with an approach that Hill and Choi (2006) followed in their study by comparing the neonatal mortality and infant mortality rates of England and Wales with selected countries' rates in demographic and health surveys.

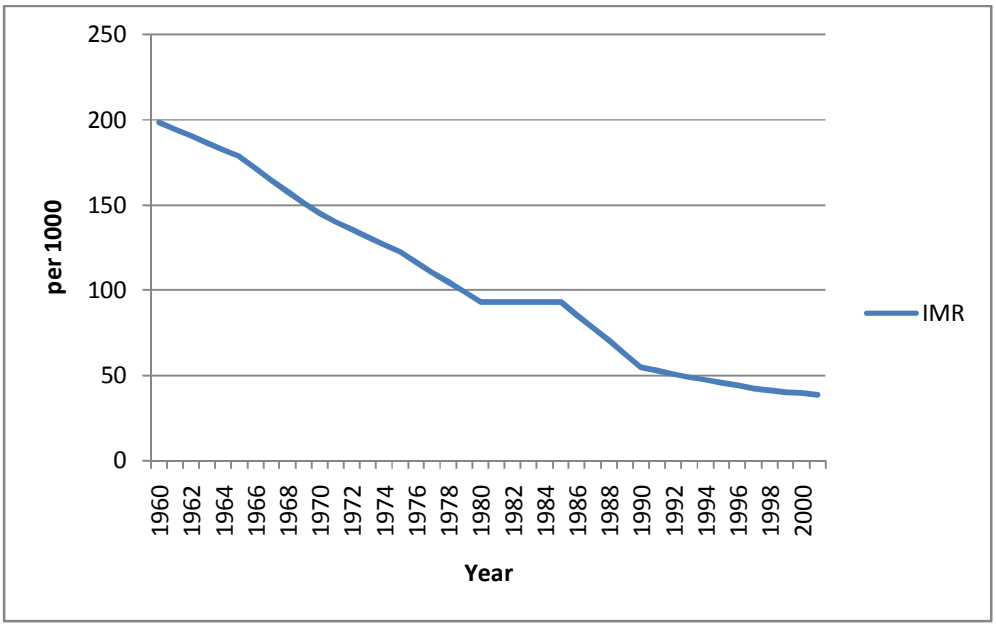
### 5.1.3 Infant Mortality Rate

To measuring the effects of short term economic fluctuations on child mortality, one should suggest that using the infant mortality rate could be beneficial to determine the living conditions at the time of child birth. According to Bengtsson and Lindstrom (Bengtsson and Lindstrom, 2000) infant mortality rate at birth can be used to measure early life effect on old age mortality. Their study showed that children born in years of outbreaks in infectious diseases faced several years shorter remaining life expectancy at age 55 years (Bengtsson and Brostrom, 2009, pp. 1584). At the same time, Johansson (2004) was using the variations in the infant mortality rates as a proxy of the early life disease load to examine the early life effect on child mortality. According to Johansson, a high disease load during the foetal stage or during the infancy is

assumed to increase the risk of mortality in later life both for adults and children (Johansson, 2004; pp. 134).

In terms of this study, infant mortality rates will be used to measure the responses of child mortality to short term economic stress by defining the living circumstances at child birth. In addition, the early life effects on child mortality will be also analyzed to examine which determinant has the highest importance in terms of child mortality. However, it is important to indicate that IMR values will not be used as figure 6. Necessary adjustments will be applied to make the variations in IMR values more obvious.

*Figure (6): Infant Mortality Rate in Turkey, 1960 – 2001*




*Source: Council of Europe – Demographic Yearbook 2002*

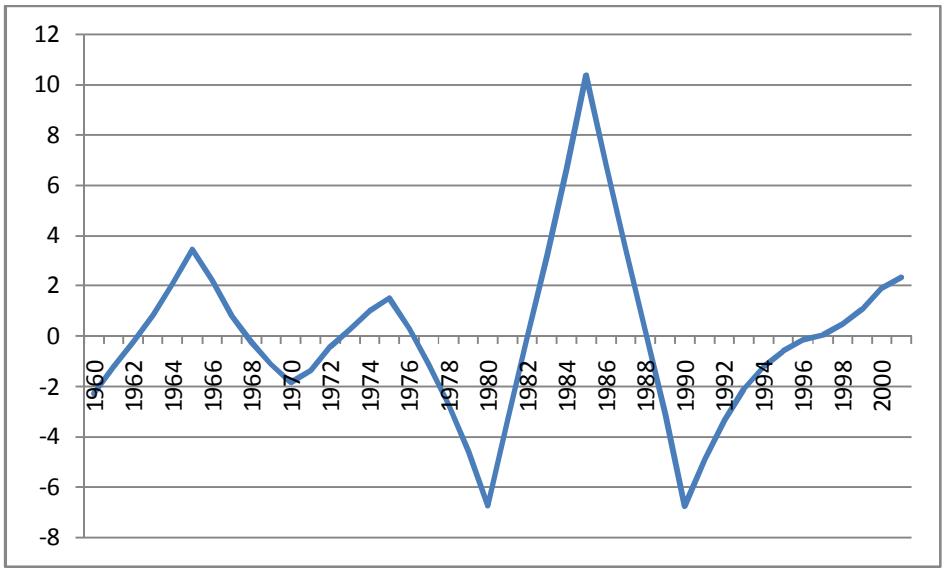
In Figure 6, the improvement in the infant mortality rates can be seen for selected time period; in the beginning of 1960s, the infant mortality rate was 200 deaths per 1000. However, we see that the IMR drops to 40 deaths per 1000 in the beginning of 2000s. According to report of Council of Europe (Demographic Yearbook 2002), the reason behind this rapid decline can be accounted to low fertility levels, improvement in living standards and health services, increasing education levels and special immunization campaigns.

The figure 7 demonstrates the variations in the infant mortality rates for Turkey. In order to calculate the variations, the same method that has been used for cost of living index, is used. More specifically, the trend of the series has been calculated by using Hodrick – Presscott filter

and in following, the difference between actual values and HP trend values has been taken to define variations in infant mortality rates. Therefore, it became possible to relate the variations in infant mortality to children's death. However, according to Johansson (2004), the coefficient of infant mortality variable should be positive in order to indicate the effects of high disease load in infancy on later life child mortality (Johansson, 2004; pp. 139). Therefore, positive coefficient for IMR variable will be looked for.

Figure 7 shows that beside the fluctuations between 1975 and 1995, the infant mortality rates are showing consistent declining trend.

*Figure (7): Variations in Infant Mortality Rates, 1960 – 2001*




*Source: Own estimations, data taken from 2002 Demographic Yearbook of Council of Europe*

## 5.2 Economic Data

The first idea of using the macroeconomic data in the analysis of demographic responses at individual levels has came to life with the study of Bengtsson (1993) in 1993. The objective of the study was to measure the standard of living; briefly he defined the measurement of standard of living as the ability to overcome short term economic stress, that is, variations in income and food prices from one year to the next, even within shorter time span (Bengtsson, Campbell, Lee et al, 2004, pp. 33). Therefore, in order to measure the effects of short term economic fluctuations on demographic responses, it is essential to use economic indicators as time-varying community covariates. We have seen that different types of economic and environmental indicators can be used to reflect economic conditions for selected time periods (Bengtsson 1993, 1999, 2002). As

an example, Bengtsson (1993) used air temperature as a sort of economic indicator to measure demographic responses among different socio economic groups. According to Bengtsson, if low winter temperature causes people to die, they can be defined as economically vulnerable persons since they are unable to protect themselves.

Choosing economic data to study the variations in economic indicators is a significant decision since the selected economic data might not reflect the economic circumstances that have had effects on demographic behaviors. Therefore, selecting and collecting processes of the economic data should be done accurately. In addition, it is also important to point out that; since we are dealing with short term economic fluctuations, trend in the economic indicator series should be taken out in order to reflect variations properly. There are several methods to remove the trend from the economic indicator series; hence deeper information about the de-trending method and process will be given in the methods section. In this study, monthly rates of cost of living index have been preferred as an economic indicator. In following section, the definition and calculation of cost of living index will be given more specifically.

### 5.2.1 What is the Cost of Living Index?

In the early 1980s, Bureau of Labor Statistics (BLS) has started to a program to develop the cost of living index by using price levels selected from the Consumer Price Index (CPI). A cost of living index can be defined as a theoretical price index that measures relative cost of living over time. It is an index that measures differences in the price of goods and services, and allows for substitutions to other items as prices change (Bureau of Labor Statistics - Handbook of Methods, 1997). More specifically, the true cost of living index is the change in the cost of attaining some base level of utility, u*, between a base area, b, and a comparison area, c:

$$\frac{e(p^c, u^*)}{e(p^b, u^*)},$$

Where "$p^c$" and "$p^b$" denote the prices faced by the representative individual in the comparison and base regions, respectively, and "e" denotes the individual's expenditure function that gives the minimum cost of attaining base level of utility "u*" when faced with a set of prices, "p", for the goods and services that enter the individual's utility function (Koo, Phillips and Sigalla, 2000, pp. 127).

In a basic framework, to measure change in the cost of living index; average weightings of several groups of items are prepared. In the table below, the average weightings to measure cost of living index have been shown.

*Table (5): Average Weightings*

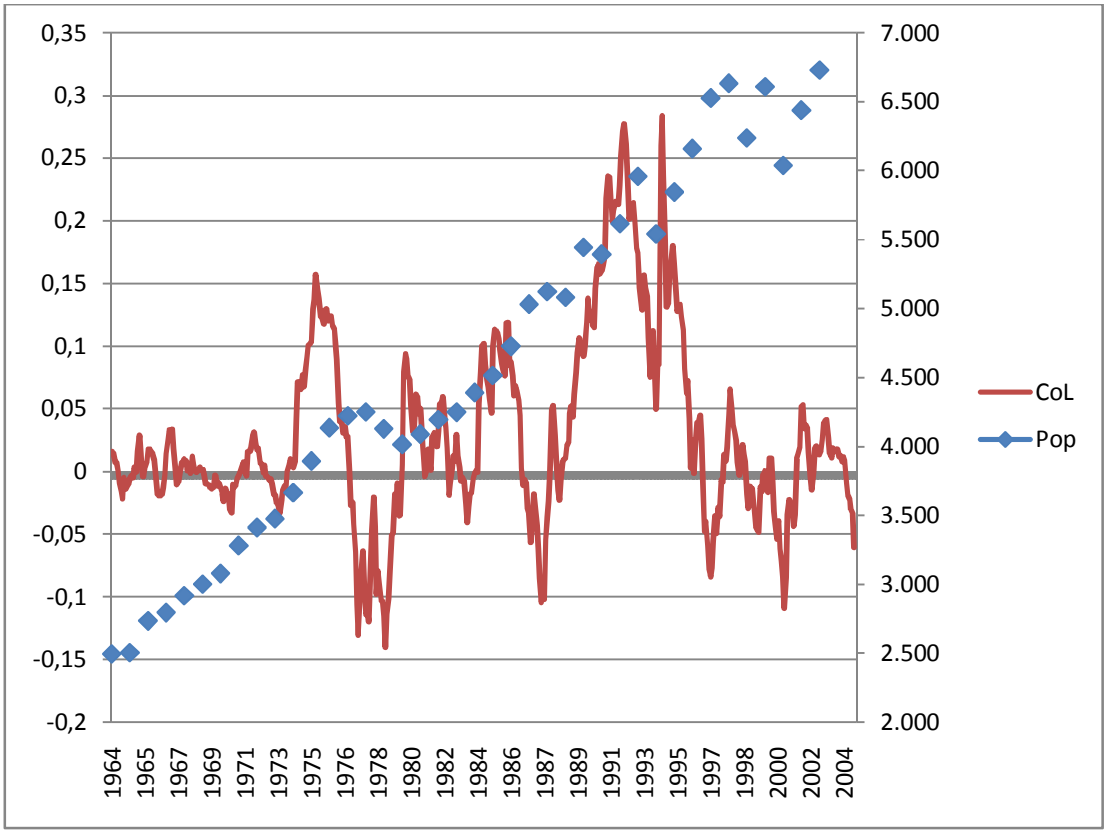
| | |
|---|---|
| *Shopping basket* | *25%* |
| *Alcoholic beverages* | *3.5%* |
| *Household supplies* | *4.5%* |
| *Personal care* | *4%* |
| *Tobacco* | *2.5%* |
| *Utilities* | *6.5%* |
| *Clothing* | *13%* |
| *Domestic help* | *3.5%* |
| *Recreation & entertainment* | *18%* |
| *Transportation* | *19.5%* |
| *TOTAL* | *100%* |

*Source: The Economist Intelligence Unite*

In this study cost of living index of Istanbul has been chosen in order to measure the fluctuations in the economic conditions. Since the cost of living index has been collected monthly, it will give us the opportunity to measure the demographic responses to economic fluctuations more accurately. In figure 8, the relationship between yearly population size and variations in cost of living index can be seen. To estimate the variations in the cost of living index, first of all; trend of the series has been calculated by Hodrick – Presscott filter and in the following process; natural logarithms of the actual values the HP trend values have been taken due to highly increasing variance of the series. Second of all, differences between log actual values and log hp trend values have been calculated to create variations in the cost of living index.

In terms of high level variations in cost of living index from 1970s to 1990s; considerable declines in population totals have been demonstrated in figure no. This negative correlation between series shows us the crude relationship between mortality and prices, from the aspects of infant and child mortality. However, the statistical models will give us more accurate and reliable results.

*Figure (8): Variations in Cost of Living Index (Monthly), 1964 – 2003 and Turkish Population Totals, 1964 - 2003*




*Source: Cost of Living Index; Istanbul Chamber of Commerce, Population; Maddison A. - Historical Statistics for the World Economy*

As it can be seen in figure 8; the relationship between economic variations and demographic behaviors in terms of mortality and fertility is obvious. However, in this study, identifying the relationship between infant and child mortality and economic variations by ocular inspection might not reflect the correct connection. At the same time, effects of economic variations on infant and child mortality might not be as clear as for all age mortality. For that reason, what I can do is to state my assumptions and expectations to increase the capability of statistical models.

## 6. Methods

### 6.1 Statistical Model

In order to explain the links between demographic behaviors and economic factors, numerous statistical models (Lee 1981, Bengtsson 1985 and 1993, Eckstein, Schultz and Wolpin 1985) have been developed and employed by demographers and economists even by historians.

Previous studies showed that different approaches have been followed to fulfill same purposes with minor differences. These studies also demonstrated the development of statistical models in terms of capability to provide reliable and accurate results. It has been seen in the previous studies section that early methods that use distributed lag models with aggregated level data give information about the magnitude and lag structure of demographic responses. In contrast, this type of approach is insufficient in terms of economic and demographic characteristics due to aggregated level data. Bengtsson (1999) suggested that absence of information at individual level make it very difficult to get an idea of the causal mechanism between economic fluctuations and mortality. Therefore, Bengtsson (1993) developed a method by combining micro level demographic data and macro economic data within Cox regression framework. The feature of this approach is the capability of analyzing the effects of economic fluctuation on demographic responses at individual and household level. With this feature, scholars have had the ability to explain causal links between economic variations and demographic responses. In following years, Bengtsson (2004) used the micro approach to define the new concept of Living Standards by analyzing the differences in demographic responses among socio-economic groups. In the recent studies of Bengtsson (2007 and 2009), we have seen that, the micro approach can also be used to measure the effects of economic fluctuations on demographic responses from different perspectives. In order to benefit from this capacity, the method that has been developed by Bengtsson (1993) is employed to analyze the effects of economic fluctuations on infant and mortality.

The basic of the micro approach is to perform the empirical analysis by combining time series and event-history analysis. With this way it becomes possible to measure the effects of different explanatory covariates on the hazard of the event, which is infant and child mortality in this study. From a more specific perspective, the regression model that has been employed is Cox Proportional Hazards Model (Cox, 1972). The difference between this model and other proportional hazards model relies on, as Bengtsson and Dribe indicated, "by not requiring any specification of the underlying hazard function with time varying external (community) covariates (Cox 1972; see also Collett 1994)" (Bengtsson and Dribe 2002; pp. 357). In addition, the advantage of this model is that the regression parameters of this model can be estimated by partial likelihood methods without even specifying a functional form for the hazard function (Winkelmann and Boes, 2006; 270). The following equation demonstrates the theoretical model of Cox Proportional Hazards Model;

$$r(t) = h(t)exp(A(t)\alpha)$$

The transition rate, r(t), is the product of an unspecified baseline rate, h(t), and a second term specifying the possible influences of a covariate vector A(t) on the transition rate (Blossfeld,

2007; pp. 223). And the specific model that will be used in this study to analyze infant and child mortality is;

$$\ln h_i(a) = lnh_0(a) + \beta X_i + \gamma Z(t)$$

Where $h_i(a)$ is the hazard of the event for the *i*th individual at age a; $h_0(a)$ is the "baseline hazard", that is, the hazard function for an individual having the value zero on all covariates; $\beta$ iss the vector of parameters for the individual covariates $X_i$ that are estimated; and $\gamma$ is the parameter for the external time varying covariate $Z(t)$ (Bengtsson and Dribe, 2002; pp. 357). In terms of this study, events are infant and child mortality for separate models. Covariates are on the other hand, demographic and socio-economic characteristics that will be given in the following chapter, in addition as a time varying covariate, cost of living index and infant mortality rate have been selected to reflect economic variations and environmental factors.

## 6.2 Variables and Expectations

In order to analyze infant and child mortality among socio-economic and demographic differences, several variable groups have been created by using relevant theory. In addition, while creating the variable groups, besides the theoretical foundation, limitations and structure of DHS datasets have been also taken into account to prevent incorrect definitions. Therefore, I used differences in sexes of child, mother's ages at birth, types of residence, regions, and education levels of fathers to define socio-economic and demographic determinants. On the other hand, as time-varying covariates, different concepts of cost of living index are used to define the fluctuations in the economy. In addition, IMR level and cycle are also included to reflect the environmental circumstances at time of births. In the table below, expected effects of variables on probability of death can be seen for different demographic socio-economic and other characteristics.

*Figure (9): Variables and Expectations*

| | *Model A* | *Model B* | *Model C* |
|---|---|---|---|
| ***Sex of child*** | | | |
| *Male* | *(+)/Small* | *(+)/Small* | *(+)/Small* |
| *Female* | *Ref.* | *Ref.* | *Ref.* |
| ***Mother's Age at Birth*** | | | |
| *15 - 24* | *Ref.* | *Ref.* | *Ref.* |

| | | | |
|---|---|---|---|
| *25 - 34* | *(-)/Medium* | *(-)/Small* | *(-)/Small* |
| *35 - 49* | *(+)/Small* | *(+)/Small* | *(+)/Small* |
| ***Type of Res.*** | | | |
| *Urban* | *(-)/Small* | *(-)/Small* | *(-)/Small* |
| *Rural* | *Ref.* | *Ref.* | *Ref.* |
| ***Region*** | | | |
| *West* | *Ref.* | *Ref.* | *Ref.* |
| *Central* | *(+)/Small* | *(+)/Small* | *(+)/Small* |
| *East* | *(+)/Large* | *(+)/Large* | *(+)/Large* |
| *South* | *(+)/Small* | *(+)/Small* | *(+)/Small* |
| *North* | *(+)/Medium* | *(+)/Medium* | *(+)/Medium* |
| ***SES*** | | | |
| *No Educ.* | *(+)/Large* | *(+)/Large* | *(+)/Large* |
| *Primary* | *Ref.* | *Ref.* | *Ref.* |
| *Secondary* | *(-)/Medium* | *(-)/Medium* | *(-)/Medium* |
| *High* | *(-)/Medium* | *(-)/Medium* | *(-)/Medium* |
| *University* | *(-)/Large* | *(-)/Large* | *(-)/Large* |
| ***Economic ind.*** | | | |
| *CoI at Death* | *(+)/Medium* | | |
| *CoI at Birth (t-9)* | *(+)/Large* | | |
| *CoL at Death* | | *(+)/Medium* | |
| *CoL at Death (t-3)* | | *(+)/Large* | |
| *CoI at Birth* | | | *(+)/Medium* |
| *CoI at Birth (t-9)* | | | *(+)/Medium* |
| *IMR Level at Brith* | | | *(+)/Small* |
| *IMR Cycle at Birth* | | | *(+)/Medium* |

*Source: Own Estimations*

As it was demonstrated in the numerous studies, sex of child could cause differences on the levels of mortality. However, it has been also shown that these differences in mortality level are likely to occur due to biological factors rather than social ones. Thus, according to Mosley and Chen's analytical framework, it would be reasonable to define the sex of child as a proximate determinant rather than socio-economic variable. Furthermore, when we consider the previous studies on mortality differences between sexes, it seems that the probability of mortality risk for male child is higher. Consequently, my expectation from the sex variable (male = 1) is positive for all models.

The variable group of mother's age at birth has been categorized to measure mother's physiological, emotional and mental maturity. In addition, it can also be used to indicate the experience level of mother on childcare. The organized age groups are, 15 – 24, 25 – 34 and 35 –

49. I think these age groups are satisfactory to measure the maturity as well as childcare experience of mothers. In terms of this study, 15 – 24 age groups is defined as reference group, and expected sign for 25 – 34 age groups is negative since these ages are enough to have necessary maturity and childcare experiences. On the other hand, expected sign is positive for 35 – 49 age groups due to decreasing productivity of women.

Since, Caldwell (1979) demonstrated the significant relationship between maternal education and child survival, many scholars (Mosley and Chen, 1984) used maternal education levels as determinant of child mortality. In addition, while several studies (Hojman 1996, Bhuiya and Streatfield 1991) considered the maternal education as a level of knowledge of appropriate health care techniques to demonstrate personal illness control as Mosley and Chen defined, and also used as a reference for access to modern contraception. Others (Victora 1992) analyzed the child mortality by controlling effect of maternal education on household income. In contrast, some studies (Mueller and Parcel 1981) showed that parental education, income and occupation are main determinants of socio-economic status. Therefore, since parental education can be used to define socio-economic status and characteristics of father's education are more suitable to measure socio-economic status in Turkey demographic and health surveys, I decided to use husband's education level instead of mother's education level to define socio-economic status. Regarding to expected signs, since primary level education is used as a reference group, the possibility of infant and child death is higher for the individuals who have no education. On the other hand, for other education level groups – secondary, high and university – expected effects are negative for all models.

Type of residence group defines the urban and rural areas that individuals live. The rationale of using this variable is to analyze differences in infant and child mortality between urban and rural areas. According to Bicego and Boerma, rural-urban residence is regarded as a crude proxy for physical access to modern health services (Bicego and Boerma, 1993; pp. 1209). Besides that it would be reasonable to consider job opportunities, better living conditions, etc. as several effects on child and infant mortality. Therefore, since living in urban areas has considerable advantageous effects, my expectation from urban variable is negative.

In addition, I have also found it interesting to analyze differences in infant and child mortality among the regions of Turkey. Due to divergence in development levels as well as in fertility levels among different regions, I expect significant differences in infant and child mortality responses among different regions. Hence, I selected the west region – the most developed region – as a reference group in the regional category, since the most developed part is used as reference group, my expectations from other regions are positive. However, it is important to state that I also expect the highest risk of mortality from the east region since it is the less developed part of Turkey.

At last but not least, in terms of time-varying covariates; different concepts of cost of living index and infant mortality rate (IMR) are used. The cost of living index is used to indicate the

fluctuations in prices of several goods and services (the calculation of cost of living index and weightings of selected items and services have been demonstrated in the data section). Since, I removed the trend in the cost of living index to measure the effects of short term economic fluctuations, positive estimations of cost of living index indicate higher prices than averages. Therefore, in times of higher prices, infant and child mortality will be affected positively. In terms of infant mortality rate (IMR), both trend and cycle of IMR are included into model. More specifically, IMR cycle refers mainly to the variations in infant mortality rates through selected time period. On the other hand, IMR level includes trend of the series therefore it represent less variations than IMR cycle. We have seen that Bengtsson (2000, 2009) employed IMR cycle and IMR level to measure the effect of early life conditions on old age mortality and found that high IMR cycle at birth have positive effects on old age mortality. Consequently, my expectation from IMR variable is in the same direction with Bengtsson's findings.

## 7. Empirical Analysis

### 7.1 Results and Discussion

In order to measure the effects of short term economic variations on infant and child mortality responses, separate models have been prepared due to the differences in determinants of infant and child mortality. According to Bengtsson (1999), this difference can be explained by the higher dependency of infants to their mothers rather than the economic conditions of the family. Therefore, to prevent misleading estimations; infants (0 – 1) (Model A) and children (1 – 15) (Model B) have been considered as different groups.

Furthermore, analyzing child mortality (Model B) with time varying covariates at the time of death will give us significant information about mortality responses of different characteristics in times of economic stress. However, for further analysis, I decided to prepare a model (Model C) that has ability to examine the early life effects on child mortality. Accordingly, IMR level and IMR cycle at birth as well as price levels at birth and at foetal stage have been included into model c.

#### 7.1.1 Infant Mortality

The first model has been prepared to measure the effects of short term economic fluctuations on infant mortality. The purpose of this model is to analyze infant mortality among different socio-economic, demographic and other characteristics. Therefore, individual level, family level and community level characteristics included into model. More specifically, as community level determinants, regional specification, type of residence have been used to define the characteristics of environments that individuals live. As family level determinant, socio-economic status of families is employed by considering education levels of husbands. At last but

not least, mother's age at birth and sex of infant have been selected for individual level determinants.

Furthermore, variations in the cost of living index have been also used as a time varying covariate to measure infant mortality responses especially in times of economic stress. Therefore, levels of the cost of living index at time of death have been included into model to examine the effects of price levels at time of death. Moreover, levels of 9 months lagged cost of living index at time of birth have also been taken into account to measure the possible effects of price levels on families during pregnancy.

For further analysis and to examine the effects of short term economic fluctuations among socio-economic groups, interactions between economic indicator and socio-economic groups are necessary. Therefore, by using both economic indicators in the basic model, interactions have been prepared for socio-economic groups.

*Table (6): Hazard Models for Infants (0-1)*

| ***Model A*** | | | ***Model A with Int.*** | | ***Model A Final*** | |
|---|---|---|---|---|---|---|
| *Max Log Likelihood* | *-29768.138* | | *-29764.131* | | *-29771.915* | |
| *CHISQ* | *376.74* | | *384.76* | | *369.19* | |
| | ***Hazard Ratio*** | ***P-value*** | ***Hazard Ratio*** | ***P-value*** | ***Hazard Ratio*** | ***P-value*** |
| ***Sex of child*** | | | | | | |
| *Male* | *1.095* | *0.004* | *1.094* | *0.004* | *1.093* | *0.005* |
| *Female* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| ***Mother's Age at Birth*** | | | | | | |
| *15 - 24* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| *25 - 34* | *0.906* | *0.004* | *0.907* | *0.005* | *0.907* | *0.005* |
| *35 - 49* | *1.156* | *0.076* | *1.147* | *0.092* | *1.147* | *0.092* |
| ***Type of Res.*** | | | | | | |
| *Urban* | *0.832* | *0.000* | *0.831* | *0.000* | *0.833* | *0.000* |
| *Rural* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| ***Region*** | | | | | | |
| *West* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| *Central* | *1.207* | *0.000* | *1.207* | *0.000* | *1.202* | *0.000* |
| *East* | *1.315* | *0.000* | *1.311* | *0.000* | *1.307* | *0.000* |
| *South* | *0.864* | *0.006* | *0.863* | *0.006* | *0.862* | *0.005* |
| *North* | *0.999* | *0.994* | *1.000* | *0.999* | *0.994* | *0.916* |
| ***SES*** | | | | | | |
| *No Educ.* | *1.207* | *0.000* | *1.189* | *0.001* | *1.185* | *0.001* |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Primary* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| *Secondary* | *0.808* | *0.000* | *0.837* | *0.004* | *0.821* | *0.001* |
| *High* | *0.700* | *0.000* | *0.752* | *0.000* | *0.732* | *0.000* |
| *University* | *0.493* | *0.000* | *0.510* | *0.000* | *0.515* | *0.000* |
| ***Economic ind.*** | | | | | | |
| *Col at Death (t)* | *0.279* | *0.000* | *0.318* | *0.003* | | |
| *Col at Birth (t-9m)* | *2.294* | *0.000* | *3.163* | *0.009* | *3.407* | *0.005* |
| ***Interactions*** | | | | | | |
| *No Educ.*CoL (t)* | | | *0.990* | *0.985* | | |
| *Secondary*CoL (t)* | | | *0.428* | *0.207* | | |
| *High*CoL (t)* | | | *0.426* | *0.229* | | |
| *University*CoL (t)* | | | *1.316* | *0.798* | | |
| *No Educ.*CoL (t-9m)* | | | *1.533* | *0.448* | *1.526* | *0.445* |
| *Secon.*CoL(t-9m)* | | | *0.887* | *0.862* | *0.678* | *0.558* |
| *High*CoL(t-9m)* | | | *0.400* | *0.199* | *0.327* | *0.107* |
| *Uni.*CoL(t-9m)* | | | *0.278* | *0.244* | *0.295* | *0.250* |

*Source: Own Estimations*

Regarding to estimations, as expected the mortality risk for male infants is estimated 9.5% higher than females. However, as it has been indicated, the reason for high mortality risk for male infants is related to biological factors rather than socio-economic ones. In terms of mother's age at birth determinant, since 15 – 24 age groups have been defined as reference group, the risk of mortality is 9.4% lower for 25 – 34 age groups. On the other hand, the mortality risk for 35 – 49 age groups is higher than both age groups. Mother's age at birth group has been used to indicate the knowledge and experiences of mother. Consequently, the hazard ratios have been estimated as expected. Nonetheless, for 35 – 49 age groups, besides the level of knowledge and experience, the negative effects of reproductive ages have been also considered. Therefore the mortality risk for this group is estimated higher than others.

In addition, type of residence has been defined as a proxy for physical access to modern health services as well as to job opportunities and better living conditions. Therefore, my expectation from mortality risk of rural residence was higher. After analysis, estimations for type of residence demonstrate that mortality risk is 17% higher for infants whose parents live in rural areas.

Another important subject is the divergences in infant and child mortality among different regions due to differences in socio-economic development levels. To indicate the divergences, the west region – most developed – has been chosen as a reference group. Thus, I expected higher mortality risks from other regions. However, due to differences in development levels, magnitudes of mortality risks should have not been same. Therefore, I also defined the strength of mortality risk in the variables and expectations section, my expectation from the east region was

large higher risk since it is the less developed region. On the other hand, I expected medium and higher mortality risk for the north region since the socio-economic development level is above the average of Turkey (Albayrak, Kalaycı and Karatas, 2004). Furthermore, for other regions, my expectations from estimations were also higher risk of mortality but the magnitudes of mortality risks were small due to differences in economic conditions. In the table above, we see that the mortality risks for the central and east regions are 20% and 31% higher than the west region. While higher mortality risks fulfill my expectations, the strengths of risks are estimated differently. On the other hand, hazard ratios for the south and north regions have been estimated completely different from my expectations. Instead of having higher mortality risks, estimations have indicated lower mortality risks for the south and north regions. However, once should state that the hazard ratio for the north region is statistically insignificant and, as a result, it could not be interpreted properly. To understand unexpected estimations, I examined distributions of events among regions in the dataset. As a result, I have seen that numbers of events (death of infant) for the south and north regions are relatively lower than the other regions.

In terms of socio-economic status, I used education levels of fathers. Therefore, primary level education has been selected as a reference group due to high amount of individuals compared to others. Estimations show that relative risk of mortality is higher (20%) for no education group, however they also indicate that mortality risk is not as high as I expected. Furthermore, mortality risks for secondary (20% lower) and high school (30% lower) level education are estimated relatively lower to primary level, however in terms of university level education (51% lower), we notice a considerable difference between mortality risks. These differences in mortality risks were expected since occupation and level of income are likely to depend on education level.

As time varying covariates, two concepts of cost of living index have been included into model, while the first one defines price levels at death, the other one reflects 9 months lagged price variations from the birth. Results show that both economic indicators are statistically significant and have positive effects on infant mortality. However, we also observe that 9 months lagged price level from birth has higher influences on infant mortality.

In addition, to measure the effects of economic fluctuations on different socio economic groups, besides the economic indicators interactions between socio-economic status and economic indicators are also essential. Therefore, to define the differences in infant mortality responses, global and final models have been estimated. Due to higher effects of 9 months lagged price levels, price level at death variable has been eliminated from the final model. The table below indicated mortality risks among socio-economic groups by including the effects of variations in economic indicator. Thus, one unit increase in the cost of living index or 272% positive change (since I have taken the logarithms of cost of living index) increases infant mortality of no education group almost 420%. In addition, 272% change in the cost of living index causes 240% increase in the infant mortality of primary education group. For secondary education groups, one unit increase in the cost of living index increases infant mortality risk around 130%. On the other hand, the effects of economic fluctuations for high school and university level groups are quite

different, 272% increase in the cost of living index increase infant mortality 11.4% for high school education group. For university level education, infant mortality risk is 0.5% higher while the cost of living index increases 272%. Unfortunately, due to statistically insignificant variables in socio-economic status groups, considering these estimations would not be reliable.

*Table (7): Total effects of interactions between SES and Cost of Living Index*

| | No Educ. | Primary | Secondary | High | University |
|---|---|---|---|---|---|
| Col at Birth (t-9m) | 1.226 | 1.226 | 1.226 | 1.226 | 1.226 |
| SES*Col at B. (t-9m) | 0.423 | 0.000 | -0.389 | -1.117 | -1.221 |
| Total Coefficient | 1.648 | 1.226 | 0.837 | 0.108 | 0.004 |
| Total Exponent Of Coefficient | 5.198 | 3.407 | 2.310 | 1.114 | 1.005 |

*Source: Own estimations*

To sum up, I have found considerable differences among individual, family and community level determinants in terms of infant mortality. At individual level, importance of mother's age at birth has been shown by defining the knowledge and experience as well as the reproductive age of mothers. In addition, as a family level determinant, divergence among socio-economic groups is properly presented. Beside minor exceptions, all estimations for socio-economic groups are fulfilled my expectations. In terms of community level determinants, I used type of residence and regional differences, as expected living in urban areas give lower infant mortality risks. For regional groups, some of the estimations were different than I expected. At last but not least, I could not find significant relationship between economic fluctuations and socio-economic groups in terms of infant mortality. On the other hand, the relationships between economic factors and mortality as well as the relationship between socio-economic status and mortality have been shown for infant mortality.

### 7.1.2 Child Mortality

Due to differences between factors on infant and child mortality, I preferred to prepare separate models to examine possible factors. Therefore, in this section, effects of economic fluctuations on child mortality have been analyzed from the aspect of economic conditions at time of death. As individual, family and community level determinants, I preferred to use the same variables as in the model A. Regarding to my expectations, most of them are similar to the ones for infant mortality. On the other hand, in terms of mother's age at birth, my expectations for magnitudes

have been changed from medium to small, due to decreasing dependency of children to their mothers.

Regarding to estimations, it can be seen that my expectations are fulfilled for statistically significant ones. More specifically, as several reasons were demonstrated earlier, the mortality risk for urban citizens is estimated also lower (%16) for the Model B. In terms of regional differences, we see that hazard ratio estimations for Model B are closer to my expectations. Mortality risk for the central region is 51% higher than for individuals from the west region. On the other hand, it has been seen that mortality risk is even higher for the east region. We observe a 75% higher child mortality risk for children who live in the east region. In terms of the south region's estimation, child mortality risk is still higher than the west region however, compared to the central and east regions' mortality risks; the south region shows relatively lower (33%) risk. On the other hand, the issue of low amounts of events for the north region also occurs for child mortality therefore the hazard ratio is estimated statistically insignificant.

*Table (8): Hazard Models for Children (1-15)*

| ***Model B*** | | | ***Model B With Int.*** | | ***Model B Final*** | |
|---|---|---|---|---|---|---|
| *Max Log Likelihood* | *-6751.424* | | *-6749.4* | | *-6751.87* | |
| *CHISQ* | *151.03* | | *155.04* | | *150.12* | |
| | ***Hazard Ratio*** | ***P-value*** | ***Hazard Ratio*** | ***P-value*** | ***Hazard Ratio*** | ***P-value*** |
| ***Sex of child*** | | | | | | |
| *Male* | *1.063* | *0.422* | *1.063* | *0.420* | *1.063* | *0.419* |
| *Female* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| ***Mother's Age at Birth*** | | | | | | |
| *15 - 24* | *1.000* | *ref.* | *1.000* | *ref.* | | |
| *25 - 34* | *0.959* | *0.614* | *0.959* | *0.614* | | |
| *35 - 49* | *0.949* | *0.823* | *0.949* | *0.824* | | |
| ***Type of Res.*** | | | | | | |
| *Urban* | *0.843* | *0.032* | *0.844* | *0.033* | *0.844* | *0.033* |
| *Rural* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| ***Region*** | | | | | | |
| *West* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| *Central* | *1.514* | *0.000* | *1.514* | *0.000* | *1.512* | *0.000* |
| *East* | *1.750* | *0.000* | *1.751* | *0.000* | *1.742* | *0.000* |
| *South* | *1.332* | *0.021* | *1.329* | *0.022* | *1.332* | *0.021* |
| *North* | *1.074* | *0.608* | *1.071* | *0.619* | *1.073* | *0.614* |
| ***SES*** | | | | | | |
| *No Educ.* | *1.667* | *0.000* | *1.661* | *0.000* | *1.681* | *0.000* |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Primary* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| *Secondary* | *0.585* | *0.001* | *0.563* | *0.001* | *0.568* | *0.002* |
| *High* | *0.673* | *0.008* | *0.677* | *0.018* | *0.681* | *0.020* |
| *University* | *0.646* | *0.020* | *0.609* | *0.025* | *0.626* | *0.031* |
| ***Economic ind.*** | | | | | | |
| *CoI at Death(t)* | *2.991* | *0.323* | *0.682* | *0.790* | | |
| *CoI at Death (t-3m)* | *0.015* | *0.000* | *0.063* | *0.066* | *0.419* | *0.000* |
| ***Interactions*** | | | | | | |
| *No Educ.*CoL (t)* | | | *32.08* | *0.185* | | |
| *Secondary*CoL (t)* | | | *8.29* | *0.620* | | |
| *High*CoL (t)* | | | *12.78* | *0.551* | | |
| *University*CoL (t)* | | | *703.49* | *0.112* | | |
| *No Educ.*CoL (t-3m)* | | | *0.028* | *0.199* | *0.713* | *0.799* |
| *Secondary*CoL (t-3m)* | | | *0.297* | *0.791* | *2.179* | *0.716* |
| *High*CoL (t-3m)* | | | *0.062* | *0.552* | *0.723* | *0.883* |
| *University*CoL (t-3m)* | | | *0.004* | *0.254* | *2.041* | *0.789* |

*Source: Own Estimations*

From the aspect of socio-economic status, most of the estimations are fulfilled my expectations. We observed higher divergence among socio-economic groups compared to infant mortality. Accordingly, for children who have fathers with no education degree, mortality risk is estimated 66.7% higher than the ones whose fathers have primary school degree. In terms of other education level groups, relative mortality risks are estimated lower. However, for secondary level group, estimation of the mortality risk was extraordinary. It can be seen that mortality risk for secondary level group is 9% lower than high school level and 6% lower than university level group. However, when we consider income levels and occupations of these groups from the aspect of Turkey, it is low possibility for individuals to have higher socio-economic status in the secondary level group. Therefore, the reason for unexpected mortality risks might be low amounts of events in secondary level group.

To show the effects of economic variations, I used variations in the actual and 3 months lagged cost of living index. The reasons behind preferring 3 months lag are, firstly, through the trial estimations, the 3 months lagged variable reflected the economic effects more properly. And secondly, when you consider the economic conditions in the early periods of Turkey, it could be possible for families to face with remarkable economic shocks due to consistent high inflation rates and its effects to decrease the real value of money.

The table above shows that the cost of living index at time of death variable has been estimated statistically insignificant. However, this estimation for the cost of living index was expected. Due to the monthly data, it would not be reasonable to expect rapid price effects on mortality.

Therefore, cost of living index at death variable has been excluded from the final model to demonstrate the economic effects accurately.

*Table (9): Total effects of interactions between SES and Cost of Living Index*

| | *No Educ.* | *Primary* | *Secondary* | *High* | *University* |
|---|---|---|---|---|---|
| *Col at Birth (t-3m)* | *-3.173* | *-3.173* | *-3.173* | *-3.173* | *-3.173* |
| *SES*Col (t-3m)* | *-0.338* | *0.000* | *0.779* | *-0.325* | *-1.221* |
| *Total Coefficient* | *-3.510* | *-3.173* | *-2.394* | *-3.497* | *-4.394* |
| *Total Exponent Of Coefficient* | *0.030* | *0.042* | *2.179* | *0.030* | *0.012* |

*Source: Own estimations*

In the table above, total effects of economic variations and divergences in child mortality risks among different socio-economic groups can be seen. Regarding to estimations, one unit increase in the cost of living index decreases mortality risks of no education, primary, high and university level groups around 96%. On the other hand, the effects of economic fluctuations increase the mortality risk of secondary level group. Accordingly, 272% increase in the cost of living index increase 118% of mortality risk of secondary level group. However, since estimations are statistically insignificant for interactions between socio-economic status and price levels, these unexpected estimations have no validity. Especially, for mortality risks that have been estimated for no education, primary, high and university level groups.

Consequently, besides the individual level determinants and interactions between socio-economic groups and economic indicator, other variables have been estimated statistically significant. While, the effects of economic factors at family levels on child mortality are being shown, the differences in mortality responses among socio-economic groups at the time of economic stress could not be demonstrated due to insignificant estimations.

### 7.1.3 Early Life Effects on Child Mortality

In the previous model, aim was to measure the effects of economic fluctuations at the time of death. On the other hand, with the model that is illustrated in this section, I examined the early life effects on child mortality by including variations in price and IMR levels. Several studies (Bengtsson and Lindstrom 2000, Johansson 2004, Bengtsson and Brostrom 2009) have been carried out to examine the early life effects on both adult and child mortality. In these studies, different concepts of economic indicators and infant mortality rates have been used to define economic and demographic conditions in the early life. In addition, Johansson (2004) used IMR and price levels from foetal and infancy stages to examine the effects of economic fluctuations

among socio-economic groups. In terms of this study, price levels at birth and at foetal stage as well as IMR levels at birth have been employed to analyze possible early life effects on child mortality.

*Table (10): Hazard Models for Children (1-15) (Early Life Effects)*

| ***Model C*** | | | ***Model C with Int.*** | | ***Model C Final*** | |
|---|---|---|---|---|---|---|
| *Max Log Likelihood* | *-6682.6839* | | *-6675.9277* | | *-6687.7342* | |
| *CHISQ* | *229.38* | | *242.89* | | *238.12* | |
| | ***Hazard Ratio*** | ***P-value*** | ***Hazard Ratio*** | ***P-value*** | ***Hazard Ratio*** | ***P-value*** |
| ***Sex of child*** | | | | | | |
| *Male* | *1.075* | *0.337* | *1.075* | *0.342* | *1.071* | *0.367* |
| *Female* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| ***Mother's Age at Birth*** | | | | | | |
| *15 - 24* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| *25 - 34* | *0.856* | *0.061* | *0.859* | *0.070* | *0.859* | *0.066* |
| *35 - 49* | *0.719* | *0.162* | *0.714* | *0.152* | *0.717* | *0.157* |
| ***Type of Res.*** | | | | | | |
| *Urban* | *0.854* | *0.047* | *0.853* | *0.045* | *0.855* | *0.048* |
| *Rural* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| ***Region*** | | | | | | |
| *West* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| *Central* | *1.467* | *0.001* | *1.466* | *0.001* | *1.479* | *0.001* |
| *East* | *1.538* | *0.000* | *1.533* | *0.000* | *1.538* | *0.000* |
| *South* | *1.299* | *0.035* | *1.298* | *0.036* | *1.302* | *0.033* |
| *North* | *1.067* | *0.642* | *1.068* | *0.637* | *1.068* | *0.637* |
| ***SES*** | | | | | | |
| *No Educ.* | *1.789* | *0.000* | *1.706* | *0.000* | *1.748* | *0.000* |
| *Primary* | *1.000* | *ref.* | *1.000* | *ref.* | *1.000* | *ref.* |
| *Secondary* | *0.566* | *0.000* | *0.559* | *0.001* | *0.549* | *0.001* |
| *High* | *0.633* | *0.002* | *0.718* | *0.038* | *0.711* | *0.029* |
| *University* | *0.620* | *0.011* | *0.552* | *0.008* | *0.603* | *0.015* |
| ***Economic ind.*** | | | | | | |
| *Col at Birth (t)* | *0.426* | *0.200* | *0.646* | *0.607* | *0.795* | *0.723* |
| *Col at Birth (t-9m)* | *2.206* | *0.250* | *1.492* | *0.647* | | |
| *IMR Level* | *7.94E-13* | *0.000* | *9.06E-13* | *0.000* | *5.83E-13* | *0.000* |
| *IMR Cycle* | *1.0319* | *0.003* | *1.044* | *0.001* | *1.044* | *0.000* |
| ***Interactions*** | | | | | | |
| *No Educ.*CoL (t)* | | | *0.414* | *0.585* | *1.447* | *0.749* |
| *Secondary*CoL (t)* | | | *9.223* | *0.398* | *1.795* | *0.749* |

| | | | | | | |
|---|---|---|---|---|---|---|
| *High*CoL (t)* | | | *0.032* | *0.168* | *0.263* | *0.049* |
| *University*CoL (t)* | | | *0.055* | *0.354* | *1.523* | *0.848* |
| *No Educ.*CoL (t-9m)* | | | *6.077* | *0.278* | | |
| *Secondary*CoL (t-9m)* | | | *0.095* | *0.378* | | |
| *High*CoL (t-9m)* | | | *0.718* | *0.897* | | |
| *University*CoL (t-9m)* | | | *97.27* | *0.145* | | |
| *No Educ.*IMR Cycle* | | | *0.953* | *0.049* | *0.956* | *0.061* |
| *Secondary*IMR Cycle* | | | *0.990* | *0.793* | *0.985* | *0.691* |
| *High*IMR Cycle* | | | *1.001* | *0.970* | *1.001* | *0.988* |
| *University*IMR Cycle* | | | *0.958* | *0.381* | *0.969* | *0.494* |

*Source: Own estimations*

In the table above, estimated mortality risks for individual, family and community level determinants have been shown. As it can be seen, besides the time varying covariates, other variables show similar patterns as in the previous model for child mortality. In addition, since different concepts of economic indicators and IMR level - as a new variable - have been included into the model, the differences in magnitudes of mortality risks are expectable.

If we compare two models, a considerable difference occurs in the mother's age at birth group. While age groups for mothers were estimated statistically insignificant for the Model B, age group 25 – 34 becomes statistically significant at 10% significance level. Regarding to estimations, mortality risk for 25 – 24 age group is almost 15% lower than the age group of 15 – 24. On the other hand, for the region group, the differences in mortality risks seem declined in the Model C. One could suggest that the reason for this might be the lower effects of early life variables. Furthermore, for the socio-economic status group, the same problem in secondary level group can be observed again. As it has been stated, the low amounts of events in this group might be causing to unexpected estimations.

From the aspect of time varying covariates, price levels at birth and 9 months lagged price level at birth have been used to examine the effects at foetal and infancy stages. Unfortunately, coefficients for these variables are estimated statistically insignificant for the basic Model C. To overcome this problem and to avoid possible correlation between these variables, lagged price levels at birth have been excluded from the final model. Furthermore, to indicate disease load at time of birth, IMR level and IMR cycle have been used in the model. The difference between two variables is the trend, while IMR level includes the trend of the rates, IMR cycle is prepared to demonstrate the variations in the series. Regarding to estimations, mortality effect of IMR level variable has been found quite small. On the other hand, considerable effect on mortality has been estimated for IMR cycle variable. As a result, we see that one unit increase in IMR cycle variable increase the child mortality risk 3.2% for all individuals in the dataset.

In the final model, the effects of price levels as well as the effects of IMR levels at time of birth have been examined to demonstrate the divergences among socio-economic groups. For that reason, interactions between price levels and socio-economic groups, as well as interactions between IMR levels and socio-economic groups have been generated. In the table below, total effects of interactions between socio-economic status and the cost of living index can be seen. Due to insignificant estimations, no considerable mortality effects have been found for different groups. Some of estimations are quite unexpected that they give no reliable information about the relationship between socio-economic status and economic variations. As an example, for high school level group; 272% increase in the cost of living index decrease mortality risk about 98%.

*Table (11): Total effects of interactions between SES and Cost of Living Index*

| | No Educ. | Primary | Secondary | High | University |
|---|---|---|---|---|---|
| Col at Birth(t) | -0.230 | -0.230 | -0.230 | -0.230 | -0.230 |
| SES*Col (t) | 0.370 | 0.000 | 0.586 | -3.636 | 0.421 |
| Total Coefficient | 0.140 | -0.230 | 0.356 | -3.865 | 0.191 |
| Total Exponent Of Coefficient | 1.150 | 0.795 | 1.796 | 0.021 | 1.211 |

*Source: Own estimations*

In terms of interactions between IMR and socio-economic status, most of the estimations are also estimated statistically insignificant, except the one for no education group. According to the table below, 1 unit increase in IMR level increases the mortality risk 0.1% for no education group.

*Table (12): Total effects of interactions between IMR and Cost of Living Index*

| | No Educ. | Primary | Secondary | High | University |
|---|---|---|---|---|---|
| IMR Cycle | 0.447 | 0.447 | 0.447 | 0.447 | 0.447 |
| SES*IMR | -0.446 | 0.000 | -0.147 | 0.001 | -0.031 |
| Total Coefficient | 0.001 | 0.447 | 0.300 | 0.447 | 0.416 |
| Total Exponent Of Coefficient | 1.001 | 1.563 | 0.863 | 1.564 | 1.516 |

*Source: Own estimations*

As a result, I have found strong relationship between socio-economic groups and economic factors. We have seen that being in low socio-economic status increased the risk of mortality. On the other hand, the relationship between child mortality and early life effects in term of prices could not be demonstrated due to insignificant estimations. From the aspects of interactions

between IMR level at birth and socio-economic groups, only significant interaction variable is estimated for no education group. Due to quite small effect, it did not give any information to discuss differences among socio-economic groups.

## 8. Conclusion

Consequently, what I have examined in this study is the differentiations in infant and child mortality responses among socio-economic groups in times of economic stress. By combining micro demographic data and macroeconomic data in a Cox regression framework, the relationship that has not been studied with this method for Turkey- between socio-economic differences and short term economic stress has been analyzed for infant and child mortality.

For infant mortality, unlike Bengtsson (1999)'s findings for historical periods of Sweden, significant relationship has been found between socio-economic groups and infant mortality. More specifically, having a university level degree decreased the risk of infant mortality more than 50% compared to primary level education degree. In addition, from the same direction that Cerit (1975) concluded, the importance of parents' education – father in this study – and characteristics of residence – rural and urban differences as well as regional differences – have been shown for the case of Turkey.

By including time varying covariates, it has been possible to demonstrate the positive effects of price variations at different stages on infant mortality. In order to analyze further effects of price variations on socio-economic groups, final model with interactions between socio-economic groups and price levels at foetal stage has been estimated. However, in terms of the responses of different socio-economic groups, significant relationship could not be found due to insignificant estimations. While divergences in infant mortality responses among socio-economic groups and effects of economic fluctuations on infant mortality are being showed, differences in infant mortality responses in times of economic stress have remained unexplained. According to Bengtsson (1999), due to high vulnerability of infants, it is difficult to distinguish the cause of death. Therefore, further study is necessary by examining the causal effects of the social, biological, etc. factors in order to draw a constant reliable conclusion.

Further results for infants showed that besides economic factors, biological factors have also significant effects on survival. On the other hand, for child mortality, dependency to economic conditions is more noticeable. According to Eryurt and Koc (2009), relative risk of child mortality is 79% higher for the poorest class compared to the richest class in Turkey. This study, showed that while the differences in mortality risks among socio-economic groups are being estimated higher than the infant mortality, effects of economic variations on child mortality have become weaker. Therefore, lagged type of economic time varying covariate has been considered in the final model. Accordingly, interactions between socio-economic groups and lagged economic variable have been formed in order to examine the child mortality responses among

different socio-economic characteristics. After the analysis of final model, unexpected and irrelevant total mortality responses have been calculated due to statistically insignificant estimations. As a result, the relationship between child mortality and socio-economic differences in times of economic stress has remained unexplained from the aspect of the economic condition at death.

Therefore, an alternative model has been prepared to measure the early life effects on child mortality. IMR levels at birth and price levels at infancy and at foetal stage have been included into model as time varying covariates. While the individual, family and community level determinants are following the same patters as in Model B, no significant effect is found for price levels at infancy and at foetal stage. On the other hand, IMR level and IMR cycle time varying covariates are estimated statistically significant. While the effect of IMR level is estimated extremely low, IMR cycle showed relatively high effects on child mortality. Despite of the significant estimation for IMR cycle variable, no significant relation is found for most of the socio-economic groups. In addition, even statistically significant no education group, the positive effect of IMR cycle variable on child mortality was quite weak. This study is unable to show a significant relation between early life effects and child mortality. However, it does not mean that there are not early life effects on child mortality. In Johansson's study (2004), the relation between early life effects and child mortality could not be found in terms of food prices. However, he also states that the relation could not be found due to use of these proxies – rye prices – (Johansson 2004; pp.208). Therefore, since Bengtsson and Lindstrom (2000) suggest that the link between rye prices and later life mortality is not direct and the indirect effects of food prices on child mortality have been shown earlier (Bengtsson and Brostrom 2009), I have the motivation to examine possible proxies that could have direct and indirect effects on child mortality.

Consequently, besides the insignificant estimations for the relationship between socio-economic status and price levels, divergence in infant and child mortality risks among socio-economic groups have been shown for Turkey. In addition, this study also demonstrated the effects of short term economic variations on infant and child mortality. By examining this, underestimated and unnoticed relationships in previous studies have been fulfilled. Regarding to socio-economic differences and mortality responses in times of economic variations, further research is necessary to examine early and local effects as well as direct and indirect effects of price variations on infant and child mortality. As a result, once again, we see the benefits of the micro approach in terms of examining the effects of individual, family and community level determinants by including time varying covariates – price levels and IMR levels – on infant and child mortality.

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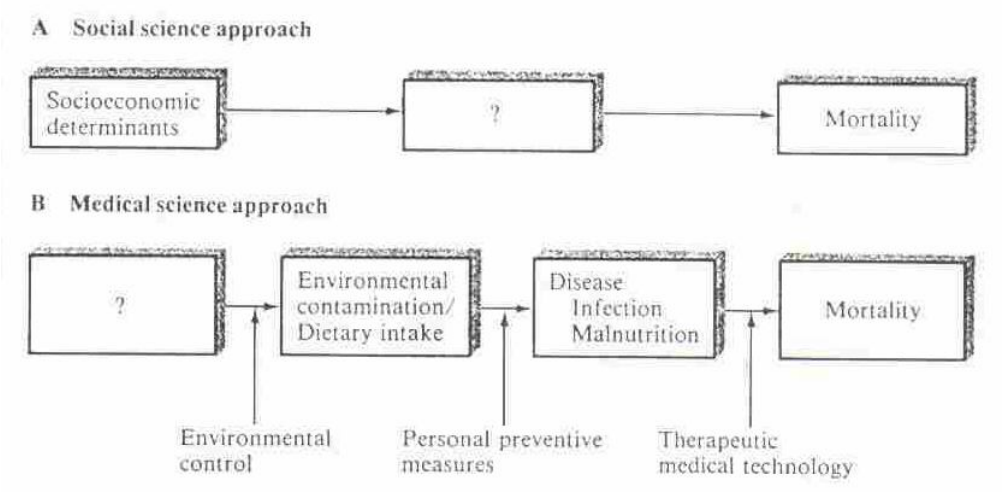
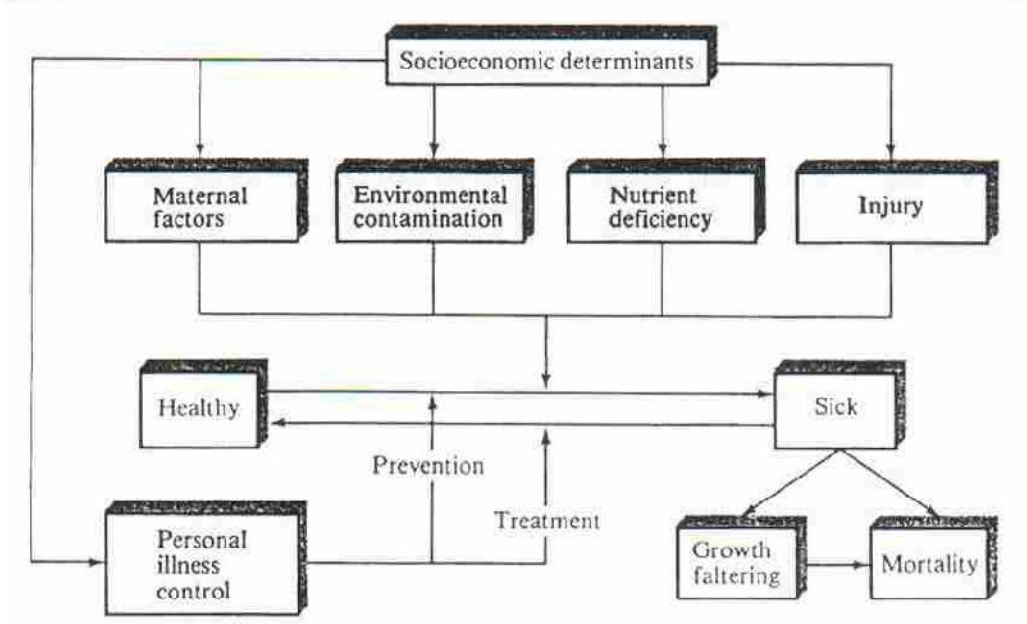
## Appendix

*Figure 1a: Conceptual models of social science and medical science approaches to research on child survival*



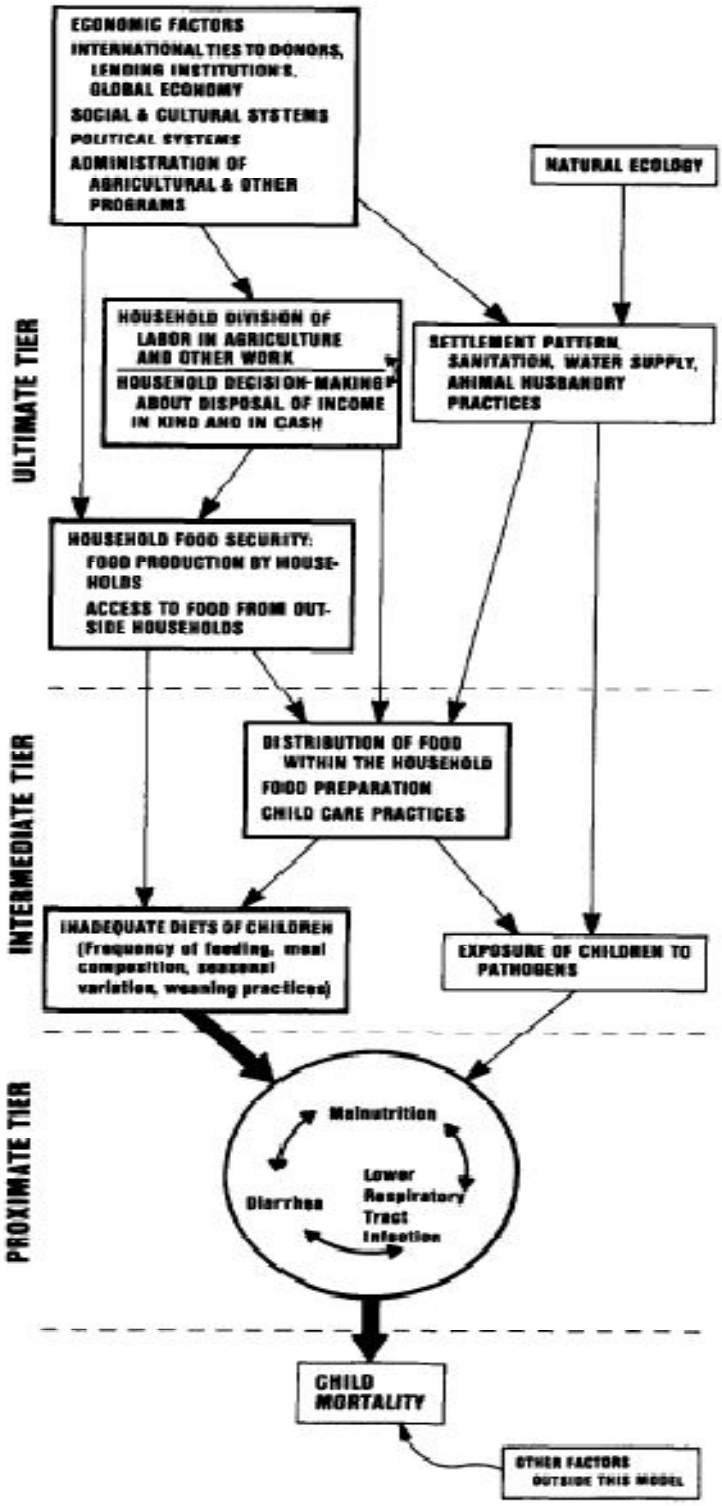

*Source: Mosley and Chen (1984)*

*Figure 2a: Operation of the five groups of proximate determinants on the health dynamics of a population*




*Source: Mosley and Chen (1984)*

*Figure 3a: A Causal Model, high rates of child mortality*




*Source: Millard (1994)*