AN ECONOMETRIC ANALYSIS OF
FERTILITY TRANSITION IN TURKEY

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ABSTRACT

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Fertility levels are investigated in the thesis because significant changes have occurred recently in the fertility levels in Turkey. It is necessary to understand the factors related to fertility level declines to determine how people behave with regard to their fertility in Turkey. It is only after understanding people's behavior then it is possible to develop appropriate social and governmental policies.

It is possible to evaluate the fertility level declines from different points of view. There are two opposite approaches when evaluating fertility level declines. One of the approaches explaining fertility level declines is the demographic transition theory which uses "modernization" as the cause of fertility level declines. The "other" approach is the opposite approach to the modernization theory. Both of these approaches are acceptable approaches from different views. However; this thesis is not written to prove either one of these approaches. The demographic transition or the modernization perspective is used as a tool to determine the variables which cause fertility levels to decline in Turkey.

The aim is to provide an understanding of the determinants of fertility levels in Turkey by constituting an econometric model of fertility across the provinces of Turkey by using the panel data estimation. Data for the variables can be found in years from 1980 to 2000. One of the purposes of this thesis in investigating the fertility level declines is to identify which changes occurred in Turkey related to fertility levels between the years 1980-1985, 1985-1990 and 1990-2000. It is found that urbanization gained importance in effecting fertility level declines in the 1985-1990 period as compared to the 1980-1985 period. The other purpose of this thesis is to investigate how different are the fertility levels in the Provinces Prioritized in Development from the "other" provinces. Although contraception usage is important in effecting fertility levels in the "other" provinces, this factor is not important in effecting fertility levels in the Provinces Prioritized in Development.

Keywords: Demographic Transition, Fertility, Panel Data, Simultaneous Equation.

ÖZ

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Türkiye'de doğum oranlarına ilişkin önemli değişmelerin olması nedeniyle tezde doğum oranları incelenmiştir. Doğum oranlarına ilişkin azalmaları incelemek, Türkiye'de insanların doğum oranları ile ilgili davranışlarını anlamak açısından önemlidir. Sosyal politikaların ve hükümet politikalarının geliştirilmesi insanların doğum oranlarına ilişkin davranışları anladıktan sonra mümkün olabilir.

Doğum oranlarına ilişkin azalmaları farklı açılardan değerlendirmek mümkündür ve bu azalışları değerlendirirken farklı iki yaklaşım mevcuttur. Bu yaklaşımlardan biri modernleşmeyi doğum oranlarına ilişkin düşüşün nedeni olarak gören demografik geçiş teorisidir. Doğum oranlarının azalmasına ilişkin bir diğer yaklaşım ise modernleşme teorisi ile ilgili ilk yaklaşıma ters olan bir yaklaşımdır. Her iki yaklaşım da farklı açılardan kabul edilebilir yaklaşımlardır. Ancak; bu tez bu yaklaşımlardan birisini kanıtlamak için yazılmamıştır. Demografik geçiş ya da modernleşme yaklaşımı, Türkiye'de doğum oranlarının azalmasına sebep olan değişkenleri belirlemek için bir araç olarak kullanılmıştır.

Tezin amacı, panel data tahmin yöntemiyle doğum oranlarını belirleyen faktörleri anlamak için Türkiye'de il bazındaki verileri kullanarak doğum oranlarına ilişkin ekonometrik modelleri tahmin etmektir. Değişkenlere ilişkin veriler 1980 - 2000 yılları arasındadır. Tezde doğum oranlarındaki azalmaları incelemekteki amaçlardan biri, Türkiye'de doğum oranlarına ilişkin 1980-1985, 1985-1990 ve 1990-2000 yılları arasında ne gibi farklılıklar olduğunu tespit etmektir. 1980-1985 yılları ile kıyaslandığında 1985-1990 yıllarında şehirleşme oranının doğum oranlarını etkilemesi açısından önem kazandığı görülmektedir. Tezin bir diğer amacı ise, kalkınmada öncelikli illerdeki doğum oranları ile diğer illerdeki doğum oranları arasındaki farklılıkları incelemektir. Doğum kontrol uygulamaları Kalkınmada Öncelikli İllerde önemli bulunmamışken, kalkınmada öncelikli iller dışındaki diğer illerde doğum oranlarını etkilemede önemli bulunmuştur.

Anahtar Kelimeler: Demografik Geçiş, Doğum Oranları, Panel Veri, Eşanlı Denklem.

To My Family

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CHAPTER 1

INTRODUCTION

In this thesis, fertility changes of Turkey are investigated between the years 1980 - 2000 by using panel data estimation. The importance of the study is that it uses panel data. In the previous studies in this area panel data are not used due to the data limitations. Most of the studies used only cross-section estimates however panel data allow a more complete analysis of region, province and time period effects on fertility levels. Therefore, in this study panel data is preferred to be used.

In this chapter of the thesis we first examine the importance of studying fertility changes in Turkey. Next, two approaches to the fertility level declines are investigated. They are namely, the Demographic Transition Theory and the “other” approach represented by feminist scientists such as Beneria, Sen and Hartmann. Then, econometric models of fertility decline are discussed. Finally, the aim of the thesis and methodology used are introduced.

1.1 Why Investigate the Fertility Changes in Turkey?

Fertility levels are investigated in the thesis because significant changes have occurred related to the fertility levels in Turkey. For instance, in the west part of Turkey the total fertility rate decreased from 4.35 children in year 1960 to 1.88 children in year 2003. However; in the east part of Turkey the total fertility rate decreased from 8.27 children in year 1960 to 3.65 children in year 2003. It is necessary to understand the factors related to fertility level declines to determine how people behave with regard to fertility in Turkey and after understanding people’s behavior then it is possible to develop social and governmental policies. According to the Tüsiad report *“If the fertility rate has registered a rapid decrease in recent years, the reasons for this should not be attributed to the actions and policies of the state, but to the fact that social and economic conditions have driven couples to have fewer children” (Tüsiad, 1999).* That is; the reasons which cause fertility level declines in Turkey are related to social and economic conditions of couples in Turkey rather than the actions and the policies of the state such as the implementation of family planning programs and laws in contraception usage since 1965 and the legalization of abortion since 1983. Fertility level declines are peoples’ own decisions in Turkey; there is not any obligation which comes from the government for people to decline their fertility levels. Thus; to determine the most important factors related to fertility level declines, an econometric model for fertility level is estimated for Turkey in the thesis. Since fertility levels are following a declining trend in Turkey, fertility levels are examined in the thesis to understand the differences between the west and the east part of Turkey and to identify the changes related to fertility levels between the years 1980-1985, 1985-1990 and 1990-2000 together with determining the most significant independent variables affecting the fertility levels in Turkey. These changes related to fertility levels are investigated because it is thought that different factors are at work in different years and in different parts of Turkey related to fertility behavior of people. In Turkey, mostly couples prefer to have a number of children that they can look after. However; this is not valid everywhere in Turkey. In some parts of Turkey, fertility levels are still high that is; some couples have lots of children although they don't have any possibility to meet the basic needs of their children. However; this does not mean that fertility levels ought to fall to very low levels. Fertility should be inside the reasonable levels that couples have possibility to look after their children.

One of the purposes of this thesis is to identify which changes occurred in Turkey related to fertility levels between the years 1980-1985, 1985-1990 and 1990-2000. The other purpose of this thesis is to investigate the fertility levels in the provinces prioritized in development (PPD) and compare it with what they are in the other provinces.

Investigation of the fertility levels in Turkey is significant because future decisions related to social, economic and political area should be taken by knowing the potential number of people in the future. For instance; if the current fertility levels are high in a country then this will bring the problem of an aging population in the future. Thus; health and old-age security institutions together with health systems should be constructed in accordance with the new situation (Tüsiad, 1999). When fertility levels are currently high then a young population will be larger in number in the near future and this will bring the problems related to the quantity and quality of education. Thus; precautions related to the quantity and quality of education should be taken if the fertility levels are high in the country.

In general, it is possible to evaluate fertility level declines from different aspects and there are two opposite approaches when evaluating fertility level declines.

1.2 How Are Fertility Declines Explained?

In this part, firstly explanations of fertility level declines are given by using two different approaches. One of the approaches explaining fertility level declines is the demographic transition theory which uses “modernization”, the increased levels of urbanization and decreased levels of non-agricultural activities, as a cause of fertility level declines and the other approach is the opposite approach to this demographic transition theory. Secondly, “From the demographic transition theory to econometric models of fertility decline” part is introduced.

1.2.1 “Modernization” as a Cause of Fertility Decline

One of the approaches related to fertility level declines is the demographic transition theory which states that the transition from high fertility and mortality levels to low fertility and mortality levels can occur as a result of the improved living conditions, modernization and economic development of a country. As it was stated by Bongaarts and Watkins (1996), the pace of fertility level decline is related to the level of development when the transition began. According to the first approach which is related to the demographic transition, development and modernization are the factors which cause fertility levels to decline. According to the demographic transition, high fertility levels were necessary for survival and properties like religious beliefs, marriage habits such as the early marriages, laws, family organizations, moral codes were the real causes of past high fertility levels. As a result of declining mortality levels due to modernization and development there was no need to properties at their original strength and fertility levels decline (Caldwell, 1976: 323). Modernization refers to urbanization and increase in the proportion of nonagricultural production or in other words urban industrialism according to the demographic transition (Caldwell, 1976: 322, 324). Thus; modernization and development are the factors which give possibility to live better, comfortable and easy lives by meeting people’s needs at the acceptable level that is the level necessary to meet people’s basic needs such as food, clothing etc. Since children are no longer seen as child labor and old age security of their families then fertility levels decline. According to this first approach, it is possible to prevent poverty by lowering fertility levels that is; the lowest the fertility levels the highest the level of per capita income of an individual. Thus; fertility should be limited to have better life standards. As a result of fertility level declines, it will be easy to find solutions to health problems and unemployment problems. People can more easily have access to health services and it will be easy to meet everybody’s basic needs. It is also possible for poor people to live better lives by accessing the basic needs. The ideas which are put forward at the International Conference for Population and Development in Cairo, 1994 by the United Nations Fund for Population Activities (UNFPA) can be given in order to put forward the ideas this approach is based on as: *"The provision of modern contraceptives … reduce the birth rate, considerably reducing pressure on the environment and economy, making everyone on the planet, rich and poor, better off"* (Hartmann, 1997: 294).

1.2.2 "Other" Approach to Fertility Decline

The modernization perspective as a cause of fertility decline which is given around the demographic transition is the first approach and it constitutes a limited view. The real problems that the first approach causes are put forward as:

"This consensus poses real problems for feminists who, on the one hand, want to defend women's right to control their own fertility through access to safe contraception and abortion, but who, on the other, are critical of population control" (Hartmann, 1997:294) and *"Much of the literature on Third World countries has focused on the question of population control without directly addressing the problem of reproductive freedom for women or the possible contradictions between class and gender… The concept of reproductive freedom includes the right to bear or not to bear children" (Beneria and Sen,1997: 50).*

Thus; it will be helpful to express the ideas of another approach which is against the first approach. This second approach is stated and supported in Hartmann's 1997 paper. In order to put forward the ideas of the second approach the statement can be given as: *"The 'good' news is that the aggressive promotion of modern contraception through family-planning programmes and the mass media can drive down birth rates in poor countries such as Bangladesh, even in the absence of economic development" (Hartmann, 1997: 301).* That is; according to the second approach development is not a necessary condition for falling birth rates.

According to this second approach which is opposite to the "modernization" as a cause of fertility decline there is no need to limit fertility levels to have a better life standard since it is possible to take other precautions. According to the this second approach, the real cause of problems in the world should not be attributed to the high fertility levels of poor people because the real cause of problems are the powerful rich rather than poor minority and as this approach stated, poor people are not actually the ones gobbling up resources because *"According to the UN, the poorest 20 per cent of the world's population receives only 1.3* *per cent of global income (UNDP, 1993: 10, 27,177). As their numbers mount, no doubt each individual's share of that 1.3 per cent diminishes-but that ignores the other 98.7 per cent of the pie" (Hartmann,1997: 299).*

Population growth is not seen as the major cause of environmental degradation in the world according to the second approach because *"Affluence has far more to do with the depletion of natural resources then population size. The industrialized nations, with 22 percent of the world's population, consume 70 percent of the world's energy…On a global level, then, it does not make sense to blame environmental degradation on population growth" (Hartmann,1997: 294-295)* and military forces are one of the main factors which cause environmental degradation.

Increased income inequalities and the wealth in the hands of the rich are the real cause of problems according to the second approach. Another point stated is that it should be differentiated between luxury and survival consumption because although a luxury life might not be possible for everybody, it is possible to meet everybody's basic needs thus; there is no need to lower fertility levels by not giving permission to the women to control their own fertility.

1.2.3 From Demographic Transition Theory to Econometric Models of Fertility Decline in Turkey

Both of these approaches are acceptable approaches from different aspects however; this thesis is not written to prove one of these approaches. That is; the purpose of this thesis is not to support any one of these approaches and also the specific role of women is not aimed to be ignored by lowering their fertility levels. The aim is to provide an understanding of the determinants of fertility levels in Turkey by constituting the econometric model of fertility across the provinces of Turkey by using the panel data estimation together with simultaneous-equation estimation. Data for the variables can be found in years from 1980 to 2000. The demographic transition or the modernization perspective is only used as a tool to determine the variables which cause fertility levels to decline in Turkey. For this purpose, theories related to demographic transition are investigated in the thesis and these theories of demographic transition help for the determination of variables related to fertility level declines in Turkey.

Modernization is one of the factors which cause fertility levels to decline according to the first approach which is given around the demographic transition. Since demographic transition is used as the tool to determine the variables which cause fertility levels to decline then it will be useful to explain what is meant by modernization and development in the thesis.

Development refers to the economic development of a province in the thesis. Economically developed province is the province in which most of the people living in the province have income level above the per capita income in Turkey. If a province in Turkey is an economically developed province then probably fertility levels will decline because since couples earn enough money as a result of economic development then they do not need more and more children to earn money for the family. Another factor which will cause fertility levels to decline is that couples do not see their children as their old-age security since they earn enough money for their old ages. Thus; economic development of the province will bring less number of children and will cause fertility levels to decline.

In Turkey, especially in the east part of Turkey, if husbands insist on fathering a son then women have lots of pregnancies to catch the male child and in such a case women's are not the controllers of their own fertility however; their husbands who insist on fathering a son is the factor controlling the women's fertility. In the thesis, modernization and development are the factors which cause education level of such couples to increase. Thus; couples especially fathers' wrong minds change about insisting on having lots of children to catch the male child. Then due to the modernization and development fertility levels decline in Turkey.

Modernization is a factor that brings knowledge about contraception usage. There are lots of health centers in Turkey ready to give information about contraception usage. After having knowledge about contraception usage whether to use contraceptives to control their fertility or not are the couple's own decisions. Couples are not forced to use any kind of contraceptives in Turkey. Couples are completely free in using the contraceptives or not. As a result of modernization, couples who wanted to control their fertility but did not know how to do this will have knowledge about contraception usage.

As a result of modernization and development of a province in Turkey, educational opportunities will increase in the province. Increased education will bring less number of children because educated parents might want high quality of children. Since quality and quantity are negatively related then, as a result of modernization and development of the province educated parents will prefer less number of high quality children.

Modernization also refers to the increased urbanization and decline in the proportion of nonagricultural production in the thesis. Important aspects of modern life reflect the desire for small families rather than larger families. In urban areas economic value of children has decreased and as a result of this, fertility levels decline in urban areas in Turkey because individualism rather than extended families gains importance.

As a result of modernization or urban industrialism, health conditions have gotten better in Turkey and this cause infant mortality levels to decline considerably. Decreasing infant mortality levels cause fertility levels to decline in Turkey because more children survive as a result of improved health conditions and parents do not need to have more children to guarantee the desired number of survived children. Parents do not take precautions by having more children against possible death risks of their children thus; fertility levels decline with increased modernization.

1.3 The Aim of This Study

This study will give answers to the following questions:

- What are the most significant factors related to fertility levels decline for the periods 1980-1985, 1985-1990 and 1990-2000?

- What are the first and the second most important variable in explaining fertility levels in Turkey between the years from 1980 to 2000?

- How different fertility levels in the PPD are than it is in the other provinces? What are the most significant factors related to fertility level declines in the PPD and in the other provinces?

- Are the theories of demographic transition verified by the econometric models constituted in the thesis?

- Are time specific effects, province specific effects or both of them significant when constituting the econometric model by using all of the provinces in Turkey, the other provinces and the provinces prioritized in development?

- Does female labor force participation influence fertility levels? What are the effects of female labor force participation levels on fertility levels for the periods 19801985, 1985-1990 and 1990-2000?

- What are the effects of educational improvements on fertility levels?

- What is the long-term relationship between the demographic (fertility) transition and the level of economic development of a province which is related to the increased levels of GPP of the province?

- What are the effects of urbanization on fertility levels in the PDD and in the other provinces?

- In Turkey, how much does the decrease in infant mortality rate accelerated the tempo of transition from 1980 to 2000?

- How does a decrease in agricultural labor force and percentage of “no schooling” in the total population together affected the demographic transition in Turkey?

- How does a cultural change, for instance, the number of public library users in a province, have accelerated the demographic transition?

- Do the provinces in Turkey have similar averages in fertility levels?

- How do the economic growth rate and the population density of Turkey affect the demographic transition in general and in sub-samples?

1.4 Methodology

The importance of the study is that in previous studies in this area panel data are not used due to the data limitations. Most of the studies used only cross-section estimates however panel data allow a more complete analysis of region, province and time period effects so in this study panel data is preferred to be used. Again in most of the studies simultaneous-equation estimation is not used however one of the determinants of the fertility level is the female labor force participation rate, since there is a simultaneity between them, panel data simultaneous-equation estimation is also estimated to have the unbiased estimation results. The other importance of the study is that this study investigates fertility levels by using *all* the provinces' data in Turkey for providing econometric estimates to understand the pace of fertility decline together with social and economic variables to have an important sight about the factors affecting fertility levels.

This study is significant because unlike others, it specifically covers every province of Turkey in modeling the fertility levels.

This study consists of 9 sections. The rest of the study is organized as follows: In Section 2 historical evolution of demographic transition is given. Section 3 introduces the general explanations and the stages of demographic transition. Section 4 gives three main theories of demographic transition. In Section 5 a brief summary of demographic transition in Turkey is investigated. Review of Literature is offered in Section 6. Estimation methodology is discussed in Section 7. Section 8 is the application section and the empirical model together with estimation results are given in this section. The study will end with concluding remarks of Section 9.

CHAPTER 2

HISTORICAL EVALUATION OF DEMOGRAPHIC TRANSITION

In the historical evaluation of demographic transition part firstly, Malthusian theory is investigated. Secondly, transition from Malthusian theory to demographic transition is examined. Thirdly, description of demographic transition is given and finally, history of demographic transition is introduced.

In the historical evaluation of demographic transition part, beginning from the Malthusian theory will be meaningful because the relationship between population growth and income was most famously examined by Thomas R. Malthus (1798) and Malthusian theory has got an important effect on the demographic transition theory.

2.1 Malthusian Theory

Malthus who wrote the book “Essay on the Principle of Population” in 1978 in which he explained the relationship between the population growth and the standard of living, the level per capita income that is the effects of population growth on welfare was investigated. His ideas about the pressure of population on resources in explaining poverty was one of the important contributions of Malthus (Ross, 1998: 1, 3). His other contribution was that he evaluated the population study with in the area of sociology (Thompson and Lewis, 1965: 35).

According to Malthus’s “principle of population” view, human’s ability to reproduce was greater than their ability to produce the necessities of life (Thomas and Lewis, 1965: 15). Growing size of population was the result of passion between sexes that were unchanging (Thompson and Lewis, 1965: 17) which resulted with the greater power of population and moreover unchecked population growth was the result of the good living conditions of human beings.

In the Malthusian model, there was a positive relationship between income per capita and population growth. Thus, when the sources of a country increase such as a rise in the availability of land then this cause a larger population to occur not a rich population (Galor and Weil, 1999: 150).

According to Malthus (1789: 3), in areas where mortality exceeds fertility, in order to close the gap, expected increase in fertility levels should be more rapid than the general increase in fertility levels.

Malthus gave different estimations of writers' such as Sir William Petty and Euler about the doubling period of population however according to his ideas when population was left as unchecked than it would double itself every twenty five years, or in other words increases in population would be geometrical however; it is not easy to determine the ratio of the increase of the world production, the only known aspect was that it had a different nature from the population increase. Additions made to the former productions of the world were diminishing but by supposing that the increases were same rather than decreasing than this result with arithmetical increases in productions of the world. According to Malthus's suggestions, increases in population should be kept down by using strong law which he thought to be acted as a check to population (Malthus, 1798: 3-6).

According to Malthus, there were two essential effects in limiting the population size and kept the population size on a level with the production of the world. These two major effects were the "positive" and "preventive" checks. Positive checks were the diseases, epidemics, wars, famine and bad nursing of children; preventive checks or in other words prudential checks (Thompson and Lewis, 1965: 18) were the postponement of marriages that cause fertility levels to decline. These checks caused increases in population size to be slow and the checks are the results of insufficiencies of productions of the world (Malthus, 1789: 8, 12, 252). By using the checks controlling the population growth rate was essential according to Malthus. That was stated in Currais (2000: 77) as *"When size population is small, the standard of living will be high."*

That is; to have a high standard of living controlling the population size is essential and checks constituted the most significant part of this controlling process.

When Malthus was evaluating the growth rate of populations in his book he made comments by using these two types of checks. Positive checks together with preventive checks were seen as the factors that could prevent the pressure on resources according to him.

As it was stated by Beaver (1975, 1975: 1-2), population was always in equilibrium by the use of positive checks and preventive checks. Due to the Malthus's ideas when there was a new settlement in a country where food were rich than this resulted with a rapid progress in population (Malthus, 1789: 252). This idea of Malthus took place in Beaver (1975: 5) as *"Malthusian thinking inextricably linked 'good times' with high birth rates"*.

From the idea above it is easy to say that according to Mathus, when countries are in their "good times" than this cause their population to increase. These good times of the countries were taken into account in Thompson and Lewis (1965: 18) with the words *"After a war was over, after a pestilence had subsided, or after a famine had been succeeded by a return to normal crop production, population would grow fast"*.

In other words, increases in population growth were the result of the increasing prosperity and this increases in population growth continued until food supply limit was reached (Currais, 2000: 75). To support his ideas Malthus gave Israelites as an example. Although Israelites were slowly increasing in number after they settled in a fertile area of Egypt than their numbers doubled in every fifteen years during the whole period of their stay (Malthus, 1789: 252).

2.2 From Malthusian Theory to Demographic Transition

Malthusian theory and the demographic transition were two opposite approaches. Although Malthusian theory suggested a positive relationship between socioeconomic development and fertility behavior that is; improvements in socioeconomic conditions bring high fertility levels, according to Malthusian approach, the demographic transition suggested a negative relationship between socioeconomic development and fertility behavior that is; increases in socioeconomic development brought low fertility levels (Kulu, 1985: 1-2). In other words, Malthus related high fertility levels to the "good times" of nations however; in Europe, the situation could not be explained by using Malthus's ideas. That is, although Europe was living its "good times" in terms of wealth level, education, and health conditions; fertility levels were falling to the levels never recorded before and the Malthusian theory was insufficient in explaining the European fertility level declines. After evaluating the reasons under the European fertility level declines then this situation caused new ideas which constituted the demographic transition theory to appear (Beaver, 1975: 11).

Reasons for the need of another theory rather than Malthusian theory can be explained by using the ideas of Thompson and Lewis (1965: 20, 21) as:

"Information regarding the social and economic changes associated with population changes was even more meager and imprecise-e.g., the relation between good and poor

crops and the growth of population in Norway and Sweden during the latter half of the eighteenth century was not widely known in 1978; Finally, the great social and economic changes which were to flow from the agricultural and the industrial revolutions, and changes in rate of population growth associated with them, were not yet clearly discernible."

According to Beaver (1975: 2-3) demographic transition theory was the theory trying to explain the divergence from Malthusian theory. The demographic transition theory was formulated after the occurrence of abnormal demographic trends in northwestern Europe, mortality declined and this contributed to the persistent population growth this caused the concerns felt by Malthus to be wrong.

Although Malthusian theory was very helpful in explaining the interactions between population growth rate together with checks and other variables then Malthusian theory became an insufficient theory in explaining the demographic differentials after some times later. For instance, in Malthus's time, high mortality levels as a result of diseases were thought as inevitable and normal however; after Malthus's time, high mortality levels as a result of diseases are accepted to lower the population growth (Thompson and Lewis, 1965: 27). In order to support the idea that Malthusian theory was not sufficient, Schultz's (1985) and Kremer's (1993) studies can be given as the studies which did not support Malthusian Theory (Currais, 2000: 75). And from an another perspective although some of the variables were regarded as essential variables currently in explaining population changes they were not mentioned at Malthus's time, for instance he did not mention contraceptive usage although he must have known the usage of contraception in his time (Thompson and Lewis, 1965: 27-29). Maybe another reason that Malthus did not mention contraception usage was that contraception was not widely used in the nineteenth century.

Because of the insufficiencies of the Malthusian Theory in explaining the ideas, theories of demographic transition began to take place the Malthusian ideas. However; there were significant contributions of the Malthusian ideas to the study of population in spite of the insufficiencies of the theory.

2.3 Description of Demographic Transition

Demographic transition theory is the theory that refers to the transition from a pre-modern society of high mortality levels and fertility levels to a post-modern society of low mortality and fertility levels as a result of a modernization process (Kirk, 1996). According to another explanation by Beaver (1975: xix), demographic transition theory is a socio demographic transition theory which tries to explain the reasons why a society having socioeconomic development experiences low fertility and mortality levels by giving the relationship between demographic variables and social structure. In other words, demographic transition is also the theory describing the transition from high fertility and mortality levels to low fertility and mortality levels as a result of the improved living conditions and economic development of a country from a pre-industrial to a post-industrial economy. Demographic transition theory uses different arguments from different areas to indicate that the fertility level declines occurred as a result of socioeconomic development which occurred after a decline in mortality levels (Beaver, 1975: 9).

Demographic transition theory has usually been used with the words such as "modernization", "development", "socioeconomic development" (Beaver, 1975: 4) and all of them can be used when giving explanations of the demographic transition. What is meant by modernization and development in the thesis is given in the introduction part of the study. As it was indicated by Beaver (1975: 4), the word "development" can be referred to as "modernization" or "socioeconomic-development" and increased urbanization, advances in educational activities together with increasing levels of living which is net domestic product per capita are all socioeconomic development aspects (Beaver, 1975: 71) which is related to demographic transition theory.

Another explicit explanation of the demographic transition was stated by Galor and Weil (1996, 374) by linking fertility and growth. As Galor and Weil (1996, 374) put it:

"First, increases in capital per worker raise women's wages, since capital is more complementary to women's labor input than to men's. Second, increasing women's relative wages reduces fertility by raising the cost of children more than household income. And third, lower fertility raises the level of capital per worker. This positive feedback loop generates a demographic transition: a rapid decline in fertility accompanied by accelerated output growth."

After giving brief explanations for the demographic transition theory, contributions of Thompson (1929), Landry (1934) and Notestein (1945) to the demographic transition idea will be investigated in turn.

2.4 History of Demographic Transition

Demographic transition idea was first appeared with the demographic transition model (DTM) which was developed by Warren Thompson in 1929. After Thompson had proposed the demographic transition model, Landry (1934) interested in demographic transition model by giving detailed explanations for fertility and mortality level declines and inquired about the beginning time of demographic transition. After Landry's studies, it was Notestein's studies in 1945 which caused demographic transition model to appear in the form of demographic transition theory.

2.4.1 The First Idea of the Demographic Transition Model

Demographic transition model (DTM) which describes the population changes over time is the model used to describe demographic transition theory. It was put forward by Warren Thompson in 1929 with an article named "Population". In his study, he tried to explain population changes over time by investigating the fertility and mortality levels of three groups of countries. These countries are group A, group B and group C countries and they comprised all over the world (Thompson, 1929: 959-962). Group A countries consist of US, Japan and North & Western Europe. Group B countries consist of Central & Southern Europe and group C countries are the rest of the world.

According to his explanations, group A countries had low mortality levels together with declining fertility levels and this resulted with a decreasing population as a result of contraceptive usage in these countries. In group B countries, since mortality levels were decreasing in a rapid manner when compared to fertility levels than this resulted in rising population although increases in fertility levels were slow. In group C countries, growth rate of population was determined by the positive and the preventive checks of Malthus, that is fertility and mortality levels were uncontrolled or very little controlled in these countries. Thompson investigated the situations in these countries separately in his 1929 paper. Developed countries in the world were lying in group A. According to his estimations, group B countries would double in about fifty-eight to sixty years and since the communication was easier than in the past, fertility levels were estimated to decline faster than it did in group A countries. Growth rate of group C countries consisted of 70 or 75 percent of total population of the world took place as explained in Malthus. That is, growth rate of countries was positively related to subsistence levels of countries (Thompson, 1929: 969-971).

As stated in Kirk (1996: 362) Landry (1934) was the person after Thompson who examined the stages of population development. Detailed explanations for both fertility and mortality level declines were given by him. His interesting explanation stated by Kirk (1996: 362) which is true at present is that in countries in which the transition starts later, fertility and mortality level declines are faster. According to Landry, there were three stages of population development. These were the primitive, intermediate and contemporary stages. Although this classification of Landry was equal to the Thompson's classification, his investigation about fertility and mortality level changes was more detailed than Thompson (Currais, 2000: 89). The other important contribution of Landry was that, his studies raised a question about the beginning time of the demographic transition which has not been solved yet (Kirk, 1996: 363).

2.4.2 The First Theory on Demographic Transition

Notestein (1945) was the person who developed the demographic transition theory by investigating the relationship between the population growth rate and industrial development. His ideas were at the center of modern thinking about population (Coale, 1983: 3) and modern demographic transition theory was born by him. In his study, he explained why fertility had begun to decline and according to his theory, high fertility levels was necessary for survival in premodern societies because of high mortality rates and the lack of opportunities for individual advancement. But after mortality rates began to decline with modernization, couples do not need to have additional children and thus fertility levels began to decline (Caldwell, 1976).

The importance of Notestein's article was stated by Currais (2000:88) as *"Notestein's article (1945, pp.36-57) is generally regarded as the first acceptable formulation of the demographic transition theory"*.

Notestein's ideas about the demographic transition theory can be stated as follows:

- Industrialization is the precondition to development. According to the demographic transition theory, lower fertility levels could only be occurred after a long-term of modernization and industrialization (Szreter, 1994).

- Socioeconomic factors were the real causes of fertility level declines rather than cultural factors (Kirk, 1996: 364).

- Fertility was high due to some reasons such as ethical codes, marriage habits, laws, family organizations which were known as props then as a result of modernization, props which caused high fertility levels to be destroyed and fertility had began to decline (Caldwell, 1976: 23).

- Attitudes had great importance in lowering fertility levels rather than contraceptive techniques, technological invention and biological factors such as population density (Coale, 1983: 5).

- Mortality level declines as a result of innovations was the necessary condition for a decline in fertility levels and socio economic changes caused fertility levels to decline by increasing the survival levels and by changing the attitudes supporting high fertility levels such as increases in new labor market conditions for women (Lehmijoki, 2003: 2, 3).

- Social changes and demographic transition that was experienced by economically advanced countries caused less developed countries to grow rapidly due to the potential created by developed countries (Coale, 1983: 5).

- It was possible for the less developed areas to have transformations especially reductions in fertility and mortality levels when they experienced economic and technological progress (Coale, 1983: 4).

- As it was stated in Caldwell (1976: 327) according to Notestein, industrialization and urbanization were essential for development and urban industrial society was the other important issue. Urban industrial society was thought to be an important factor since it caused new ideas such as the small family sizes to occur (Kirk, 1996: 364).

From the ideas of different writers above, it is possible to say that according to Notestein, demographic transition was the result of socioeconomic factors together with improved health conditions and improved social conditions such as decreased mortality levels, increased urbanization, educational advances and changes in situations of women in the society. And it can be said that firstly developed societies experienced the stages of demographic transition in the history then less developed countries followed them but since they imitated the developed countries, demographic transition advanced quickly in less developed countries. Moreover; it is significant to indicate that these stages of demographic transition are not real, they are only mental constructions.

Although Notestein did important contributions to the area of demography, his theory was criticized for different reasons which were stated in Kirk (1996: 364, 365). To summarize, firstly, it was criticized because of giving to much attention to socio-economic factors rather than cultural factors. Secondly, although mortality level declines were thought to be before fertility level declines in the Notestein's theory then this situation was not always valid for instance as in the European Fertility Project. Finally it was criticized because although fertility declines were thought to be as a result of socioeconomic modernization, in several regions of Europe fertility level declines was resulted from the diffusion of thoughts within a specific cultural and linguistic area.

Although Notestein's theory was criticized from different aspects, it was the first one as a theory and it guided other theories. After Notestein's traditional theory (Lehmijoki, 2003: 4), new theories in the field of demographic transition which can be seen as complementary rather than competitive were put forward and these new theories of demographic transition tried to explain specific features of demographic transition comprehensively (Lehmijoki, 2003: 3). In the next section, these theories of demographic transition will be investigated separately.

CHAPTER 3

THEORIES RELATED TO DEMOGRPAHIC TRANSITION

As it was stated by Chesnais, since it was hard to investigate the factors such as individualism and freedom then it was hard to explain fertility and mortality by using a few parameters which are measurable (Kirk, 1996: 386). This idea might be true but in order to have idea about the changes in fertility and mortality levels and to investigate the causal factors behind the demographic transition theory, it will be significant to investigate the theories. This investigation helps to see the factors behind the demographic transition theory to see whether a country is a developed or a developing country.

Kirk (1996: 386) stated that, by using Notestein's explanations, it is not possible to be precise about the causal factors' behind the fertility decline however; theories are important to give ideas about the demographic transition since fertility decline is a function of both economic, social, psychological and cultural factors (Beaver, 1975: 11). Thus, in order to understand the causes of fertility level declines; economic, cultural and homeostatic theories related to demographic transition will be investigated in this section. However; as it was stated in Lehmijoki (2003: 13) these theories should be seen as alternative rather than competitive explanations of demographic transition theory.

3.1 Economic Theories of Demographic Transition

Due to modernization process around the demographic transition, childrearing was begun to seen as economically disadvantageous then this caused the economic theories of fertility decline to be formulated (Kirk, 1996: 369). According to Kirk (1996: 370) economic and related socio-economic theories are more successful than cultural and ideational theories in explaining the relations because of giving mathematical accuracy to their models.

It is possible to divide economic theories of demographic transition into three. One of them is the households demand theory, other one is the wealth flow theory and the last one is the excess supply theory. Firstly, household demand theory will be investigated.

3.1.1 The Household Demand Theory

Household demand theory was developed by Becker (1960). It is related to the demand for children. Prices and income are the most important factors affecting demand for children. Importance of the household demand theory comes from the idea that it was the first application of microeconomic thinking to demographic transition theory. According to this theory, reduced demand for children was the main point for the fertility transition and it was decided by income, prices and the tastes (Kirk, 1996: 369, 370).

According to the theory, children are considered as commodities that maximize utility function of a household. This approach is based on the maximization of the utility function of a household subject to the budget constraint.

Utility function of a household can be written as in (3.1) following Becker and Lewis (1973: 280).

$$U=U\ (n, q, C) \tag{3.1}$$

where U represents the utility function, n is the number of children, q is the quality of children with the assumption that children has same utility and C represents the other commodities and budget constraint can be written as in (3.2):

$$I = p\ (qn) + p_c C \tag{3.2}$$

where p is the cost of a unit quality of children, qn is the quality of demanded children, C represents the other commodities, p_c is the price of C and finally, I is the income.

After giving the utility function and the budget constraint in (3.1) and (3.2), respectively then in order to explain fertility level declines due to the household demand approach, full-time income should be used. This full-time budget can be written as in (3.3) which is derived from the budget constraint, I.

$$p_n\ (n) + p_q\ (q) + p_c C = R \tag{3.3}$$

where R is the full-time income which is related to the cost of an additional child, p_n, together with the cost of a unit increase in quality, p_q.

In (3.3), p_n is the shadow price of children with respect to number and p_q is the shadow price of children with respect to quality (Becker and Lewis, 1973: 279). Full-time income gives the total spending on the number of children, quality of children and the other commodities and calculated by using the p_n and p_q (Becker and Lewis, 1973: 281).

It is possible to explain fertility level declines in two different ways by using the household demand theory which is given in Lehmijoki (2003: 5).

According to one approach, when there is a decline in the shadow price of children with respect to quality, maybe due to an increase in public schooling, then this results with an increase in the quality of children. Since there is negative relationship between quality and quantity of children (Becker and Lewis, 1973: 279), increases in quality will lead to a decrease in quantity of children because increases in quality might lead to an increase in the shadow price of children with respect to the number. When n decreases, this again causes a decrease in the cost of a unit increase in quality and the loop will repeated again which causes further declines in fertility.

According to another approach, income increases have two different effects on the desired number of children. Due to the direct income effect, when the amount of income increase then this increase will lead to increases in both child quality and quantity. But since increases in n and q cause shadow prices to rise as a result of this, increases in R will be less than the increases in I. Increases in I is the result of the increases in wage rates which leads to the price of time effect. Since the prices of children are increased by the increases in the price of time than this will lead to another effect of income which is the price-of-time effect (Becker and Lewis, 1973: 281). Due to that price-of-time effect, childbearing process which requires time causes the price-of-time to increase. As price-of-time increases, this leads to desired number of children to decrease. Dominant effect of income increase can be determined by evaluating the relative wages between men and women. Especially investigating the woman's relative wage is significant in understanding the fertility behavior. According to Galor and Weil's (1996) explanations, since economy is developing this will cause demand for mental labor to increase and since women are important in supplying mental labor, price-of-time effect of women are important which can cause fertility to decline.

Since mother's wages might have important contributions to full-time income of a family which is important in buying goods for utility gain then opportunity cost of mother's time is the most important input when evaluating the costs of children. If a mother was in the labor market outside the home then the price of a child would be greater since the loss of full-time income was large. In order to prevent this loss of full-time income woman decided to work in the labor market rather than to have children. Then, this situation will cause the demand for children to decrease. As a result of the increases in women's relative wages, opportunity cost of children increase more than household income and this causes fertility levels to decline however situation is different for male's wage rates because male's wage rates cause fertility levels to increase as a result of the pure income effect (Galor and Weil, 1999: 153).

As stated in Shopira (1997: 3) according to empirical study results when opportunity costs of mother's time and direct cost of children are compared opportunity costs of mother's time is found to exceed the direct cost of rearing a child.

Investigating the interaction between quantity and quality of children is very helpful in formulating the household demand theory. From another point of view, when the income level of a family rises then it is expected to increase the number of children demanded according to Becker's model. However; this income level increases can lead to fertility level declines because increases in income level can cause more qualified children to be preferred then this results with decreases in the quantity of children demanded. Moreover, this does not mean that children are inferior goods. When children are assumed as normal goods, higher income level is expected to increase the children demanded. However; increased demand for children is realized as the increased quality of children rather than increased quantity. "Child quality" is the greater resource endowments or in other words higher expenditures per child in the economics literature on fertility (Shapiro, 1997: 1). Since the increased demand for children is the increased demand for quality rather than quantity, demand for children can be seen as demand for consumer durable goods rather than normal goods. Reason is that, when income level rises, this cause demand for quality to increase rather than demand for quantity to increase. Because according to cross-sectional and time-series data, there is a negative correlation between quality and quantity of children (Becker and Lewis, 1973: 279).

Moreover, from another point of view reason for the quantity of children to decrease was the increased cost of children although the income level of a family increased. There were two types of costs for childrearing, direct costs and indirect costs. Costs come from the goods and services supplemental to children are direct costs and costs of mother's time spent in childcare are indirect costs (Shapiro, 1997: 2).

To present briefly, although a family's income level is high, might be due to a mother's contribution to family income with high earning power, due to the opportunity cost of a mother’s time, couples prefer to have less children. From another aspect, if a family’s income level is high then this result with an increased demand for child quality as a result of this, number of children demanded decrease.

However; there are some problems with the household demand approach. In a developing country situation, there are different conditions from the Becker’s model (Shapiro, 1997: 4). Since children are seen as old-age security for their families then this cause fertility levels to be high in a developing country. Children are also important in agricultural activities thus families especially mothers do not have to make a choice between childbearing and entering the labor force. Opportunity cost of mother’s time is not important when compared to developed countries. Moreover, children would expect to contribute future income of their families and since the net cost of children is lower when compared to developed countries then the demand for children are not expected to decrease in developing countries and in rural areas. Furthermore, in the household demand theory there is an inconsistency of the general idea that there is a negative relationship between fertility and economic development (Panapoulou and Tsakoglou, 1999:1338). In order to solve the inconsistency in the household demand theory, other theories to explain fertility behavior is developed and wealth-flow theory which will be investigated in the next section is one of them.

3.1.2 The Wealth Flow Theory

The wealth flow theory was developed by Caldwell (1976). According to Caldwell’s theory (Lehmijoki, 2003: 9) net flow of wealth, money, goods, services and guarantees, can go either from children to parents or parents to children. According to the theory the most important issue in demographic transition theory is the direction and the magnitude of intergenerational wealth flows (Caldwell, 1976: 344).

According to Caldwell’s wealth flow theory, direction of wealth flow is the main determinant of fertility in any society and at any stage of economic development (Currais, 2000: 81). According to this theory, societies which are pre-modern and modern societies have different fertility behaviors and the movement of a society from a pre-modern society to a modern society is the result of social changes rather than cultural changes (Caldwell, 1976: 322). In pre-modern societies, since the direction of wealth is from younger to older that is from children to parents then couples prefer to have high fertility levels. Because when the numbers of children are high in these societies then this indicates the maximization of flows from children to parents and since net suppliers of income are children as a result of this, parents prefer to have large families (Panalopou and Tsakoglou, 1999: 1338). However;

in modern societies as a result of turning of wealth from parents to children, fertility levels start to decrease thus couples prefer to have fewer children due to the increasing cost of children to their parents.

Caldwell's (1976) study of Nigerian Yoruba society was a good example in investigating the wealth flow theory because this study gave him possibilities to investigate all types of societies. By observing the Nigerian Yoruba society, Caldwell made inferences about the fertility behaviors of the societies.

Societies in which wealth flow is from children to parents are pre-modern societies. Families want to have as many children as possible because additional child means additional wealth in these types of societies. In pre-modern societies children have several contributions to their families. Children do a great amount of work although they are young. When the numbers of children are large in amount and when the family is a populous family then it brings power to the person on the top of the family by providing more possibilities. Children not only work in the farm as a labor input but also provide services such as carrying water, looking after younger sisters and brothers. Social security is important and children are seen as the security for old ages of their parents (Caldwell, 1976: 343,344).

Societies in which wealth flow is from parents to children are modern societies. Families prefer to have minimum number of children because costs of children are high in these type of societies, for instance educational expenditures is only a factor which increases the cost of children to their families. However, when the numbers of children are large in amount then this will be a factor which increases the expenditure of the families in modern societies. Moreover, families do not see their children as old age security for their future. Then, these are the reasons which cause fertility levels to decline in modern societies.

According to Kaplan and Bock (2001: 5559), education which is an important factor and stated in the above paragraph has significant effects on fertility behavior according to the wealth-flow theory. Firstly, education increases the costs of children to family and as a result of this; investment in children increases the family spending rather than an increased contribution of children to family. Secondly, since children don't have enough time then they do not contribute to household economy because of their insufficient skills. Then, it can be said that education is negatively related with fertility behavior according to the wealth flow theory.

According to the wealth flow theory, changes in family structures from pre-modern societies to modern societies is the reason for the demographic transition and this change occurs as a result of the new ideas such as the individual satisfaction. Mass education is the reason that causes ideas to spread to the developing world (Kaplan and Bock, 2001: 5557).

As it was stated by Kirk (1996: 371), modernization and westernization are two different concepts according to Caldwell's wealth flow theory and it was the westernization which causes fertility levels to decline not the modernization. In order to support this idea, fertility levels decline in Bangladesh and Southern Africa were investigated. Due to the study results, although these areas were low modernized areas fertility levels decline occurred in these areas which supported the Caldwell's ideas about modernization and westernization.

Although there are lots of contributions of wealth flow theory, according to Kaplan and Bock (2001: 5560), there are two problems with the theory. These problems can be stated as follows:

One of the problems is that, evidences are not adequate to support the validity of the wealth flow theory that is validity of the theory depends on data. If the data are cross-sectional data and measured at the national level then theory is supported however; when the data is longitudinal data and measured at the micro level then theory is not supported. In such a situation, although the society is a pre-modern society, it shows the evidence of wealth flow from parents to children not from children to parents and there is not any direct evidence to support the wealth flow is from children to parents in pre-modern societies. For instance, according to Kaplan's study (cited in Lehmijoki, 2003: 10) net receivers of wealth in a primitive society are children under 18 years old although according to Caldwell's theory, these children should be net suppliers. This study contradicted with Caldwell's theory.

The other problem with the wealth-flow theory stated in Kaplan and Bock (2001: 5560) as *"The second deficiency is that the theoretical foundations for the determination of familial wealth flows are not well specified…The theory does not specify why certain value systems governing wealth flows arise, nor the relations ships between exogenous economic factors, human psychology, and cultural evolution"*.

In the next section, another economic theory of fertility transition which is the supply demand theory will be investigated.

3.1.3 The Supply Demand Theory

Easterlin (1975) was one of the economists who brought another economic approach to fertility. He tried to develop a model which was suitable with the approaches to fertility used in other disciplines (Shapiro, 1997: 1). His aim was to put together the economic and sociological theories of fertility decline however; when doing this he did not try to assume any dominance between the economic, socio-economic and cultural theories (Kirk, 1976: 370, 371). Importance of the Easterlin's model comes from the idea that the model does not only depend on demand but it also gives essential significance to the demographic concepts such as natural fertility levels (Easterlin, 1975: 62).

In Easterlin's model, demand for children, supply of children and the costs of fertility regulation were taken as the three main concepts which constituted the supply demand theory. Social and economic modernization together with other determinants influences fertility by using these three main concepts (Bongoarts, 1993: 438).

Descriptions of these concepts were given in Easterlin (1975: 55) as:

Demand for children: It's the number of surviving children parents would have if fertility regulation were costless.

Supply of children: It's the number of surviving children parents would have if they didn't limit fertility.

Costs of fertility regulation: It includes all types of costs to learn and use contraceptive methods.

Detailed explanations of these three main concepts of Easterlin's model can be found in Easterlin (1975: 55-57). These three concepts can be summarized as follows:

When the demand side of the Easterlin's model is evaluated then it can be seen that, in the case when child quality is seen as an additional good then increases in income is expected to increase child quantity together with child quality. In the evaluation of the relation between fertility and demand for children, infant together with child survival has great importance. According to Easterlin, fertility is not only linked to the income, prices and tastes; changes in survival rates of children cause fertility levels to change no matter whether prices, tastes and income remained unchanged. When the infant and child survival rates are high, then to accomplish the required number of children, demand for children will be high.

When the supply side of the Easterlin's model is evaluated then it can be seen that supply depends on natural fertility and natural fertility can be defined as *"The number of births a couple would have if they took no action aimed at limiting fertility behavior." (Shapiro, 1997: 2)*

According to Easterlin, both biological factors and cultural factors such as the ability to carry a fetus and beliefs about the avoidance of intercourse while a mother is nursing, respectively have great importance in the determination of natural fertility. Increases in the infant mortality rates are the reasons behind the increases in the supply of children.

After giving the supply and demand side of fertility behavior in Easterlin's model, the third and the last main concept of Easterlin's model is the cost of fertility regulation. However; before investigating the cost of fertility regulation, motivation for fertility regulation should be investigated. Because in order to apply fertility regulation, only lower costs of fertility regulation is not sufficient, firstly there should be motivation for fertility regulation. When demand for children is greater than the supply of children then there is no motivation for fertility regulation, families do not want to apply fertility control because children desired by families are greater than their natural fertility levels. When demand for children is less than the supply of children then there is motivation for fertility regulation. However; motivation for fertility regulation is not sufficient although it is necessary because there are two types of costs related to the fertility regulation. These costs are the subjective costs or psychic costs and market costs. Market costs are time and money costs needed to learn about and to use fertility control methods. Psychic costs are the costs of dissatisfaction related to the ideas of fertility control.

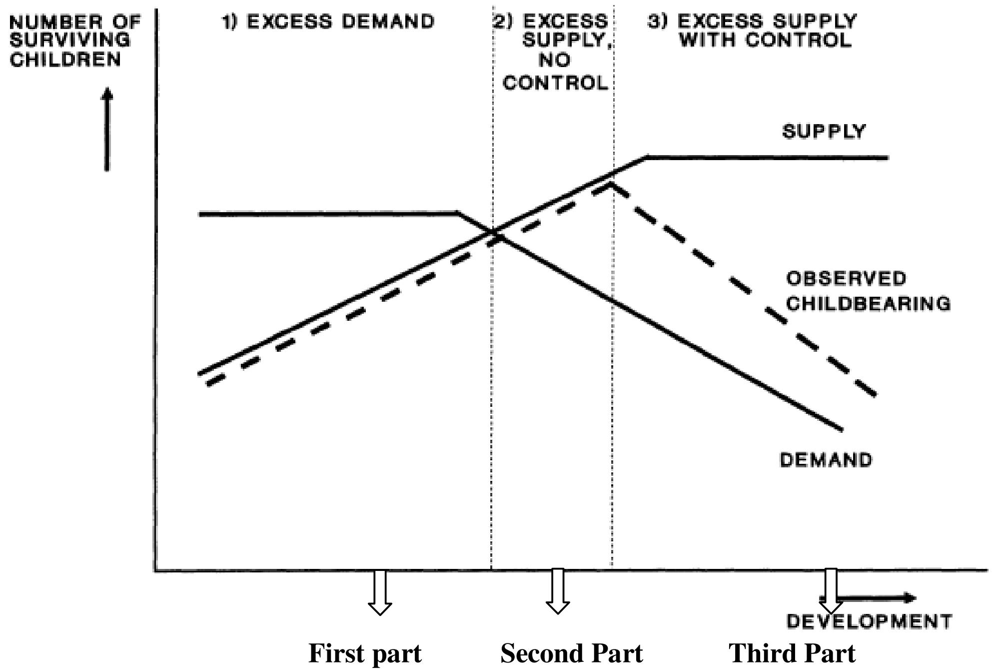

Figure 3.1: Relationship between fertility and three main concepts of Easterlin's model (Source: Bongaarts, 1993: 439)

Figure 3.1 gives the relationship between three main concepts of the Easterlin's model which were demand for children, supply of children together with costs of fertility regulation and the fertility in the context of development. The three main concepts are important in determining the actual fertility differentials. Although the graph was from the Bongaarts (1993: 439), it was possible to find the same model in Easterlin (1975: 60, figure f). Figure 3.1 was significant in understanding the relationships between fertility and other areas such as demography, sociology and economy.

Figure 3.1 consists of three parts. Explanations of these three parts can be found in Easterlin (1975: 56-61). These three parts of figure 3.1 can be summarized as follows:

In the first part of the figure 3.1, there is excess demand situation. Couples prefer to have as many children as possible and since demand for children is higher than the natural fertility level then couples do not have any motivation to apply fertility regulation. Thus observed childbearing that is shown with dotted lines is at the same level with the natural fertility level.

In the second part of the figure 3.1, there is excess supply situation. Couples prefer to have fewer children than they currently have. That is supply of children is greater than the demand for children. Although there is demand for limiting fertility that is although there is motivation for fertility regulation, implementation of fertility control is dependent to the cost of fertility regulation. In this second part, there is a point in which the motivation for fertility regulation exceeds the cost of fertility regulation because of the loss in welfare and as a result of this; number of unwanted children is greater than the cost of fertility regulation. After this point which both the supply curve and the observed childbearing curve make a peak, fertility control begin to occur and as development proceeds then this causes to pass beyond the third part of figure 3.1. In this second part of the excess supply situation with no control, there are unwanted children since the observed childbearing is greater than the desired number of children. Area between the dotted line and the demand curve gives the numbers of unwanted children of families have.

In the third part of the excess supply situation, firstly the cost of fertility regulation is compared with the motivation to limit fertility. As development proceeds cost of fertility regulation is found acceptable in this part then fertility control is adopted due to the lower costs of fertility regulation. As a result of the adoption of fertility regulation, observed fertility in the society become low. This observed fertility is shown by dotted lines in the third part of figure 3.1. There are still unwanted children however; the number of unwanted children is decreasing. In this third part same as the second part, area between the dotted line and the demand curve gives the number of unwanted children. Different from the second part, since fertility regulation is applied in this third part then there will be degree of voluntary fertility control which is the area between the supply line and the dotted line. Unwanted children are the results of positive fertility control costs. And as it was stated by Easterlin (1975: 61), in any real world situation fertility costs are positive not zero. Thus, there have been unwanted children in real world situation.

Although social control is effective in the first and the second part of figure 3.1, individual control is effective in the third part. Since the cost of fertility regulation is lower when compared to the motivation for fertility regulation in the third part then the number of children couple's desire would be equal to the number of children they had (Easterlin, 1975: 56, 57).

One of the difficulties with the Easterlin's model is that since the model is using the number of children a woman has given birth then there are problems with the occurrence of current events. That is, only the decisions at the beginning of the marriage of the couples about the number of children wanted are taken into consideration in the Easterlin's model not the current decisions of the couples according to Kirk (1996: 371).

Another deficiency of the model stated by Bongaarts (1993, 438) as *"Despite its broad acceptance and potential to resolve a number of conflicting views of the fertility transition the model has thus far not been widely used to quantify the determinants of fertility. In this regard the framework has fallen short of original expectations."*

3.2 Cultural Theories of Demographic Transition

Ideational theory is the theory in which fertility is linked to cultural variables (Hirschman, 1994: 216). Ideational theory was developed by Lesthaeghe (1983).

Lesthaeghe (1938: 411) stated the importance of the ideational system as *"If persons engage in an evaluation of utilities and disutilities, they operate on the basis of a preference map, and if such a preference structure exists, there must also be a meaning-giving or ideational system that directs it"*.

In other words, although economic theories are important and necessary they are not sufficient because behind these economic theories and cost-benefit structure is the ideational system which consists of the changes in family formations, increases in the individual rights and freedom which define the goals (Lesthaeghe, 1938: 429).

According to Lesthaeghe and Surkyn (1988: 5) social stratification is important in building the ideational system. 'Secularization' and 'Individuation' are given as the two most important matters which cause Western ideational system to change (Lesthaeghe and Surkyn, 1938: 8). Secularization can be defined as the decreasing loyalty to religion. In order to give idea about how secularization affects the ideational system, the breaking of prohibition on marriages during Lent and decreases in dominical practices together with voting for secularized parties can be given as examples (Lesthaeghe and Surkyn, 1988: 10). Secularization is important because it helps fertility to be an individual choice (Lehmijoki, 2003: 11). For instance, reasons underline the high fertility levels of rural central Asia were thought to be the religious beliefs and the dominant Muslim culture although the direct connection remains to be established (Knodel and van de Walle, 1979: 238).

Lesthaeghe stated the idea of exogenous and changing 'tastes' although economic theories of fertility assumed the assumption of exogenous and constant 'tastes' (Kirk, 1996: 372). Cultural and ideological factors which are the results of individual freedom and choice cause tastes to change (Lehmijoki, 2003: 11). Thus, in the cultural theory, changes in culture cause changes in tastes and according to Lesthaeghe and Surkyn (1988: 17), cultural changes are transmitted through by educational factors.

According to Hirschman (1994: 216), only socioeconomic characteristics are not adequate to understand the fertility behaviors of the societies, cultural values cause different behaviors in different societies. As Hirschman (1994: 216) put it:

"The strong cultural hypothesis is that groups differ in fertility behavior because of cultural values. Some populations may have higher levels of fertility than other groups with equivalent socioeconomic characteristics because their culture places a higher value on children or prescribes certain method of fertility control".

It is possible to give the eastern minorities of European Russia and Central Asia as examples. In eastern minorities of Russia although there were lot of socio-economic improvements in the areas of education and health such as the reduction of mortality levels, fertility levels decrease slowly. Reasons under the slowly decreasing fertility levels of eastern minorities of Russia were thought to be the attitudes despite the advanced socio economic features (Knodel and van de Walle, 1979: 238).

According to cultural theories of fertility, as a result of the economic growth, new types of needs occur which are, 'higher-order needs' rather than 'irreducible needs'. Although 'irreducible needs' are the needs that keep people alive, 'higher-order needs' are the needs such as freedom, self fulfillment which are due to individualism and by cultural theory these higher order needs are connected to the economic utility theory (Lesthaeghe and Surkyn, 1988: 3-5). And as a result of the economic growth which causes higher order needs to occur, people are now less willing when adopting the traditional behaviors (Lehmijoki, 2003: 11). Diffusion of ideas and information between areas is possible as a result of the cultural theories of fertility transition (Lehmijoki, 2003: 11). For instance, language barriers in the same area can be given as an example of a cultural factor which is thought to effect fertility behavior. Language barriers have negative effects on fertility transition and cause fertility transition to slow down.

Knodel and van de Walle (1979: 235) stated the importance of cultural variables on fertility behavior independent of socioeconomic factors by giving evidence from different parts of the world. According to them, to understand the importance of culture in fertility behavior, it will be helpful to look at the demographic transition of different areas. Although the areas with parallel socio-economic characteristics and different cultural characteristics entered the demographic transition period at different times, areas with similar cultural characteristics and different socio-economic characteristics entered the demographic transition period at the same time. From these ideas and observations of Knodel and van de Walle, it is possible to understand that cultural factors have great importance on the changes in fertility behavior by living aside socio-economic variables. For instance, Belgium was given as an example to understand the effects of cultural factors on fertility behavior by Knodel and van de Walle (1979: 236, 237). After Belgium was divided into a French speaking area, Walloon, and Dutch-speaking area, Flemish, then according to the study results Flemish side of Belgium experienced high fertility and late decline although Walloon side experienced early and faster decline. According to the Belgium experience, although there were no significant social differences between Walloon and Flemish, a cultural factor namely the language barriers caused differences in fertility behavior.

These thoughts of Knodel and van de Walle are significant in understanding how differentials in cultural variables are affecting the countries which share similar socio-economic features when evaluating the fertility behaviors. As it was stated by Knodel and van de Walle (1979: 236) *"Provinces within regions typically share similar cultural characteristics, such as a common dialect or common customs. Regional boundaries often coincide with cultural boundaries, which in turn impede the flow of information and the process of diffusion"*.

A criticism of the theory was done by Kirk (1996: 373). According to him, although the theory was logical, its applicability to fertility decline was not strong because of the unclearly defined accurate link. As it was stated by Kirk, on the one hand , ideational system such as the self-fulfillment of people cause fertility levels to decline, on the other hand these ideas can cause some other effects to appear such as the increases in pre-marital sexuality, more children born out of marriage which cause the fertility levels to increase. In order to mention his ideas Kirk (1996: 373) stated that *"Thus, as a sociological generalization it is very attractive and could be applied to family structure and fertility decline, at least in theory"*.

3.3 Homeostatic Theories of Demographic Transition

The homeostatic theory in other words equilibrium theory of population growth is a Malthusian based biologically oriented theory (Lehmijoki, 2003: 12). Homeostatic theory was emphasized by Lehmijoki (2003: 12-13) and Kirk (1996: 386-387). Malthus related the increase in population to the discovery of a new piece of land however the situation is different from Malthusian explanations because the most fertile land are the poorest today. Thus; the homeostatic theory is not sufficient in explaining the recent demographic transition theory.

Kirk stated by using Lee's words that *"Demographic homeostasis has changed since the nineteenth century. The influence of what he describes as 'population density' has been greatly weakened. The positive relation with fertility no longer exists"* (cited in Kirk, 1996: 386). According to Kirk (1996: 386-387), when all the demographic transition process has completed in all parts of the world then world population will reach a new equilibrium of mortality and fertility levels thus; investigating the homeostatic principle will make it easy to understand the post-transition levels of fertility.

CHAPTER 4

DEMOGRAPHIC TRANSITION AND STAGES OF THE DEMOGRAPHIC TRANSITION

In the “Demographic Transition and Stages of Demographic Transition” part of the study firstly, stages of demographic transition will be given then effects of the demographic transition theory on less developed countries (LDCs) and more developed countries (MDCs) will be investigated.

4.1 Stages of the Demographic Transition

Demographic transition occurred in several stages. When and how the transition starts and how long it takes is specific to each country. Social, economic and cultural history of country is important when determining the stages of the demographic transition thus; every country has unique conditions when experiencing the stages of demographic transition because demographic transition refers to modernization perspective (Shorter, 1995: 21, 24).

In 1929, Warren Thompson divided the demographic transition into three stages. However in some sources, demographic transition process is taken as involving four stages such as Montgomery (2000).

In 1947, C.P. Blacker divided the transition into five stages (Caldwell, 1976). According to the original demographic transition theory, stages of demographic transition can be seen from the figure 4.1.

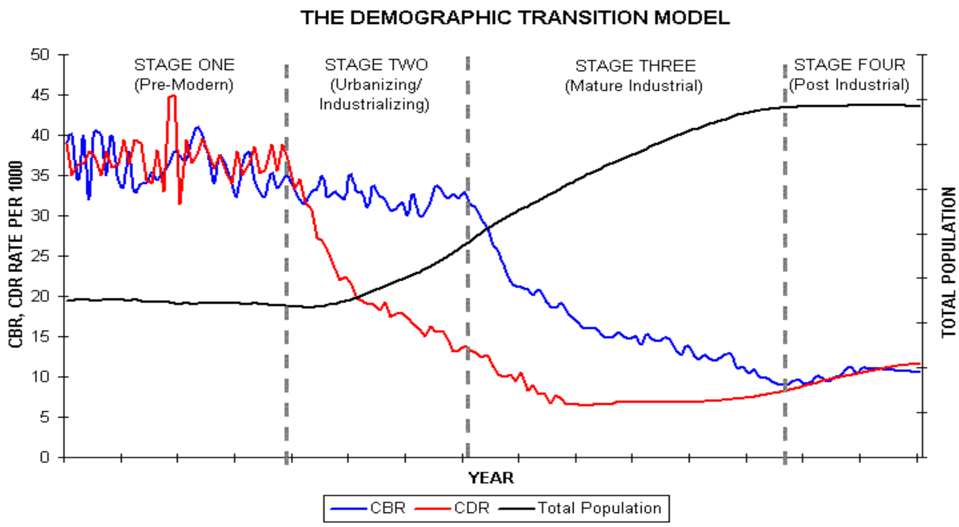

Figure 4.1: Stages of demographic transition model (Source: Montgomery, K., 2000: 1)

Most of the developing countries are experiencing stage two or stage three in the demographic transition process. Stage two countries involve less developed countries however; stage three countries represent more developed countries than the stage two countries. Countries in the fourth stage are the most developed countries in the world.

The way that a country must pass in order to industrialize and modernize is the stages of demographic transition (Szreter, 1994). According to Notestein, *"careful planning, particularly in the early stages, might speed the process…"*.

In the next sections, each stage of demographic transition process will be explained separately by examples.

4.1.1 First Stage of the Demographic Transition

Countries which are experiencing stage one in their demographic transition are pre-modern countries. Both fertility and mortality levels are high and fluctuate rapidly in those countries. Mortality levels are high as a result of undeveloped health conditions, illnesses such as plague, scarlet fever, cholera, dysentery etc. and food shortages. Other reasons of high mortality levels are unclear drinking water, lack of sewage disposal and food hygiene (Montgomery, 2000). And majority of the deaths are children's deaths purely due to living conditions. Fertility levels are high in that stage because children are seen as old age security of their families and since brings children up does not exceed the total contribution of children to their family than families prefer to have many children. Cost of rearing a child is low because there is no educational expenses in these countries and for instance in equatorial Africa, there is no clothing expenses.

In that stage, population growth rate was slow due to the balance between fertility and mortality levels which was less than 0.05% and until the seventeenth century, world was in stage one and this stage was first broken in Western Europe (Montgomery, 2000) and on the present day, an example of a country in the first stage can not be given because none of the countries in the world are in stage one in the world today.

4.1.2 Second Stage of the Demographic Transition

As it was said before, the first stage of demographic transition was broken in Western Europe. This situation was occurred as a result of the Agricultural revolution of the eighteenth century which leads to the second stage of demographic transition (Montgomery, 2000).

Second stage of demographic transition involves developing countries. Countries experiencing stage two have still high fertility levels but low mortality levels. Mortality levels decline in that stage because of the improvements in public health conditions which reduce illnesses. Sewage disposal systems are developed and food hygiene is improved. These improvements which cause mortality levels to decrease are due to the access to technological and educational advances.

In that stage population growth rate had begun to increase due to the imbalance between fertility and mortality levels. That's although fertility levels are not increasing, due to the decline in mortality levels, population growth occurred. As a result of high population growth rate age composition of the population changed in the countries. Because of the improved living conditions, children born began to survive contrary to the high death rates of children in stage one. As the number of the survived children increase, this results with a young population of a country experiencing the second stage of its demographic transition. When these children reach reproductive age, they maintain the high fertility levels of their parents. Therefore a cycle occurs which result with a high population growth rate.

Investigating age-sex pyramid of a country is significant because it reflects the demographic experience of its population. All of the age-sex pyramids given in the study are generated from the International Data Base (IDB) at the U.S. Census Bureau. An example from the Third World country, Afghanistan in the year 2004 can be given in figure 4.2 to represent the age-sex composition of Afghanistan in the second stage of its demographic transition process.

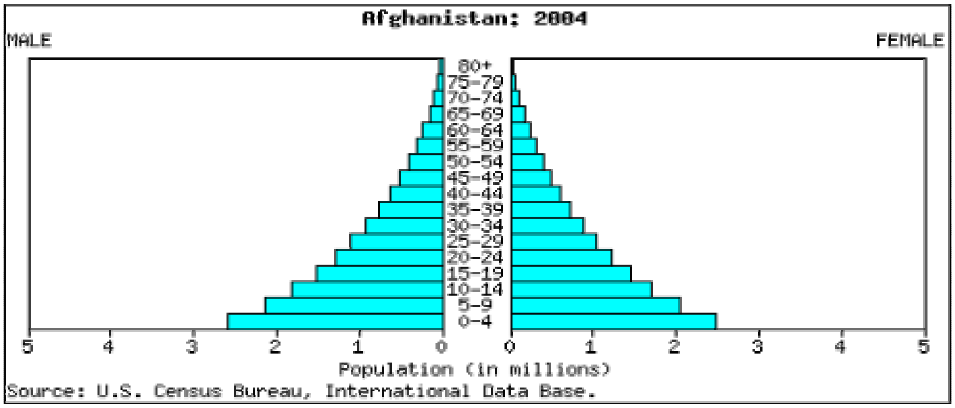

Figure 4.2: Second stage country with a high fertility level and low mortality level country, *Afghanistan*, 2004.*

In this age-sex pyramid there does seem to be an imbalance between fertility and mortality levels. According to the general shape of this pyramid of Afghanistan in year 2004, young age generation is more than the old age generation. This has an important affect in accelerating population growth. Since infant mortality rate is high this is the indication of the relatively low life expectancy at birth in these second stage demographic transition countries.

4.1.3 Third Stage of the Demographic Transition

Countries experiencing stage three of demographic transition have both declining fertility levels along with declining mortality levels. Mortality levels had begun to decline in stage two and continue to decline in stage three.

Some of the factors causing fertility levels to decline in that stage are contraception usage, increase in urbanization, increase in wages, increase in the status and education of women and lastly increase in educational investment. Decline in fertility levels has begun in Northern Europe at the end of the 19th century (Montgomery, 2000).

Reason under the declining fertility levels in the third stage of demographic transition was the declining mortality levels of the second stage. That is; when infant mortality levels had fallen, this cause fertility levels to decrease because couple's do not need to substitute new

* Vertical axis gives the age composition and horizontal axis gives the population in millions.

babies in place of their lost children. Relationship between infant mortality level and total fertility level of Sweden between years 1855 and 1935 can be given as in figure 4.3.

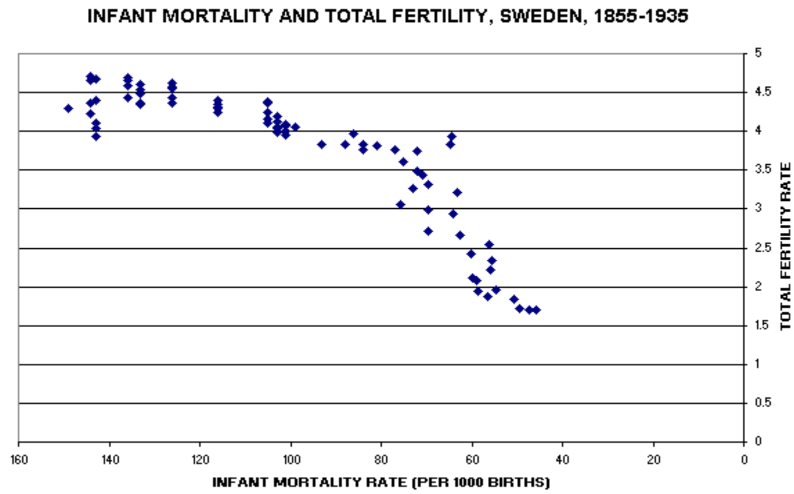

Figure 4.3: Total fertility level and infant mortality rate of Sweden between years 1855-1935 (Source: Montgomery, K., 2000: 8)

According to figure 4.3, after infant mortality levels had fallen under 100 per 1000 births, then fertility levels declined to under 2 births beginning from above 4 births. Another reason for the positive relation is that, declines in infant mortality levels is the indication of the improved living conditions in the society and in such a condition cost of the rearing a child can increase and as a result of this no matter whether children are seen as old age security of their families or not then fertility levels of families decline.

Another feature of this stage is that as a result of the increase in the status and the education level of the women, women want to enter the labor force and since working women have less time to rear children, fertility levels decline. Another reason for the fertility levels decline in that stage is the law forbidding children to work outside home, as a result of this since contribution of children to the family is limited then families do not want to have many children.

In the third stage of demographic transition contraceptive usage is another significant factor in decreasing fertility levels. Couples are now well informed in using the contraceptives and availability of the contraceptives is widespread.
Age structure of a country experiencing the third stage in the demographic transition is different from the age structure of a country experiencing the second stage. Turkey can be given as an example by using the age-sex pyramid in figure 4.4 to illustrate a developing

country in the third stage of its demographic transition and to make inferences about a third stage country.

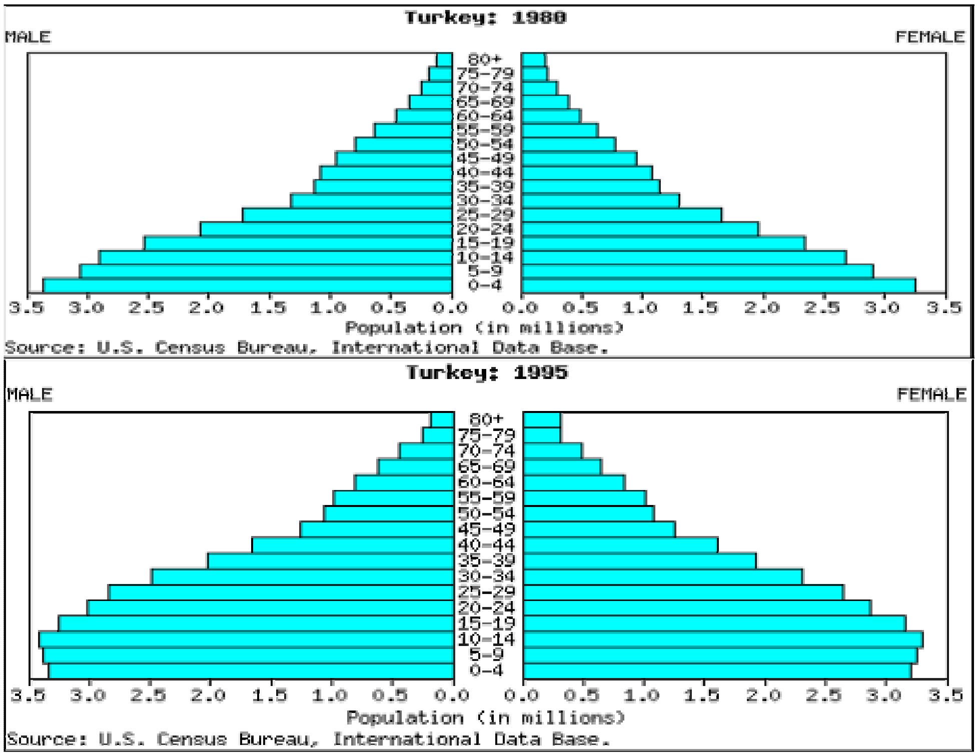

Figure 4.4: Third stage country with a low fertility level and low mortality level country, *Turkey*, 1980 and 1995.*

As it can be seen from the figure 4.4, pyramid takes a less triangular shape in 1995 when compared to 1980. In the third stage, population growth rate began to become stable since there is again a balance between mortality and fertility levels but this time both of them were fewer. As it is seen from the pyramid, bottom part of the population which is 0-4 years of age is no longer expanding. Population is getting older but still the country has a young population. If this young generation can have opportunity to contribute to the economy by entering the labor force before getting old than this produce an economic growth in the country and it is known as the demographic window of opportunity of a country. Different countries have the demographic window of opportunity in different times. In Turkey the window of opportunity is expected to last until 2050 (Tüsiad, 1999). But for instance in India this window of opportunity is expected to begin in year 2010.

* Vertical axis gives the age composition and horizontal axis gives the population in millions.

At the end of stage three, fertility levels is expected to fall to replacement levels, for instance Turkey is thought to reach the replacement level of fertility which is 2.1 in year 2050. That is, Turkey is expected to complete and proceed to stage four in the year 2050 (Tüsiad, 1999).

4.1.4 Fourth Stage of the Demographic Transition

Countries such as Canada, China, and North Korea are experiencing stage four in their demographic transition process. In the fourth stage, both fertility and mortality levels are low even fertility levels reach replacement levels in this stage. As a result of the low fertility and mortality levels, countries have stable populations in that stage. Another feature of the fourth stage is that demographic transition is completed when a country reached the fourth stage.

Age and sex composition of the countries experiencing the fourth stage are different from other countries which are experiencing other stages of the demographic transition process. Age-sex pyramid of Canada in the year 2000 can be given in figure 4.5 to illustrate the countries in the fourth stage of demographic transition.

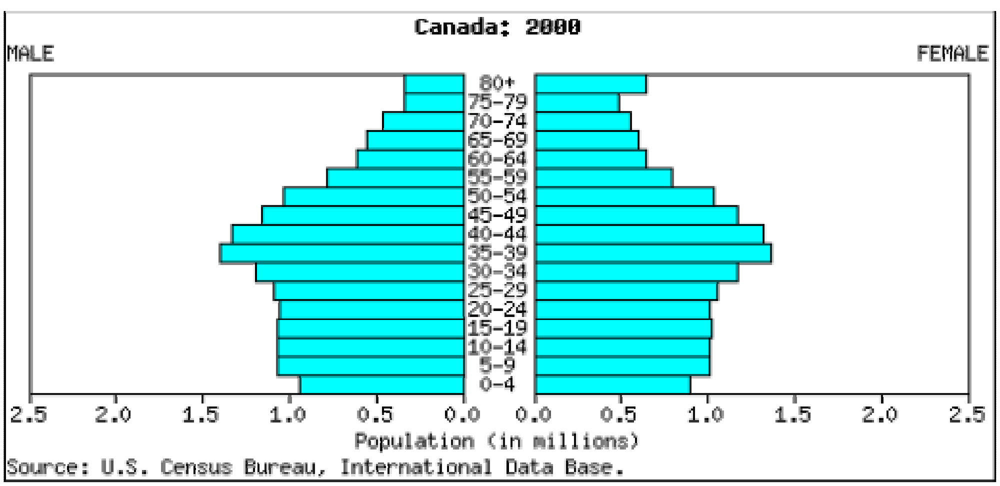

Figure 4.5: Fourth stage country with a replacement fertility level and low mortality level country, *Canada*, 2000.*

As it is seen from the Canada example, age-sex pyramid of the fourth stage countries have no longer young generation, population has become older and fertility levels are replacement fertility levels.

* Vertical axis gives the age composition and horizontal axis gives the population in millions.

Some of the countries such as Italy are in the fourth stage of its demographic transition. Although Italy is taken as in the fourth stage of its demographic transition in Montgomery (2000), Italy is sometimes taken as in the fifth stage of its demographic transition. The reason is that countries which have fertility levels below their replacement levels and whose economies are based on information and service rather than manufacturing can be taken as stage five countries. But since the demographic transition has four stages originally (Montgomery, 2000), these four stages are investigated in the thesis.

Finally, before completing this section it is possible to say that when the effects of the demographic transition theory on less developed countries (LDCs) and more developed countries (MDCs) is felt, changes in fertility levels require both social and behavioral changes than this change is slow in LDCs. In LDCs, there can be problems such as AIDS since early 1980s which can affect mortality levels, but these problems are not taken into consideration when evaluating demographic transition (Lee, 2003). Transition is late in LDCs when compared to MDCs and rate of population growth is higher in LDCs (Montgomery, 2000).

CHAPTER 5

THE DEMOGRAPHIC TRANSITION IN TURKEY

In Turkey, the demographic transition is almost complete. The most important indicator for the demographic transition is the decline in fertility levels. The total fertility rate was 6.9 children during the years 1945-1950. It declined to 2.7 children in the year 1993 and 2.5 children in the year 1998. It is predicted from the projections to decline to 2.0 children in the year 2010 (Turkish Industrialists' and Businessmen's Association (Tüsiad) 1999: 18).

In Turkey, the demographic transition process was begun at the end of the nineteenth century in the two big cities, İstanbul and İzmir. The most important fact that separated Turkey from other Muslim countries was the revolutions in the area of law about woman rights. Secularism in Civil Law, increase in education level of women, rapid economic development, urbanization, revolutions in the area of law, social revolutions of 1920's and 1930's were the most important factors in the demographic transition process on Turkey (Tüsiad, 1999).

In 'The Demographic Transition in Turkey' part of the study, firstly trends in total fertility and mortality over time will be investigated and secondly, stages of the demographic transition in Turkey will be given.

5.1 History of Fertility Levels and Mortality Levels in Turkey

Before looking at today's situation when evaluating Turkey's demographic structure it will be helpful to look at the history because significant changes occurred in the demographic structure after the foundation of Turkish Republic in 1923. For that reason information on fertility and mortality will be investigated historically by giving charts and tables. Additionally, effects of fertility levels and mortality levels on Turkey will be investigated.

5.1.1 History of Fertility Levels and Its Effects on Turkey

First population census was conducted in 1927 in Turkey. There were about 14 million people living according to census results. At that time in Turkey, population was low and the structure of population reflected the effects of a long period of wars, firstly World War I and after that Turkish War of Independence. To provide national security and to recover the social life more people were needed in Turkey. It was stated in Cumhuriyet newspaper dated September 29, 1935 that "If we have many people living in Turkey as Turks, no one will occupy Turkey…It was a surprise when the 1927 census counted 14 million. Only 8 million were expected. We hope to find an even higher population in the 1935 census" (cited in Shorter, 2000: 105).

In 1935, there were more than 16 million people living in Turkey. However, there were problems about the age and sex composition at the time. There were a great number of widows and the number of young people especially men was low. As a result of this, fertility levels decreased and mortality levels increased. To increase the population, reward was given to mothers who had more than six children (Shorter, 2000). However, increasing the population by having a lot of babies was not a solution, fewer births by making all of the babies live should be more important. Due to the poor public health conditions child mortality rate was high at the time, it was 27‰ (SIS, 1994). There were more people living in rural areas. In urban areas, health conditions were better however in other areas life was hard at the time.

Although fertility decline had begun in the 1950s in Turkey and continued in the 1970s due to the increased health conditions, fertility was thought to be still high in 1960s according to the highest levels of the state which are The State Planning Organization and Ministry of Health (Shorter, 1995: 6). Thus; to prevent the high fertility levels, beginning from 1965's, laws in contraception usage were implemented as a precaution however high rate of population growth started in 1950s does not stop currently. Annual growth rate of population increased from 21.73 ‰ in 1950 to 27.75 ‰ in 1955 and the annual growth rate of population reached its highest value of 28.53 ‰ in 1960 (SIS, 2005: 27, Table 3.1) .

In order to reduce the high annual growth rate of population, family planning has been implemented since 1965 in Turkey and to prevent unwanted pregnancies abortion has been legal since 1983 that is important in preventing the increase in population. As a result of the legalization of abortion in 1983, fertility decreased from 4.3 births per woman in 1980 to 2.7 births per woman in 1993 (World Bank Report, 2002 and Turkish Population and Health Survey, 1994). In 1988, a television campaign was launched by The Turkish Family Health and Planning Foundation (TAP VAKFI) to persuade people about family planning (Shorter, 1995: 6, 7). History of TAP VAKFI and purposes can be stated as:

"The Turkish Family Health and Planning Foundation was established in 1985 by a group of eminent industrialists, businessmen, and scientists of the country under the leadership of Mr. Vehbi Koç. It is a private, voluntary, non-governmental agency dedicated to increasing family planning information and improving the quality of services to the masses in Turkey…. The goal of the Foundation was to encourage the private sector to be actively involved in improving the quality of life of families in Turkey by expanding and increasing the efficiency of family planning services. The Foundation, since the International Conference on Population and Development,(ICPD) in 1994 in Cairo, has widened its scope to reproductive health, which includes family planning, sexually transmitted diseases, and safe motherhood"(http://www.tapv.org.tr/background.htm*).*

Above attempts to decrease the fertility levels give positive outcomes in encouraging people to use contraceptives to lower fertility levels. According to the World Bank report of 2002 total fertility rate was 2.4 births per woman in 2000; however there were differences among regions. For instance although total fertility rate was 2.0 in the West region, it was 4.4 in the East region. However; currently, there is a steady decline in total fertility rate and it will continue to decline until it reaches to 2.1 births per woman for all Turkey. Projections were published in the report for the Turkey's Statistical Yearbook 2004 and given in the table 5.1.

Table 5.1: Total fertility rate projections, 2005-2040

	2005 2010	2010 2015	2015 2020	2020 2025	2025 2030	2030 2035	2035 2040
Total fertility rate (per woman)	2.33	2.18	2.10	2.10	2.10	2.10	2.10

Source: Turkey's Statistical Yearbook (2004: 74, table: 4.13)

Fertility level will continue to fall because parents are willing to invest economically and socially in their children and they want to give improved educational opportunities to their children. Thus most of the parents, especially well-educated parents, prefer to have fewer children in this sense. Urbanization is another factor in lowering the levels of fertility. When people move from rural areas to urban areas that cause young generations to come across the controlled fertility environment and as a result of this they prefer to have lower fertility. Table 5.2 summarizes the information about increased urbanization in Turkey.

Table 5.2: Urbanization, 1927-2005

Census Year	Urban population (% of total population)
1927	16.4
1935	16.9
1940	18.0
1945	18.3
1950	18.1
1955	22.5
1960	26.3
1965	29.9
1970	35.8
1975	41.4
1980	45.4
1985	51.1
1990	56.3
1994	61.6
1998	63.7
2001	65.3
2003	66.3
2005	67.0

Source: 1927-1990. Percentages are from Shorter (1995: 18).
1994-2003. Percentages are from United Nations Statistic Division (Table: 6, pp.11).
2005. Percentage is from the World Bank report of 2007 (Table: 3.10, pp. 164).

The share of urban population showed a significant increase after 1950s and as a result of the increasing urbanization, fertility levels decreased.

To investigate regional differences in demographic variables Turkey is divided into five regions according to State Institute of Statistics which are West, South, Central, North and East Regions.

The goal of lowering fertility levels has been more or less reached all over in Turkey; however people in the East region have higher fertility rates than people in the West region. Fertility differentials for the West region and the East region can be seen by looking at the table 5.3.

Table 5.3: Total fertility rates for the West region and the East region, 1960-2003.

Date of the Total Fertility Rate	West	East
1960*	4.35	8.27
1978*	3.53	6.94
1983*	2.97	6.72
1988*	2.34	5.56
1989**	2.6	5.7
1993***	2.0	4.4
1998***	2.03	4.19
2003***	1.88	3.65

Source: 1960-1988. SIS (1994: 27, Table 3-7).
1993. Turkish Population and Health Surveys (1993: 28, Table 3.2)
1998. Turkish Population and Health Surveys (1998: 37, Table 3.2)
2003[1]. Turkish Population and Health Surveys (2003: 48, Table 4.2)

According to 2000 Census of Population Results, the province in which the total fertility rate is the highest is Şırnak with 7.1 children per woman and the provinces in which the total fertility rate are the lowest are Edirne, Çanakkale, Kırklareli and Eskişehir with 1.7 children per woman. Currently, when distribution of total fertility rate is investigated it is seen that total fertility rate is increasing from West to East (SIS, 2003, Census of Population of 2000).

Sometimes fertility rate and population growth rate are confused however they are not the same. Fertility levels helps to determine the population growth rate. Although total fertility rate is decreasing in Turkey, population keeps on growing due to the "population momentum" stated by Shorter (1995). In population momentum, population continues to increase because although people are getting older, they do not die until they reach high ages. In such a situation if fertility levels increase then this can worse the situation by causing a much faster population growth rate. Thus lower levels of fertility are important to stop population growing. Although fertility levels and population growth rate are decreasing in present time in Turkey, this does not mean there are not any problems. Average annual population growth rate of Turkey was 1.9% between the years 1980-2000 and it will be only

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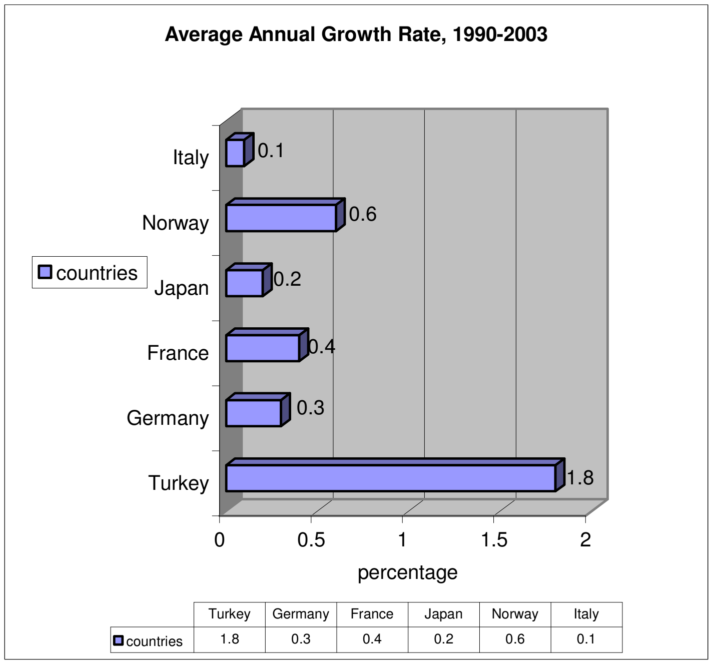
* 1960-1988 results are census-based measures.

** 1989 results are survey-based measures from 1989 Turkish Demographic Survey.

*** 1993, 1998 and 2003 results are survey-based measures from 1993, 1998 and 2003 Hacettepe Institute of Population Studies, Turkish Population and Health Surveys, respectively.

[1] Turkish Population and Health Surveys of Hacettepe Institute of Population Studies has done every five years thus; the next survey will be resulted in the year 2008.

1.2% between the years 2000-2015 according to the report of the World Bank (2002: 50, Table 2.1). However the growth rate is still high when compared to high income countries. This comparison can be seen from the graph 5.1.



Graph 5.1: Average annual population growth rate (%) in some selected high income countries and in Turkey (Source: For data, see table 3.14 of Turkey's Statistical Yearbook, 2004: 46)

High population growth rate has many disadvantages in Turkey. The negative effects of the rapid population growth earlier in history when fertility was still high are being experienced by young generation of Turkey today (Shorter, 1995). That is; Turkey is a country with young population currently and young people of Turkey who require employment are having problems in finding jobs because there are less job opportunities for them today. New jobs should be planned and human capital levels should be increased to overcome the increasing unemployment problems and regional differences. Due to urbanization and increased population, some cities are getting crowded. Precautions should be taken in the highly crowded cities to organize the social life. Unless that is done there will be problems in health, education and social services.

According to Tüsiad (1999) projections, the share of the population over the age 65 years old will increase from 5.5% in 2000 to 9.0% in 2025 in Turkey and it will continue to increase steadily over the next years. In the future Turkey will be a country with old population thus;

improvements in the pension system should be given more attention to solve the problems of elderly in various areas to meet the needs and wants of them.

Accomplishment of education is also effected by the high population growth rate in Turkey. Due to the growth, number of young adults having educational opportunities is more important than the quality of the education presented to them. This does not mean that there is not any improvement in education. While in 1975, only 1.85% of the population had higher education, in 2000, 7.80% of the population had higher education (SIS, 2003). Also, the percentage of population with higher education is increasing day by day.

Another important improvement in the educational area is that, it has been undergone 8-year compulsory education since 1997-1998 year.

5.1.2 History of Mortality Levels and Its Effects on Turkey

Mortality is the other important component of population growth and demographic transition. Moreover it has significant effects on the demographic structure of Turkey. Investigating mortality trends are important in understanding the changes in society such as in living conditions and in health conditions. Decreased mortality levels cause population to increase in size in a rapid manner because they show the improved health and living conditions in a country. However in Turkey although morality risks are decreasing and life expectancy at birth is increasing, the number of deaths will rise over the next twenty years (Tüsiad, 1999). Number of deaths between the years 1990 - 2020 can be seen from the table 5.4.

Table 5.4: Annual Deaths in Thousands, 1990-2020

	1990-1995	2000-2005	2010-2015	2015-2020
Deaths(thousand)	396	448	535	638

Source: Tüsiad (1999: 41, table 1.4)

Increase in the number of deaths does not mean that health conditions are getting worse in Turkey. Ageing of population which means increase in the number of people facing higher mortality risks is the real cause of the increased deaths in Turkey. The reason for the ageing of population is the lower fertility levels rather than lower mortality levels and increase in the life expectancy at birth. Thus, increase in number of deaths is due to the ageing of population. Although death risks decrease, due to the ageing of Turkey's population and increased number of deaths cause population growth rate to decrease.

According to Shorter (1995: 9) increased fertility levels rather than decreased mortality levels were the real causes for the high rate of population growth in Turkey. In the past fertility levels were high and after the health conditions got better than the average expectation of life at birth began to rise with decreasing infant mortality rates. These were the reasons for the high rate of population growth in earlier times in Turkey between the years 1950 and 1965. The rates of population growth were 27.75‰ and 28.53‰ in 1955 and 1960, respectively (SIS, 2005: 27). At the present time, increase in the number of deaths together with lower fertility levels is the real cause of the decrease in the population growth rate. The rate of population growth is estimated to be 13.5‰ between the years 2005 and 2010 (SIS, 2005: 74).

Reason behind the increase in the expectation of life at birth is due to the reduction of death risks and the decreased infant mortality rate with the improvements in health conditions. The change in both the life expectancy at birth and the infant mortality rate can be seen from the table 5.5.

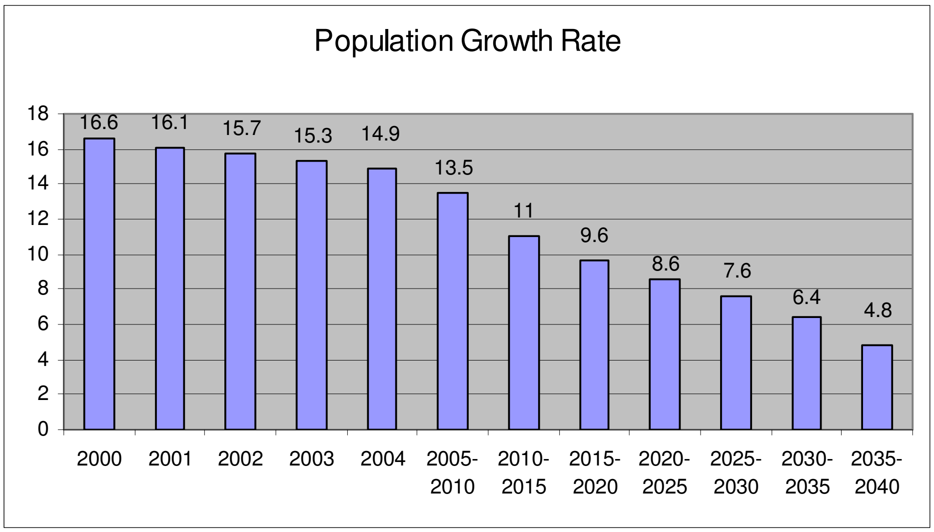
Table 5.5: Infant mortality rate and life expectancy at birth

	Year	**Values**
Life expectancy at birth	1980	61 years
	2000	70 years
Infant mortality rate	1980	109 per 1000 live births
	2000	34 per 1000 live births

Source: World Bank Report (2002: 124, Table 2.20)

There was a large decrease in infant mortality rate in Turkey. Starting from the level of 109 per 1000 live births in the year 1980, it was only 34 per 1000 live births in the year 2000. As it is seen from the table 5.5, there is a negative relation between infant mortality rate and life expectancy at birth. Starting from 61 years in 1980, the life expectancy at birth rose by 9 years up to 2000. Life expectancy will be at around 74.5 years during 2020-2025 (Tüsiad, 1999). When infant mortality rate is investigated by regions, it is seen that infant mortality rate is higher in the East of Turkey than in the West. Ardahan has the highest infant mortality rate with 77‰ and Trabzon has the lowest infant mortality rate with 31‰ (SIS, 2003).

The common idea of 1935s was that population was power. However the world is changing and when highly improved East and Southeast Asian countries are considered, it can be seen that quality is more important than quantity and declining birth rates provide high growth rates in East Asian countries. According to Tüsiad report, Turkey has the same kind of opportunity with these countries. Annual growth rate of population has slowed down in Turkey and in the near future it will catch the trend of developed countries. Graph 5.2 shows the population growth rate in Turkey with projections.



Graph 5.2: Population Growth Rate in Turkey, 2000-2040.

According to projections from the graph 5.2, population growth rate is almost certain to decrease to 4.8 between the years 2035 and 2040.

However, one of the problems is that although the trend of developed countries will be caught in the near future, balancing higher fertility regions with lower fertility regions must not be the case. The trend of developed countries should be caught with whole regions of Turkey, not balancing East by West. The other problem is that Turkey is a country with young generation currently and when young-age population of Turkey will become old-age population then young population will diminish in size over the next years. Thus; Turkey should plan to have less labor intensive production systems with policies for the future from today.

After giving the changes in both fertility and mortality over time by explaining how declines took place beginning from past through present in Turkey, it is time to explain the changes in demographic structure of Turkey from a theoretical perspective by using demographic transition theory or in other words modernization perspective (Shorter, 1995) by leaving aside migration. The demographic transition is used as a tool to determine the variables which cause fertility levels to decline in Turkey. And the theories of demographic transition help for the determination of variables related to fertility level declines in Turkey.

In the next section changes in demographic variables will be explained by using the stages of demographic transition theory.

5.2 Demographic Transition in Turkey

5.2.1 Stages of Demographic Transition in Turkey

According to SIS (1994), the Turkish Demographic Transition is divided into three stages by giving the demographic outcomes chronologically. According to the Tüsiad report, the Turkish demographic transition is almost complete and it will be completed entirely when the population is expected to stop growing and become unchanging at around 95 million populations by the mid_21st century. Stages of the Demographic Transition in Turkey are given below as the first stage of demographic transition, the second stage of demographic transition and the third stage of demographic transition.

5.2.1.1 The First Stage of the Demographic Transition in Turkey

Before beginning of this first stage of Turkish demographic transition, the effects of the Turkish War of Independence caused a decline in fertility levels since there were a shortage of young adults especially men. When this first stage began in 1923 in Turkey, after a long period of war, first thing is the steady rise in fertility levels and decrease in mortality levels due to the peace in the country and recovery of life. In Turkey, to recover the social life after the war, to solve the problems of labor force shortages, to earn money from agricultural activities and finally to wipe out the negative effects of the war time by forming new families age of marriage decrease in the new found Republic in Turkey. Moreover; fertility levels increase between the years 1923 and 1950s in Turkey.

Fertility increased from 5.5 children to 7.0 children and it fluctuated between 7.0 and 6.5 children during the first stage of demographic transition in Turkey (SIS, 1994: 4) Moreover, due to the low mortality levels and high fertility levels annual growth rate of population increased from 21.10 ‰ in 1931 to 27.75 ‰ in 1952 (SIS, 2003: 5, Table 1.1). The population was 13 million and 24 million in 1923 and in 1950s, respectively (SIS, 1994: 5).

The first stage of Turkish demographic transition has taken place between the years 1923 and 1950s. It was completed in the 1950s when the fertility level began to decrease.

5.2.1.2 The Second Stage of the Demographic Transition in Turkey

The second stage of Turkish demographic transition took place between the years 1950 and 1985. Decline in fertility began in 1950s and had continued during this second stage of transition. Although fertility levels decrease, population continued to grow. During the second stage, due to improving health conditions that reduced mortality levels and increased expectation of life at birth, population of Turkey increased from 24 million in 1955 and to 51 million in 1985 (SIS, 1994: 5). In this second stage of transition, annual growth rate of population was almost three per cent per year that's the highest level of population growth in Turkey (Shorter, 1995: 9).

Urbanization was the important subject of this second stage of transition. It was essential in explaining the fertility level decline. During this second stage of demographic transition period, Turkey was becoming an urban society between the years 1950-1985. As a result of this, urban population increased from 22.5 percent in 1955 to 51.1 percent in 1985 during the second stage of demographic transition in Turkey (SIS, 1994: 5). Fertility level was declining over time in the second stage, which could be due to many factors, but one of the most important factors might be increasing of urbanization. The increase of urbanization to high levels causes fertility levels to decline because young couples moved from rural to urban areas chose to control their fertility levels. In order to benefit from social and economic opportunities of the urban areas, young couples didn't need to have many children to have worked in agricultural activities to earn their life as in rural areas. On the contrary, young couples needed to work in an urban industrial labor market to survive so they chose to have fewer healthy and educated children rather than many children to have worked in agricultural activities. For instance, the relationship between the working statuses of woman which was thought to be inversely related to her fertility behavior came out to be in the expected direction only in urban areas in Turkey (Karadayı, 1971: 196). Moreover, the data for the study were conducted in 1968 when Turkey was in the second stage of its demographic transition. Thus, this result of the study gave the evidence that in the second stage of the demographic transition couples prefer to have fewer children and as a result of this fertility levels decline in urban areas. Because of these reasons, people who live in the urban areas or people who move to urban areas prefer to control their fertility. As a result of the increased urbanization, fertility levels decreased essentially together with the mortality levels due to the improved conditions of living. Annual growth rate of population was

27.75‰ in 1952 and it decreased to 21.71‰ by 1987 (SIS, 2003: 5, Table 1.1) and it was the natural result of the decreased fertility and mortality levels during this second stage of transition.

5.2.1.3 The Third Stage of the Demographic Transition in Turkey

In the third stage of the Turkish demographic transition, both fertility and mortality levels continued to decline, the difference of the third stage of transition from the second stage of transition was the significant and unchangeable decline in the annual growth rate of population. The annual growth rate of population was 24.88‰ during 1980-1985 (SIS, 2003:5, Table 1.1) and it decreased to 18.28‰ during 1990-2000 (SIS: 2005: 27 Table 3.1). According to projections of Tüsiad, the annual growth rate of population will be zero nearing the year 2050 and might be negative after the year 2050 (Tüsiad, 1999: 18, 32).

Third stage of demographic transition began in the 1980s but has not been completed yet. In order for the third stage to be completed, the population should stop growing and fertility levels should fall to such a level that births should not be more than the parent generation. Although total fertility rate declined to 2.41 children per woman (SIS, 2005: 73, Table 4.12) in 2004 in Turkey, due to high fertility levels of the past, annual growth rate of population did not decline. Improved living and health conditions have increased and expected to increase the expectation of life at birth given as in table 5.6:

Table 5.6: Expectation of life at birth (year)

	2005 2010	2010 2015	2015 2020	2020 2025	2025 2030	2030 2035	2035 2040
Expectation of life at birth (year)	69.33	70.06	70.90	71.73	72.61	73.41	73.41

Source: SIS (2005: 74, Table 4.13)

Thus when young generations at present will be added to old generations, this will increase the population of Turkey in the near future. Given the above reasons, demographic transition has not been completed in Turkey yet. Because although fertility level has declined substantially in Turkey beginning from the 1950s, according to population projections given in the 1994 report of SIS, Turkey's population will increase to between 95 and 98 million by the mid_21st century. The lowest forecast is 95.5 million and the highest forecast is 99 million (Tüsiad, 1999: 18, 34).

The fertility level of Turkey is still high when compared with the developed countries. And this decreasing fertility levels cause the age structure of the population to change (SIS, 1992). To investigate the structural change of the total population, the shares of the age-groups within the total population can be seen in table 5.7.

Table 5.7: Shares of age-groups within the total population of Turkey

	1990*	2000*	2010**	2020**	2025**
0-14	35.5	29.5	26.0	23.6	22.7
15-64	60.5	65.0	67.9	68.7	68.3
65+	4.0	5.5	6.1	7.7	9.0
Total	100.0	100.0	100.0	100.0	100.0

Source: Tüsiad (1999: 34, Table 1.1)

According to the Tüsiad report (1999: 34, 40), consequences of the structural change in population such as the ratio of the dependent population to active population is as important as the consequences of the stabilization of the population of Turkey. Thus; giving the consequences of the structural change is important in investigating the demographic transition in Turkey. Dependent population, children under 15, will constitute only the 22.7 percent of total population in the year 2025. Although the total population size will continue to increase further. However; there will be an increase in the share of adult population, people between ages 15-64, who are the active labor force in Turkey. This shows that Turkey has an increasing labor force. But correct social and economic policies should be developed and used in order to take the advantage of young population. According to an analysis done, fertility level decline has important contributions to the growth rate of country if the people of a country with active labor force continue to rise (Tüsiad, 1999). Another important aspect of the structural change is that, percentage of old ageing people, people over 64, is increasing rapidly. In 1990, only 4.0 percent of total population was old ageing people however;

* 1990 and 2000 values are census results.

** 2010, 2020 and 2025 values are projection results.

according to projection results of Tüsiad (1999: 37, Table 1.2), 9.0 percent of total population will be old age in 2025. That's between 1990 and 2025, the elderly population more than doubled, increasing from 4.0 % to 9.0 %. Moreover, the elderly population will continue to rise after 2025. In Turkey, in order to meet the needs of growing number of elderly population some policies should be again developed. When evaluating the consequences of structural change in Turkish population in frame of demographic transition, another important point will be the mortality levels. Growing number of elderly population won't be a result of decreasing mortality levels because according to projections of SIS (1994), the number of deaths will increase. When evaluating the Turkey's situation, increase in the number of deaths won't be due to the bad or insufficient health care conditions. Although developed health conditions reduce the death risks in Turkey, as the number of people facing higher death rates increases than the number of deaths will be increased in the year 2025 as stated in Tüsiad report.

According to the projections of the SIS (2005: 74, Table 4.13), total fertility rate for the years 2005-2010 will be 2.33 and it will be 2.10 for the years 2015-2020. That is the replacement level according to the World Bank if mortality level is low. But that is only an assumption not generally true for every country. Each and every country has special situation when facing the stages of demographic transition and that is also true for Turkey.

5.2.2 Fertility by Regions in Turkey

Total fertility levels vary in Turkey according to regions. Five demographic regions, West, North, Central, East and South, are defined by the State Institute Statistics. In all the regions, fertility differences have taken place. The history of fertility decline and the regional differences are given in table 5.8.

Table 5.8: Total fertility rates for five regions, 1960 to 2003.

Date of the TFR	West	South	Central	North	East
Census based measures					
1960	4.35	6.71	6.56	6.56	8.27
1978	3.53	4.75	4.64	4.98	6.94
1983	2.97	4.32	3.95	4.39	6.72
1988	2.34	3.29	3.06	3.39	5.56
Surveys					
1989	2.6	3.0	3.1	3.5	5.7
1993	2.0	2.4	2.4	3.2	4.4
1998	2.03	2.55	2.56	2.68	4.19
2003	1.88	2.30	1.86	1.94	3.65

Source: State Institute Statistics (1994: 27, Table 3-7).
1998. Turkish Population and Health Surveys (1998: 37, Table 3.2)
2003. Turkish Population and Health Surveys (2003: 48, Table 4.2)

As it can be seen from table 5.8, all regions have had important contributions to fertility level declines in Turkey in the past however especially the West region has had the most significant contribution. These differentials in total fertility rate were due to the demographic transitional differences. Higher fertility regions such as the East region has been balanced with the lower fertility regions, for instance the West region. As it is seen from the table 5.8, some regions were below or very close to replacement level that is; nationally the general replacement level was caught in Turkey. The problematic East region was balanced by other regions. But; although the replacement level assumed by the World Bank was reached, another important limitation for the demographic transition to be completed is the growing of population to stop. Annual growth rate of population is given in table 5.9.

Table 5.9: Annual growth rate of population according to census results 1927-2000.

Census Year	Annual Growth Rate of Population
1927-1935	21.10
1935-1940	19.59
1940-1945	10.59
1945-1950	21.73
1950-1955	27.75
1955-1960	28.53
1960-1965	24.62
1965-1970	25.19
1970-1975	25.00
1975-1980	20.65
1980-1985	24.88
1985-1990	21.71
1990-2000[*]	18.28

Source: SIS (2005: 27, Table 3.1)

As before said, annual growth rate of population is expected to stop by the year 2050 according to projection results of Tüsiad (1999: 18).

When evaluating the demographic transition in Turkey, contrary to the widespread idea, according to Shorter, East region can not be seen as a special case when homogenization expectation of transition theory is thought. According to him, the reason was that, the decline

[*] The last population census was conducted in Turkey in 2000. For this reason; it is not possible to update the results in table 5.9.

had began in East by the 1970's and the East region had also experienced declines which is a bit less than the decline in the West but that situation does not cause East region to be seen as a special case (Shorter, 1995: 24-26).

However, there are some different ideas then the Shorter's ideas that East region can not be seen as a special case. For instance in order to support the idea and to give the evidence that there are regional differences in Turkey and the East region is a special case, a statement from a report by the Hacettepe Institute of Population Studies (1998: pp. 37-38) can be given as:

"*There are clear variations in fertility levels by region and education….Regional variations of fertility involve three regional groupings. The Eastern region is notable as a high fertility region, with a total fertility rate exceeding four children (4.2). The North, Central and South regions constitute another group, with rates well under three children (2.7, 2.6 and 2.6, respectively). The lowest rate (2.0) is found in the West region and is comparable to that of many Western European countries. The regional groupings based on current levels of fertility are also cogent for examining differences in the past fertility experience.*"

That is, although the East region is also experiencing declines, the East region can be seen as a special case because when general fertility rate decline is thought in Turkey beginning from 1950s (SIS, 1994: 4), East region is always balanced with low-fertility regions.

When only demographically thought, Shorter might true in his ideas that the East region can not be seen as a special case however; since demographic transition theory is the modernization perspective; variations among regions can be seen when evaluating the demographic transition within a country and also there were significant differences among the regions in Turkey related to fertility behavior according to study by Peker (1979: 158).

The reason why fertility levels are still high in some parts of the country especially in the East part might be due to the low use of contraceptives. In order to support this idea, table 5.10 can be given. As it can be seen from the table 5.10, contraceptive usage has the lowest level in the eastern part of Turkey which has the highest fertility level. Furthermore, some of the families who are aware of family planning programs in the East region still insist on having children then this cause high fertility levels in the East region.

Table 5.10: Percentage of contraceptive usage, 1960 - 2003.

Percentage of contraceptive usage	West	South	Central	North	East
1978	71	50	56	55	30
1983	77	58	61	66	31
1988	83.6	67	80.9	80	62.8
1993	71.5	62.8	62.7	64.2	42.3
1998	70.5	60.3	68.3	67	42
2003	74.2	70.8	74.2	71.9	57.9

Source: 1978. Turkish Population and Health Surveys (1978: 88, Table IX-10)
1983. Turkish Population and Health Surveys (1983: 98, Table VI-15)
1988. Turkish Population and Health Surveys (1988: 88, Table II-6.19)
1993-2003. Turkish Population and Health Surveys (2003: 69, Table 5.7)

It is also possible to see the differences between the East region and the other two regions, West region and Central region, by evaluating the total fertility rates of three big city centers of these regions between the years 1980 and 2000 which can be seen from table 5.11.

Table 5.11: Total fertility levels of selected cities from the regions West, East and Central between years 1980-2000.

REGION / YEAR		**1980***	**1985**	**1990**	**2000**
	İstanbul	2.69	1.96	2.08	1.97
WEST REGION	İzmir	2.52	1.85	2.00	1.75
	Edirne	2.41	1.8	1.82	1.66
	Mardin	5.15	4.29	5.59	4.98
EAST REGION	Bitlis	6.01	4.95	5.92	5.03
	Diyarbakır	4.42	4.12	4.74	4.51
	Ankara	2.83	2.04	2.07	1.9
CENTRAL REGION	Çankırı	4.07	2.81	2.61	2.27
	Eskişehir	2.74	2.03	1.96	1.74

Source: For data, see table 3.11 of State Institute of Statistics, 2000 Census of Population, Social and Economic Characteristics of Population, Province Yearbooks for 2000.

As it can be seen from table 5.11, although there's a decline in fertility levels for the East region, it is not as fast as the West and the Central regions. The reason is that; although modernization, which is thought to bring fertility levels down according to demographic transition theory, advances in Turkey some of the ideas such as increases in education,

* Total fertility levels are given beginning from 1980 because there wasn't any statistic belonging to total fertility levels of cities before 1980. That is because the information on the total number of children born alive in a province was not collected before 1980.

improvements in status of women and contraceptive usage in the East region are not as widespread as in the West region. Thus; that brings the idea that the East region can be seen as a special case when demographic transition theory in Turkey is evaluated.

Since demographic transition has not been completed yet in Turkey, consideration for the development of East region should be given. By doing this, there is no need to balance East region with other regions when evaluating the improvements in fertility levels and other socioeconomic variables and after that East region won't be an important exception.
However; in this study, rather than a separation such as east, west, south, central or north, there will be two groups. These are Provinces Prioritized in Development and others. List of the provinces of Provinces Prioritized in Development and others is given in Appendix B. As it can be seen from the list of the province names, Provinces Prioritized in Development are mostly composed of the East part of Turkey.

CHAPTER 6

REVIEW OF LITERATURE

6.1 Review of General Literature

The literature review presented below describes the analysis of the determinants of fertility as informed by the demographic transition theory and gives estimation methodologies to analyze fertility that is given in the previous studies done in the field of fertility.

The paper by Szreter (1994) gives idea to understand the demographic transition process and fertility change. This paper provides the detailed explanation of demographic transition and also investigates demographic transition theory historically. Szreter (1994) emphasized that stages of demographic transition theory is important in understanding the modernization and industrialization of a country.

Most of the studies were concerned on some areas in the World and aggregate level data are used. In her 2003 article Lehmijoki presented an analysis of the determinants of fertility rate and its change for 73 countries, 22 of which are European origin and 49 are from other continents during the five years from 1965 to 1995 to understand demographic transition process. This study is different from other studies in the way that it brings together the determinants of fertility under the title of three main theories, which are economic theories, cultural theories and homeostatic theory of fertility transition. Lehmijoki (2003) investigated the determinants of fertility by using both Random Effect Model (REM) and Fixed Effect Model (FEM) due to the usage of panel data. Using panel data was the positive feature of this study, because by this way the study allows a more complete analysis of region, province and time period effects. According to the study, REM is found to be better than Ordinary Least Square (OLS) and FEM is found to be the best solution. Although there is simultaneity between fertility and female labor force participation, simultaneous equation estimation is not used in this study. Lehmijoki concluded that, because the percentage of women in the labor force might be endogenous to the fertility rate, it is proxied by the lagged value of the same variable. This study has some important results about demographic transition process and fertility. One of the main results of the paper is that demographic transition process began in Europe fifty years earlier than in the rest of the world. The study also demonstrates that in countries where infant mortality was high, demographic transition process advanced slowly. The study confirmed the positive relationship between agricultural labor force and fertility.

Panapoulou and Tsakoglou (1999) investigated the relationship between fertility and socio-economic factors related with economic development by using a cross-country data set for the year 1992 of 13 developed and 55 developing countries. They found that, fertility is negatively related with urbanization and female education and positively related with infant mortality and economic development. According to theoretical background, it is anticipated a negative relation between fertility and female labor force participation however no significant relationship is found between them. This is because of the fact that not only female labor force participation affects fertility but also fertility affects female labor force participation. Thus it is recommended to use a simultaneous equation system but due to data limitations this attempt is failed in this study.

The theoretical consideration of the relationship between fertility and female labor force participation was considered in Rosenzweig and Wolpin's (1980) paper. The most remarkable finding is the simultaneous nature of fertility and female labor force participation. According to the paper, simultaneous equation estimates must be used otherwise coefficient estimates will be biased.

A number of studies have sought the relationship between fertility and female labor force participation. Mahdavi (1990) investigates simultaneous-equations model of cross-national differences in fertility and female labor force participation. In the theoretical part of the study, socio-economic theories of fertility by Easterlin and Leibenstein are discussed. Agricultural labor force decline and high status of living, which cause increase in expenditures, are the main reasons of fertility decline. In that study, two equations one for general fertility rate and the other for female labor force participation are specified. According to the study, because of the mother and worker roles of married women are incongruous, higher female labor force participation will prevent fertility and vice versa, thus there is a negative relation between female labor force participation and fertility. Mahdavi (1990) concluded that female labor force participation is included in the fertility equation because it is seen as the proxy for some correlates of fertility decline and fertility rate is included in the female labor force participation equation because of two reasons; one reason is that young children take most of the time of their mothers and women have limited time to work at home and this has a negative effect on female labor force participation and second reason is that because of pregnancies women have disadvantageous position in the business world. In order to estimate equations, Two-Stage Least Squares (2SLS) method is used as the methodology by using a sample of 53 LDC's and MDC's in the year 1975. The main result is that fertility affects female labor force participation and it is affected by it.

In her 2001 article Tansel provides cross-province estimates of economic development and female labor force participation in Turkey. The study is important that panel data of 67 provinces of Turkey in years 1980, 1985 and 1990 are used. By the inclusion of regional dummy and time dummy variables, estimation methodology is the fixed-effects estimation. This paper is important since it also investigates region-specific results and differentials in female labor force participation, which are observed due to the regional differentials. One finding of the paper is that, female labor force participation increase due to the high rate of economic growth. Other finding is that education level of women is found to be the most important variable and it has positive effect on female labor force participation.

The paper by Al-Qudsi (1998) also investigates the relationship between fertility and labor force participation by applying a two-step econometric model to individual level data of four Arab countries. Two-step econometric model consists of two-equations; one is the Poisson count equation whose parameters are estimated using maximum likelihood technique. The dependent variable in this equation is the number of births that a woman has ever had. After that, "predicted" fertility levels from the fertility equation are used as an explanatory variable in the second equation, which is a probit labor supply function. The dependent variable in this equation is dichotomous taking a value of one if the individual is employed and zero otherwise. One finding of the paper is that women's labor force participation is negatively related with high fertility that is because of reproductive responsibilities of women and women spend most of their time to child rearing. Another important finding is that cultural forces affect fertility. The paper also investigates country-specific results.

Some of the studies investigated only one region or a country in the World and in some of them individual level data are used rather than aggregate level data. According to Amonker and Brinker (2000), fertility rates give information about the socioeconomic development of societies. Thus factors affecting fertility as informed by the demographic transition theory is examined in this study by using the data of 89119 ever-married women in the age of 15-49 from the 25 states of India between years 1998-1999. Ordinary Least Square multiple regression is used in the study and according to the results, findings support the demographic transition theory in the way that the level of modernization, education that is the overall socioeconomic development have a significant role in lowering the fertility.

As it is seen from the literature review most of the studies uses cross-sectional data due to data limitations rather than panel data. Most remarkable aspect of the studies is that different models are constituted to analyze fertility by including different sets of independent variables and methodology used for the analysis of the determinants of fertility differs from study to study.

6.2 Review of Studies on Turkish Fertility

In this section, studies concerning the factors related to fertility levels in Turkey are reviewed.

One of the recent studies relating to the fertility behavior is the M.A. thesis by Günaydın (2003). In his study, he investigates the relationship between the education levels of parents and fertility behavior. This study is an individual level study and it includes 6152 ever-married women between the ages 15-49 (Günaydın, 2003: 39). Number of children is taken as the dependent variable and to investigate fertility behavior, education levels of parents, working status of mother, occupation of father, social security status and monthly income of family are taken as the independent variables. Multiple regression analysis was used and χ^2 test was conducted to investigate the relationship between variables.

According to the findings of this study, among all of the variables education level was the most effective factor on fertility levels and a significant negative relationship was found in education levels and fertility (Günaydın, 2003: 124). Age of mother is another factor effecting fertility levels. It is found that, living in urban areas in the west region is a factor lowering fertility levels however living in rural areas in the east region is a factor increasing fertility levels (Günaydın, 2003: 39). Another finding is that, education level of mother is a more important factor than education level of father.

Another study related to fertility behavior is the M.A thesis by Doğan (1987). He asked a question in his study and tried to find an answer. That question was *"…does female participation to employment depress fertility, and if so, what type of participation is most likely to do so?"* In his study, data was from 1983 Turkish Fertility, Contraceptive Usage and Family Health Survey and the sample design were stratified multistage sampling. He also investigated the effect of female labor force participation on fertility behavior.

According to the findings of the study, female labor force participation is related to the education level of women, urbanization and marital status (Doğan, 1987: 109-110). It is also found that, widowed, divorced and separated women enter the labor force in higher proportion than married women and married women who are employed have fewer children than other married women. Employment is found to effect fertility negatively in urban areas than in rural areas (Doğan, 1987: 114). Another finding is that, education level is found to be an important factor on fertility level.

The M.A. thesis by Kulu (1985) investigates the relationship between the socioeconomic development and fertility on the aggregate level provincial data by using cross-sectional multivariate analysis relating to 1980.

Education, urbanization, income and mechanization in agriculture were used as socioeconomic factors affecting fertility levels. According to the study results, urbanization had the highest correlation with fertility levels however; there positive relation was found between them contrast to the theoretical expectation As a result of the increase in mechanization, total fertility levels found to decline (Kulu, 1985: 92). Income was found to have a strong but insignificant correlation with total fertility rate although it was stated in the study that previous studies found weak correlations between income and fertility rates. The reason under this insignificant relation was thought to be the correlation of income with other economic development indicators (Kulu, 1985: 91-92). As a final result of this study, industrialization was thought to bring low fertility levels (Kulu, 1985: 93).

The present thesis is similar with Kulu's study in the way that they both uses aggregate level provincial data however; difference is that although Kulu's study used cross-sectional multivariate analysis relating to 1980, this study uses panel data simultaneous equation model relating to 1980, 1985, 1990 and 2000 Census years provincial data. Together with these similarities and differences, since the study of Kulu (1985) was a provincial based study, some of the variables such as infant mortality rate (IMR) could not be included in her study however; estimations of such variables are used in this study.

Another study related to the fertility behavior in Turkey was the study by Karadayı (1971). In her study, she investigated the factors influencing fertility behavior by using socio-economic variables such as the education level and working status of women, income and education level of men, total income of family and occupation of husband. In order to determine the factors affecting fertility behavior in Turkey, Karadayı (1985: 9-10) considered the Freedman's model. Freedman's model gave the factors affecting fertility beginning from more general ones which were country level variables to more specific ones which were individual level variables. The study attempted to show the close negative relationship between the socio-economic variables and the fertility. Study was a cross-sectional study and data were conducted from three questionnaires for woman, man and households. In the study five regions were considered which were Central Anatolia, Black Sea, Agean Marmara, Mediterrenean and Eastern Anatolia.

Among the most important study results, socio-economic variables such as education of wife and husband, husband income in urban areas were found to be negatively related to fertility behavior. Moreover, inside the socio-economic variables education of woman was found to be the most important factor (Karadayı, 1971: 194). Working status of women in urban areas was found to have the expected inverse relation with fertility behavior (Karadayı, 1971: 196). According to another study result, declines in fertility levels were higher in developed societies and declines in fertility levels decrease towards rural areas (Karadayı, 1971: 195).

Although Karadayı's study is a cross-sectional study, this study is a panel data study. To determine the factors affecting fertility level, Freedman's model was taken into consideration in Karadayı's study however; in this study, theories of demographic transition are taken into consideration. Moreover, there are similar socio-economic variables in both of the studies such as the education level of woman and working level of woman. Moreover, although five regions were considered in Karadayı's study, in this study provinces of Turkey are divided into two groups which are the Provinces Prioritized in Development and others. List of these provinces are given in appendix B for this study.

Another study concerning the factors involved in fertility behavior is the study by Peker (1979). In his study; literacy rate, urbanization, income, occupation type, labor force participation of woman except agricultural activities, modernization in agricultural activities and usage of family planning programs were investigated as the independent factors thought to affect fertility behavior of families. In Peker's study, data were conducted by using questionnaires and the observation unit was the family.

According to the findings of the study, education was the most significant factor involved in fertility behavior. In his study, factors such as urbanization and labor force participation of woman except agricultural activities couldn't be evaluated due to data shortage (Peker, 1979: 163). According to study findings, contraceptive usage and education level was found to be closely related. Increases in the level of education resulted with increased use of contraception which causes fertility levels to decline (Peker, 1979: 159, 161). Another important finding of the study was that, significant differences were found among regions related to fertility behavior (Peker, 1979: 158).

CHAPTER 7

METHODOLOGY

7.1 Introduction

Firstly, panel data estimation technique which allows a more complete analysis of region, province and time period effects (Tsakloglou & Panopoulou, 1999) will be investigated then; simultaneous equation estimation technique will be examined and finally panel data simultaneous equation estimation will be given in this methodology section.

7.2 Panel Data Models

In panel data section firstly, a general introduction will be given. Secondly, a general specification of the model will be introduced. Then, two types of estimation methods fixed effects estimation and random effects estimation will be examined. Finally, Hausman test will be given.

7.2.1 General Introduction to Panel Data Models

Panel data, in other words longitudinal data, combine time series and cross-sections. It allows investigating $N = 1, \cdots, N$ cross-sections (firms, countries, provinces, individuals) at $T = 1, \cdots, T$ time periods.

Panel data set which can be referred to as a "balanced" panel data set consists of teach cross-sections data at each time period. If panel data sets have some missing data than it's called as "unbalanced" panel data set.

Before giving the basic framework for the panel data regression model it will be useful to express why panel data models are used. Certain amounts of advantages of using panel data structure are given by Hsiao (2003).

One benefit from using panel data is its ability to prevent omitted variable bias is shown by Hsiao (2003). That can be seen from the regression model

$$y_{it} = \alpha + \beta' x_{it} + \gamma' z_{it} + u_{it} \qquad i = 1, \cdots, N \quad t = 1, \cdots, T \tag{7.1}$$

where z_{it} and x_{it} are the exogenous variables. If both z_{it} and x_{it} are observable variables then the regression will yield unbiased and consistent estimators of α, β and γ. But if z_{it} variables are unobserved which are correlated with the other explanatory variable, x_{it}, and then the results of the regression will be biased. Thus by using the first-difference given by Hsiao (2003), it is possible to eliminate the effect of omitted variable bias. One of the ways is to take

$$y_{it} - y_{i,t-1} = \beta'(x_{it} - x_{i,t-1}) + (u_{it} - u_{i,t-1}) \qquad i = 1, \cdots, N \quad t = 1, \cdots, T \tag{7.2}$$

and the other way is to take

$$y_{it} - \overline{y}_t = \beta'(x_{it} - \overline{x}_t) + (u_{it} - \overline{u}_t) \qquad i = 1, \cdots, N \quad t = 1, \cdots, T \tag{7.3}$$

where $\overline{y}_t = \frac{1}{N}\sum_{i=1}^{N} y_{it}$, $\overline{x}_t = \frac{1}{N}\sum_{i=1}^{N} x_{it}$ and $\overline{u}_t = \frac{1}{N}\sum_{i=1}^{N} u_{it}$.

The other benefit of using panel data is to provide more precise results than using cross-sectional and time-series data alone when predicting the behavior of cross-sections that's because of the ability of panel data to decrease the collinearity among the variables and to increase the degrees of freedom which will cause more efficiency (Hsiao, 2006).

The third benefit of using panel data is that it allows to measure and to identify the effects which are not easy to detect by using only cross-sectional data or only time-series data. For instance, in order to see whether union membership decreases or increases the wages, panel data makes it possible to observe a worker moving from nonunion to union participation (Baltagi, 2005: 6).

Although panel data offer many benefits, there are some disadvantages of panel data. One of the disadvantages is its difficult in collecting data and it is much more costly of collecting panel data than the cross-sectional and time-series data alone. The other disadvantage is the availability of data, panel data needs to be a long-term of statistical collection (Hsiao, 2006). However in developing countries, it is hard to find a long-term of statistical collection.

7.2.2 General Model Specification

The most general specification of the panel data model is given by (Hsiao, 2003) as:

$$y_{it} = \alpha_{it} + \beta'_{it} x_{it} + u_{it} \qquad i = 1, \cdots, N$$
$$t = 1, \cdots, T \qquad (7.4)$$

where α_{it} is the scalar, β_{it}' is the $1 \text{x} K$ vector of constants and both of them vary across cross-sectional units and time. In model (7.4), dependent variable vector, y_{it}, is explained in terms of $1 \text{x} K$ vector of exogenous variables, x_{it} and u_{it} is the vector of disturbances.

Although model (7.4) is the most general specification of panel data model, it is not predictable, because the number of parameters to be estimated is greater than the number of observation, NT.

In order for that model in (7.4) to be estimable, assumptions about the properties of disturbance terms, explanatory variables and the relation between explanatory variables and disturbance term are needed to be assumed.

These assumptions are as follows (Baltagi, 2005: 12):

- u_{it}'s are normally distributed with $E(u_{it}) = 0$ and $E(u_{it}{}^2) = \delta^2$, all i and t.
- $E(u_{it} u_{js}) = 0$ for all i, j and $t \neq s$.
- $\mathrm{E}\left(\mathrm{u}_{\mathrm{it}} / \mathrm{X}_{it}\right) = 0$ for all i and j.

However the most important assumption that has to be made to have the predictable version of model in (7.4) is the assumption about the degree of variability of the regression coefficients (Balestra, 1996).

By taking account the degree of variability of the regression coefficients following Hsiao (2003), model in (7.4) can be written in four different ways:

1st version of model (7.4):

$$y_{it} = \alpha_i + \sum_{k=1}^{K} \beta_k X_{kit} + u_{it} \qquad \begin{array}{l} i = 1, \cdots, N \\ t = 1, \cdots, T \end{array} \qquad (7.5)$$

In this first version of model (7.4), intercept varies over cross-sectional units however slope coefficients are constant.

2nd version of model (7.4):

$$y_{it} = \alpha_{it} + \sum_{k=1}^{K} \beta_k X_{kit} + u_{it} \qquad \begin{array}{l} i = 1, \cdots, N \\ t = 1, \cdots, T \end{array} \qquad (7.6)$$

In this second version of model (7.4), intercept varies over both cross-sectional units and time however slope coefficients are again constant.

3rd version of model (7.4):

$$y_{it} = \alpha_i + \sum_{k=1}^{K} \beta_{ki} X_{kit} + u_{it} \qquad \begin{array}{l} i = 1, \cdots, N \\ t = 1, \cdots, T \end{array} \qquad (7.7)$$

Both of the intercept and slope coefficients vary over cross-sectional units in this third version of model (7.4).

4th version of model (7.4):

$$y_{it} = \alpha_{it} + \sum_{k=1}^{K} \beta_{kit} X_{kit} + u_{it} \qquad \begin{array}{l} i = 1, \cdots, N \\ t = 1, \cdots, T \end{array} \qquad (7.8)$$

Both of the intercept and slope coefficients vary over time and cross-sectional units in the fourth version of model (7.4).

Although all of the models (7.5), (7.6), (7.7) and (7.8) take the degree of variability of regression coefficients into account, the most commonly used models are (7.5) and (7.6) which have constant slope coefficients and variable intercepts when analyzing panel data models because according to Hsiao (2003) these two models with constant slope coefficients and variable intercepts take account of the heterogeneity across cross-sections and / or through time. Therefore, they provide plausible alternatives to the assumption of constant parameters with values common to all cross-sectional units at all times (Hsiao, 2003).

In this study, models which have a constant slope coefficients and variable intercepts will take into consideration. Reason explained in the former paragraph. Following this idea, the general formulation of panel data models used in that study can be written following Baltagi (2005) as:

$$y_{it} = \alpha + X'_{it}\beta + u_{it} \qquad i = 1, \cdots, N \quad t = 1, \cdots, T \tag{7.9}$$

α is a scalar, β is Kx1 vector of coefficients, X_{it} represents the observations on K exogenous variables.

In model (7.9), u_{it} can be written as:

$$u_{it} = \mu_i + \lambda_t + v_{it} \tag{7.10}$$

In (7.10), u_{it} is composed of three parts. μ_i denotes the unobserved cross-sectional effect, λ_t denotes the unobserved time effect and v_{it} is the error term. The general name of such type of models is known as two-way panel data models.

In model (7.9), u_{it} can also be written as:

$$u_{it} = \mu_i + v_{it} \tag{7.11}$$

In (7.11), u_{it} is composed of two parts. μ_i again denotes the unobserved cross-sectional effect and v_{it} is the error term. The general name of such type of models is known as one-way panel data models.

There are two different types of panel data estimation methods according to μ_i's are assumed to be fixed or random parameter.

If μ_i's are taken as group specific fixed parameters than the panel data model is known as the fixed effects model.

If μ_i's are taken as group specific disturbance or in other words if μ_i's are taken as random variables than the panel data model is known as the random effects model.

The above case can be generalized to λ_t parameters. Thus according to the structure of the disturbance term u_{it}, a fixed effects model can be one-way or two-way fixed effects model and again, a random effects model can also be one-way or two-way random effects model.

Test which will indicate whether to use one-way specification or two-way specification will be given in sections 7.2.3.3 and 7.2.4.3 when testing the presence of fixed effects or random effects in the fixed effects estimation method and random effects estimation method, respectively.

After a general specification of the model, in the next part, fixed effects and random effects estimation methods will be explained separately.

7.2.3 Fixed Effects Model

7.2.3.1 One Way Fixed Effects Model

Fixed Effects Model is investigated under the name of Error Components Model in Baltagi (2005). That is because the error components model is taken as the prototypes of all panel data models (Balestra, 1996). There are also other names given to fixed effects model including least square dummy variable model (Green, 2000) and the covariance model (Balestra, 1996 and Hsiao, 2003).

In model (7.9), the general formulation of panel data model is written as:

$$y_{it} = \alpha + X'_{it}\beta + u_{it} \qquad i = 1, \cdots, N$$
$$t = 1, \cdots, T$$

And the disturbance term, u_{it}, is composed of two parts in (7.11). That's

$$u_{it} = \mu_i + v_{it} \tag{7.11}$$

In the one way fixed effects model, μ_i's, the unobserved cross-sectional effects are assumed to be fixed parameters to be estimated.

By formulating the model in (7.9), following Hsiao (2003), the general formulation can be written as:

$$y_{it} = \alpha_i + \beta' X_{it} + u_{it} = \alpha_i + \beta_1 X_{1,it} + \ldots + \beta_k X_{k,it} + u_{it} \qquad i = 1, \cdots, N \quad t = 1, \cdots, T \tag{7.12}$$

α_i is the cross-sectional specific effect in (7.12).

Assumptions for the fixed effect regression model are:

1. μ_i's are assumed to be fixed parameters.
2. Error term has identically distributed. That is; u_{it} ~ i.i.d. (0, δu^2) for all i and t.
3. Error term has conditional mean of zero given the regressors. That is; $\mathrm{E}\left(\mathrm{u_{it}} / \mathrm{X}_{it}\right) = 0$ for all i and j.
4. u_{it} in the fixed effects model are uncorrelated over time. $E(u_{it}, u_{is}) = 0, i \neq s$

After giving the general formulation and the assumptions of the fixed effects model, it can be said that there are two different ways in estimating the fixed effects model. These are; least squares dummy variable (LSDV) model and the is the fixed effects transformation, within transformation model when the number of cross-sections, N, is relatively small, then the model can be estimated by using the least squares dummy variable approach but however when the cross-sections are in thousands then it is useful to use the within transformation approach since the model cannot be estimated by using the dummy variable approach.

7.2.3.1.1 Least-Squares Dummy Variable Approach

Model in (8) can be written in vector forms as:

$$Y=\begin{bmatrix} y_1 \\ \vdots \\ y_N \end{bmatrix}=\begin{pmatrix} e & & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & e \end{pmatrix}\begin{bmatrix} \alpha_1 \\ \vdots \\ \alpha_N \end{bmatrix}+\begin{bmatrix} x_1 \\ \vdots \\ x_N \end{bmatrix}\beta+\begin{bmatrix} u_1 \\ \vdots \\ u_N \end{bmatrix}=\begin{bmatrix} e \\ \vdots \\ 0 \end{bmatrix}\alpha_1+\cdots+\begin{bmatrix} 0 \\ \vdots \\ e \end{bmatrix}\alpha_N+\begin{bmatrix} x_1 \\ \vdots \\ x_N \end{bmatrix}\beta+\begin{bmatrix} u_1 \\ \vdots \\ u_N \end{bmatrix}$$

(NTx1) (NTxN) (Nx1) (NTxK) (NTx1)

In the above matrices

$$y_i=\begin{bmatrix} y_{i1} \\ \vdots \\ y_{iT} \end{bmatrix}_{Tx1}, e_i'=[1,\cdots,1]_{1xT}, X_i=\begin{pmatrix} X_{1i1} & \cdots & X_{Ki1} \\ \vdots & \ddots & \vdots \\ X_{1iT} & \cdots & X_{KiT} \end{pmatrix}_{TxK}, u_i'=[u_{i1},\cdots,u_{iT}]_{1xT}$$

or the above matrices can be written as:

$$y=D_N\alpha+X\beta+u \tag{7.13}$$

D_N is the dummy variable matrix consists of each i th unit's dummy variable.

Model (7.13) is known as the least squares dummy variable (LSDV) model. By using the dummy variable approach, the fixed effects regression model in (7.13) can be written in terms of the common intercept, explanatory variables and N-1 dummy variables following Erlat (1997) as:

$$y_{it}=\alpha+\beta' X_{it}+D_N\mu+v_{it} \tag{7.14}$$

In that model $\mu=(\mu_2,\cdots,\mu_N)'$ and $D_N=(d_2-d_1,\cdots,d_N-d_1)$ in here d_i are the columns of D_N. These two approaches are equivalent however, interpretation of the coefficients of dummy variables differ. That is, if model (7.13) is estimated then the coefficients of the dummy variables give the direct effect of the each of the cross-sectional units however; if model (7.14) is estimated then the coefficients of the dummy variables give the effect of each cross-sectional unit from the chosen base category. By using this dummy variable approach, direct estimates of cross-sectional units, μ_i, can be found.

Alternatively one can omit the intercept and include N dummy variables. Since the number of cross-sectional units is relatively small so it's possible to estimate fixed effects directly along with the common intercept and slope coefficient, but due to perfect collinearity when estimating equation (7.14), one of the cross-sectional units needed to be chosen as a base level and the estimation of intercept, α, slope coefficients, β, and the cross-sectional fixed effects, μ_i, done subject to the restriction $\sum_{t=1}^{N} \mu_i = 0$. Unless the results found are not feasible. Thus each dummy variable coefficient will be an estimate of $\mu_i - \mu_1$.

7.2.3.1.2 Fixed Effects Within Transformation Approach

When the number of cross-sectional units is large, in thousands, it is useful to use within transformation approach. It is based on transforming the equations to eliminate the unobserved cross-sectional effects when estimating the slope coefficients, β (Wooldrige, 2002).

Firstly, model (7.12) need to be written in terms of the means of cross-sectional units across time as follows:

$$\bar{y}_{i.} = \alpha_i + \bar{x}_{i.}\beta + \bar{u}_{i.} \qquad (7.15)$$

where $\bar{y}_{i.} = \sum_{t=1}^{T} y_{it} / T, \bar{x}_{i.} = \sum_{t=1}^{T} x_{it} / T$ and $\bar{u}_{i.} = \sum_{t=1}^{T} u_{it} / T$ $\qquad i = 1, \cdots, N$

$t = 1, \cdots, T$

This model is known as the Between Regression Model.

Next we take the differentials from the means by subtracting equation (7.15) from equation (7.12). This process eliminates the α_i's which are specific cross-sectional effects.

$$y_{it} = \alpha_i + \beta' X_{it} + u_{it} \qquad (7.12)$$

$$- \quad \bar{y}_{i.} = \alpha_i + \bar{x}_{i.}\beta + \bar{u}_{i.} \qquad (7.15)$$

$$y_{it} - \bar{y}_{i.} = \beta'(X_{it} - \bar{x}_{i.}) + (u_{it} - \bar{u}_{i.}) \qquad i = 1, \cdots, N \qquad (7.16)$$

$t = 1, \cdots, T$

The resulting model, the model (7.16) is called the fixed effect within transformation model for each time t.

Fixed effects within transformed model in (7.16) wipe out the cross-sectional specific effects from the model. The OLS estimator of β from equation (7.16) gives the fixed effects within estimator (Wooldridge, 2002: 267-269). Following Hsiao (2003: 44), fixed effects or within estimator can be expressed as:

$$\hat{\beta}_{FE} = \left[\sum_{i=1}^{N} \sum_{t=1}^{T} (x_{it} - \overline{x}_i)(x_{it} - \overline{x}_i)' \right]^{-1} \left[\sum_{i=1}^{N} \sum_{t=1}^{T} (x_{it} - \overline{x}_i)(y_{it} - \overline{y}_i) \right] \qquad (7.17)$$

Fixed estimator in (7.17) is also known as within estimator that is because it only takes the variation within each cross-sectional unit.

7.2.3.2 Two Way Fixed Effects Model

Sometimes, the disturbance term, u_{it}, is assumed to be composed of three parts:

$$u_{it} = \mu_i + \lambda_t + v_{it} \qquad (7.10)$$

where μ_i is the unobserved cross-sectional effects, λ_t is the unobserved time-specific effects and v_{it} is the usual disturbance term. When μ_i and λ_t are assumed to be fixed parameters, then this type of model is known as two-way fixed effect model. Again, there are two ways of estimating the fixed effect model with cross-sectional and time-specific effects. Least square dummy variable estimation and within estimation can be used. One-way fixed effect model contains $N-1$ cross-sectional dummy variables; two-way fixed effect model contains additional $T-1$ dummy variables for time-specific effects. To avoid multi collinearity among regressors, one of the dummy variables for the time effects together with one of the dummy variables for the cross-sectional effects should be dropped. A two-way fixed effect model can be written as:

$$y_{it} = \alpha + \beta' x_{it} + D_N \mu + D_T \lambda + v_{it} \qquad (7.18)$$

where D_N and D_T are the sets of $N-1$ and $T-1$ dummy variables, respectively μ and λ are the vector of coefficients. One of the cross-sectional units and one of the time units should be chosen as the base level and the estimation of the common intercept, slope coefficients, cross-sectional fixed effects and time effects should be done subject to the restriction $\sum_{i=1}^{N} \mu_i = 0$ and $\sum_{t=1}^{T} \lambda_t = 0$.

When N and T are large in number, in thousands, due to the loss in degrees of freedom it will be useful to use within estimation. Within estimation eliminates μ_i and λ_t effects from the model. To have the transformed model, as given by Balestra (1996), firstly model (7.12) need to be written by averaging the regression over individuals as follows:

$$\bar{y}_{.t} = \alpha + \frac{1}{N}\sum_{i=1}^{N} \mu_i + \lambda_t + \beta \bar{x}_{.t} + \bar{u}_{.t} \qquad (7.19)$$

where $\bar{y}_{.t} = \frac{\sum_{i=1}^{N} y_{it}}{N}$, $\bar{x}_{.t} = \frac{\sum_{i=1}^{N} x_{it}}{N}$ and $\bar{u}_{.t} = \frac{\sum_{i=1}^{N} u_{it}}{N}$

Then model (7.12) need to be written by averaging the regression in terms of the means of cross-sectional units across time as follows:

$$\bar{y}_{i.} = \alpha + \mu_i + \frac{1}{T}\sum_{t=1}^{T} \lambda_t + \beta \bar{x}_{i.} + \bar{u}_{i.} \qquad (7.20)$$

where $\bar{y}_{i.} = \frac{\sum_{t=1}^{T} y_{it}}{T}$, $\bar{x}_{i.} = \frac{\sum_{t=1}^{T} x_{it}}{T}$ and $\bar{u}_{i.} = \frac{\sum_{t=1}^{T} u_{it}}{T}$

After that model (7.12) need to be written by averaging across all observations as:

$$\bar{y}_{..} = \alpha + \frac{1}{N}\sum_{i=1}^{N} \mu_i + \frac{1}{T}\sum_{t=1}^{T} \lambda_t + \beta \bar{x}_{..} + \bar{u}_{..} \qquad (7.21)$$

By subtracting models (7.19) and (7.20) from model (7.12) and by adding model (7.21) to model (7.12), two-way fixed effect within transformation model can be expressed as:

$$y_{it} - \bar{y}_{i.} - \bar{y}_{.t} + \bar{y}_{..} = (x_{it} - \bar{x}_{i.} - \bar{x}_{.t} + \bar{x}_{..})\beta + (u_{it} - \bar{u}_{i.} - \bar{u}_{.t} + \bar{u}_{..}) \qquad (7.22)$$

Ordinary least square estimation of β from model (5) gives the within transformation for the two-way fixed effect model. Although within transformation eliminates the cross-sectional specific effects, μ_i, and time-specific effects, λ_t from the regression model, these estimations are given as following Baltagi (2005):

$\hat{\mu}_i = (\bar{y}_{i.} - \bar{y}_{..}) - \hat{\beta}_{within}(\bar{x}_{i.} - \bar{x}_{..})$ and $\hat{\lambda}_t = (\bar{y}_{.t} - \bar{y}_{..}) - \hat{\beta}_{within}(\bar{x}_{.t} - \bar{x}_{..})$

7.2.3.3 Testing Significance of Fixed Effects Parameters

Firstly, two-way fixed effect estimation should be done and the joint significance of the dummy variables should be tested because if one-way fixed estimation is used instead of two-way fixed effect estimation by ignoring the time dummies, then this situation will cause omission bias.

Three hypotheses can be tested for fixed effects (Baltagi, 2005: 34, 35) and these are as follows:

1. H_0: μ_i=0 and λ_t=0 i=1,$\cdots$,N-1 and t=1,$\cdots$,T-1

This hypothesis tests the absence of individual and time effects. Test statistic is,

$$F_1 = \frac{(SSR_{pooledOLS} - SSR_{twowayfixedeffectwithinregression})/(N+T-2)}{SSR_{twowayfixedeffectwithinregression}/(N-1)(T-1)-K} \sim F$$

If the first hypothesis is rejected than in order to see from where the effects come from below hypothesis need to be tested. These are:

2. H_0: μ_i=0 allowing $\lambda_t \neq 0$ i=1,$\cdots$,N-1 and t=1,$\cdots$,T-1

This hypothesis tests the absence of individual effects. Test statistic is,

$$F_2 = \frac{(SSR_{regressionwithtimedummies} - SSR_{twowayfixedeffectwithinregression})/(N-1)}{SSR_{twowayfixedeffectwithinregression}/(N-1)(T-1)-K} \sim F$$

3. H_0: λ_t=0 allowing $\mu_i \neq 0$ i=1,$\cdots$,N-1 and t=1,$\cdots$,T-1

This hypothesis tests the absence of time effects. Test statistic is,

$$F_3 = \frac{(SSR_{regressionwithcross-sectionaldummies} - SSR_{twowayfixedeffectwithinregression}) / (T-1)}{SSR_{twowayfixedeffectwithinregression} / (N-1)(T-1)-K} \sim F$$

If the first hypothesis is rejected, then hypothesis (2) and (3) need to be investigated because there're important fixed effects. If the second hypothesis is rejected than this is the indication of the important cross-sectional effects and when the third hypothesis is rejected than is the indication of the important time-effects. If both the second and the third hypotheses are rejected than this shows that the model will be two-way fixed effect regression model.

7.2.4 Random Effects Model

7.2.4.1 One Way Random Effects Model

In the Random Effects Model, the disturbance term, u_{it}, of the general model of (7.9) is again consists of two parts. That is, $u_{it} = \mu_i + v_{it}$ (7.11) but this time, in the random effects model μ_i the unobserved cross-sectional effects will be treated like the disturbance term, as random variables. When N individuals are being drawn randomly from a large population, the random effects model is the appropriate specification (Baltagi, 2005).

Assumptions for the random effects model are given in Green (2000: 568) and Baltagi (2005: 14, 35) as:

1. Disturbance term, the unobserved cross-sectional effects and unobserved time-specific effects are independently and identically distributed as: $v_{it} \sim i.i.d(0, \delta_v^2)$, $\mu_i \sim i.i.d(0, \delta_\mu^2)$ and $\lambda_t \sim i.i.d(0, \delta_\lambda^{\ 2})$, respectively.
2. Random variables; λ_t, μ_i and v_{it} are all independent of each other for all i and t.
3. X_{it}'s are independent from both of the random variables μ_i , λ_t and v_{it} for all i and t.
4. $E(v_{it}v_{js}) = 0$ if $t \neq s$ or $i \neq j$.
5. $E(\mu_i \mu_j) = 0$ for all i and j.

Generalized Least Square (GLS) estimation will be used to estimate the Random Effects Model with non scalar variance-covariance matrix of $\Omega = E(uu')$. In order to have the GLS estimators, the inverse of the variance-covariance matrix, $\Omega^{-1/2}$, is needed which is:

$$\Omega^{-1/2} = \frac{1}{\delta_1} P + \frac{1}{\delta_v} Q \tag{7.23}$$

where $\delta_1^{\,2} = T\delta_\mu^{\,2} + \delta_v^{\,2}$, P is the matrix which averages the observations across time for each cross-sectional unit and Q is the matrix which obtains deviations from cross-sectional means.

To obtain the GLS estimators for the random effect model transformations on all the observations of the model should be done by using $\delta_v \Omega^{-1/2}$ and then OLS should be used in the transformed model to obtain GLS estimators of the random effect model. When the general model (7.9) is transformed model will be $\delta_v \Omega^{-1/2}$ then the typical elements of the transformed model will be

$$y_{it} - \theta \overline{y}_{i.} \text{ and } X_{itj} - \theta \overline{X}_{ij.} \text{ where } \theta = 1 - \frac{\delta_v}{\sqrt{T\delta_\mu^2 + \delta_v^{\,2}}} \tag{7.24}$$

GLS estimator is a matrix weighted average of within and between estimators which comes from equations (7.16) and (7.15), respectively. To obtain GLS estimators, within and between estimators are weighted by the inverse of their variance (Baltagi, 2005). Thus, following Green (2000), the GLS estimator can be written as follows:

$$\hat{\beta}_{GLS} = (S_{xx}^{\ within} + \lambda S_{xx}^{\ between})^{-1} S_{xx}^{\ within} \hat{\beta}_{within} + \left[1 - (S_{xx}^{\ within} + \lambda S_{xx}^{\ between})^{-1} S_{xx}^{\ within}\right] \hat{\beta}_{between}$$

(7.25)

where $\lambda = \dfrac{\delta_v^{\,2}}{\delta_1^2} = (1-\theta)^2$ and $S_{xx}^{\ within} = \sum_{i=1}^{N}\sum_{t=1}^{T}(x_{it} - \overline{x}_{i.})(x_{it} - \overline{x}_{i.})'$ that is the within group sum of square that comes from equation (7.16).

If the variance components of the random terms are known, GLS estimator can be computed however when the variance components are not known, firstly δ_1^2 and $\delta_v^{\,2}$ should be computed then Feasible Generalized Least Square (FGLS) estimator for the random effect model can be found. Estimators of the variance components can be given as follows:

$$\hat{\delta}_1^2 = \frac{T\sum_{i=1}^{N}\overline{u}_{i.}^{\,2}}{N} \tag{7.26}$$

and

$$\hat{\delta}_v^{\,2} = \frac{\sum_{i=1}^{N}\sum_{t=1}^{T}(u_{it} - \overline{u}_{i.})^2}{N(T-1)} \tag{7.27}$$

There are different methods to estimate the variance components. According to Wallace and Huseyin (1969), OLS residuals can be used to estimate $\hat{\delta}_1^2$ and $\hat{\delta}_v^{\,2}$. Amemiya (1971) suggests using the least square dummy variable residuals which can be obtained from (10) in estimating the variance components. Swamy and Arora (1972) suggest obtaining $\hat{\delta}_1^2$ and $\hat{\delta}_v^{\,2}$ by running the within and between regression models of (7.16) and (7.15), respectively. All these three approaches suggestion is to estimate $\hat{\delta}_\mu^{\,2}$ indirectly as: $\hat{\delta}_\mu^{\,2} = \frac{\hat{\delta}_1^2 - \hat{\delta}_v^{\,2}}{T}$ and $\hat{\delta}_\mu^{\,2}$ can be negative. As the fourth approach, Nerlove (1971) suggest estimating $\hat{\delta}_\mu^{\,2}$ directly as $\hat{\delta}_\mu^{\,2} = \frac{\sum_{i=1}^{N}(\hat{\mu}_i - \overline{\hat{\mu}})}{N-1}$ where $\hat{\mu}_i$ are the dummy variable coefficients estimated from the model (7.14) and suggest estimating $\hat{\delta}_v^{\,2}$ as: $\frac{\text{SSR from model } (12)}{NT}$.

To estimate FGLS estimators, after obtaining $\hat{\delta}_1^2$ and $\hat{\delta}_v^{\,2}$ by using the above approaches $\hat{\theta}$ should be obtained as: $\hat{\theta} = 1 - \frac{\hat{\delta}_v}{\sqrt{T\hat{\delta}_\mu^{\,2} + \hat{\delta}_v^{\,2}}}$. Then the typical elements of the transformed model will be $y_{it} - \hat{\theta}\overline{y}_{i.}$ and $X_{itj} - \hat{\theta}\overline{X}_{ij.}$. FGLS estimator can be obtained by using (7.25).

7.2.4.2 Two Way Random Effects Model

Suppose that the disturbance term, u_{it}, is composed of three parts such as:

$$u_{it} = \mu_i + \lambda_t + v_{it} \tag{7.10}$$

where both μ_i , the unobserved cross-sectional effect and λ_t, the unobserved time specific effect, are assumed as random variables like the disturbance term, v_{it}. That is, μ_i and λ_t are independently identically distributed with zero mean and with variance of $\delta_\mu^{\ 2}$ and $\delta_\lambda^{\ 2}$ respectively. Such models are known as two-way random effect models. Independent variables, X_{it}, are assumed to be independent of both random variables, μ_i, λ_t and v_{it}.

If the variance components are known, it is possible to estimate the GLS estimator for the two-way random effect model but if they are not known, then FGLS estimator for the model can be found.

To compute the GLS estimator, inverse of the variance-covariance matrix, $\Omega^{-1/2}$, is needed because the general model (2.6) will be transformed by using $\delta_v\Omega^{-1/2}$. Following Baltagi (2005), the transformation of y_{it} for GLS will be:

$$\delta_v\Omega^{-1/2}y_{it} = y_{it} - \theta_1\overline{y}_i - \theta_2\overline{y}_{.t} + \theta_3\overline{y}_{..}$$

where

$$\theta_1 = 1 - \frac{\delta_v}{\sqrt{T\delta_\mu^2 + \delta_v^{\ 2}}}, \theta_2 = 1 - \frac{\delta_v}{\sqrt{N\delta_\lambda^2 + \delta_v^{\ 2}}} \text{ and } \theta_3 = \theta_1 + \theta_2 + \frac{\delta_v}{\sqrt{T\delta_\mu^2 + N\delta_\lambda^2 + \delta_v^{\ 2}}} - 1$$

$$\overline{y}_{i.} = \frac{\sum_{t=1}^{T} y_{it}}{T}, \overline{y}_{.t} = \frac{\sum_{i=1}^{N} y_{it}}{N} \text{ and } \overline{y}_{..} = \frac{\sum_{i=1}^{N}\sum_{t=1}^{T} y_{it}}{NT}$$

and GLS estimator can be obtained as OLS estimator by the regression of the transformed y_{it} on the same transformations of X_{it} (Green 2000).

If the variance components are not known, FGLS estimator will be used after estimating the variance components. Like in the one-way random effect model, there are different methods when estimating the variance components. Estimation suggestions are given in Wallace and Huseyin (1969), Amemiya (1971) and Swamy and Arora (1972).

7.2.4.3 Testing Significance of Random Effects Parameters

In the random effects model testing whether μ_i's and λ_t's are equal to zero is same as testing δ_μ^2's and δ_λ^2's, their common variances, are equal to zero or not (Erlat, 1997). In the random effects model, the existence of unobserved cross-sectional effects and unobserved time-specific effects can be tested. Lagrange Multiplier approach can be used to test the effects.

Firstly, two-way random effect estimation should be done because if one-way random effect estimation is used instead of two-way random effect estimation, then this situation will cause omission bias.

Three hypotheses can be tested for random effects model (Baltagi, 2005: 59-64) and these are as follows:

1. $H_{01} : \delta_\mu^2 = \delta_\lambda^2 = 0$

   $H_{A1} : \delta_\mu^2 \neq \delta_\lambda^2 \neq 0$

Firstly H_{01} hypothesis should be tested because this hypothesis tests the absence of individual and time effects. Test statistic is,

$$LM = LM_1 + LM_2 \sim \chi_2^2$$

where

$$LM_1 = \frac{NT}{2(T-1)}\left[\frac{\sum_{i=1}^{N}(\sum_{t=1}^{T}\hat{u}_{it})^2}{\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{u}_{it}^2} - 1\right]^2 \text{ and } LM_2 = \frac{NT}{2(N-1)}\left[\frac{\sum_{i=1}^{N}(\sum_{t=1}^{T}\hat{u}_{it})^2}{\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{u}_{it}^2} - 1\right]^2$$

and $\hat{u}_{it}$'s are OLS residuals.

If the first hypothesis is rejected than in order to see from where the effects come from below hypothesis need to be tested. These are:

2. $H_{02}: \delta_\mu^{\ 2} = 0$

$H_{A2}: \delta_\mu^{\ 2} \neq 0$

This hypothesis tests the absence of cross-sectional effects. Test statistic is given in Green (2000: 572) as:

$$LM_1 = \frac{NT}{2(T-1)} \left[\frac{\sum_{i=1}^{N} (\sum_{t=1}^{T} \hat{u}_{it})^2}{\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{u}_{it}^2} - 1 \right]^2 \sim \chi_1^{\ 2}$$

3. $H_{03}: \delta_\lambda^{\ 2} = 0$

$H_{A3}: \delta_\lambda^{\ 2} \neq 0$

This hypothesis tests the absence of time-specific effects. Test statistic is given in Baltagi (2005: 60) as:

$$LM_2 = \frac{NT}{2(N-1)} \left[\frac{\sum_{i=1}^{N} (\sum_{t=1}^{T} \hat{u}_{it})^2}{\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{u}_{it}^2} - 1 \right]^2 \sim \chi_1^{\ 2}$$

If the first hypothesis is rejected, then hypothesis (2) and (3) need to be investigated because there are significant random effects. If the second hypothesis is rejected than this is the indication of the important cross-sectional effects and when the third hypothesis is rejected than is the indication of the important time-specific effects. If both the second and the third hypotheses are rejected than this shows that the model will be two-way random effect regression model.

7.3 Hausman Specification Test

Hausman Test is the test that is used to choose between fixed and random effects model. Test statistic is generally based on the difference between $\hat{\beta}_{GLS}$ and $\hat{\beta}_{within}$ within estimators. Following Hausman (1978), test statistic can be given as (Baltagi: 66-68):

$$m = \hat{q}' \operatorname{var}(\hat{q})^{-1} \hat{q} = (\hat{\beta}_{GLS} - \hat{\beta}_{within})' \left[\operatorname{var}(\hat{\beta}_{within}) - \operatorname{var}(\hat{\beta}_{GLS}) \right]^{-1} (\hat{\beta}_{GLS} - \hat{\beta}_{within}) \qquad (7.28)$$

and the test statistic is distributed as $\chi_K{}^2$ where K is the dimension of the slope vector β.

Hypothesis for the Hausman Test is:

$$H_0 : E(u_{it} / X_{it}) = 0$$
$$H_A : E(u_{it} / X_{it}) \neq 0$$

Both of the random effects estimators ($\hat{\beta}_{GLS}$) and fixed effects estimators ($\hat{\beta}_{within}$) are consistent under H_0. No matter whether H_0 is true or not, fixed effects estimators always give consistent estimators but they may not be efficient. However under H_0, random effects estimators give both consistent and efficient estimators so it allows taking advantage of having an efficient estimator.

One thing is important when using the Hausman Test that is; rejection of the H_0 hypothesis should not be seen as the adoption of the fixed effects model and acceptation of the H_0 hypothesis should not be seen as the adoption of the random effects model (Baltagi, 2005).

That is Hausman Test is just a selection of a more efficient model against a less efficient but consistent model. It guarantees that the more efficient model gives consistent estimators (http://dss.princeton.edu/online_help/analysis/panel.htm#choice,2006).When H_0 hypothesis is rejected, that is random effect estimator is not a consistent estimator thus fixed effect estimator should be used but when H_0 hypothesis is not rejected, that is the random effect estimator is consistent and has Cramer-Rao lower bound and should and should be used.

7.4 Simultaneous Equations Model

7.4.1 General Model Specification

A general framework for the system of simultaneous equations is following:

$$Y_1 = \alpha_0 + \alpha_1 Y_2 + \alpha_2 X_1 + \varepsilon_1 \qquad (7.29)$$

$$Y_2 = \beta_0 + \beta_1 Y_1 + \beta_2 X_2 + \varepsilon_2 \qquad (7.30)$$

In equations (7.29) and (7.30), Y_1 is a function of Y_2 and simultaneously, Y_2 is a function of Y_1. Y_1 and Y_2 are known as the endogenous variables and other variables are known as the exogenous variables. When there is a simultaneous-equation system, all the endogenous variables will be correlated with the terms. This situation can be shown as:

$Cov(Y_2, \varepsilon_1) \neq 0$ and $Cov(Y_1, \varepsilon_2) \neq 0$

That is, a change in the disturbance of the second regression model, ε_2, will cause a change in Y_2, change in Y_2 cause a change in Y_1 in equation (7.29). Thus, a change in ε_2 will cause a change in Y_1 and this shows a correlation between the endogenous variables and disturbance terms. In such a situation, if each of the equations (7.29) and (7.30) are estimated as a single equation than this will cause biased and inconsistent estimates of the coefficients. This bias on the estimated coefficients is known as the least square bias or as the simultaneous equation bias which overestimates the model coefficients (Ramanathan, 2002). Moreover, when simultaneity is ignored, together with biasedness there will also be inconsistency of coefficients as said before no matter the increase in the sample size. Derivation for the biasedness and inconsistency of the parameters are given by Keshk (2003) and other books by considering simplified versions of the simultaneous-equations model.

Equations (7.29) and (7.30) are known as the structural equations of the simultaneous-equation model. Since there'll be a positive bias and inconsistency on the estimated coefficients of the structural equations, instead of estimating the structural equations directly, reduced form equations should be constituted from the structural equations and then estimation should be done by using the reduced form equations. By solving each of the endogenous variables, Y_1 and Y_2, in terms of the exogenous variables, X_1 and X_2, reduced form equations are constituted. Reduced form equations for the structural equations in (7.29) and (7.30) can be given as follows following Keshk's formulation:

$$Y_1 = \beta_1 X_1 + \beta_2 X_2 + v_1 = \pi_1 X + v_1 \qquad (7.31)$$

$$Y_2 = \beta_1 X_1 + \beta_2 X_2 + v_2 = \pi_2 X + v_2 \qquad (7.32)$$

After estimating the reduced form equations in terms of the exogenous variables, main purpose is to solve for the structural equation coefficients (7.29) and (7.30). Identification problem is the name given to the estimation of the structural parameters from the estimation of the reduced form parameters (Ramanathan, 2002).

7.4.2 The Problem of Identification

Three types of identification problem can be occurred. If it is not possible to find estimates of the structural parameters from the estimates of the reduced form parameters, such a situation is known as under identification. If there is only one possible way to go back to structural parameters, this is known as exact identification, but if there are possible ways to estimate structural parameters by using reduced form parameters, such a situation is known as over identification.

Identification problem is essential because if the equation is an unidentified equation, then it is not possible to estimate structural form parameters and thus, obtain a model. In order to evaluate the identifiability of the structural equations, two conditions which are the rank and the order conditions should be checked.

Order condition for identification is the necessary but not the sufficient condition. For identifiability of the model, rank condition should also be satisfied. Investigation of identification is done for each equation.

Order condition is satisfied if the number of excluded exogenous variables from the equation is at least as large as the number of included endogenous variable (Green, 2000). Another way of evaluating order condition is that, number of excluded variables from an equation must be greater than or equal to (number of structural equations-1) (Ramanathan, 2002). For instance, if there are three structural equations, each equation must exclude at least 3-1=2 variables no matter exogenous or endogenous to be identified. Degree of over identification, if there is, can be checked by evaluating the order condition. That is, if there are four variables excluded from an equation and five structural equations then this is the indication of the exact identification since four is equal to the (number of structural equations-1). However if there are five variables excluded from an equation with five structural equations then this is the indication of the over identification. Because now five is greater than the (number of structural equations-1), and in such a situation degree of over identification will be one.

Rank condition is a restriction that is imposed on a sub matrix of the reduced form coefficients in models (7.31) and (7.32). Rank condition along with the simple method for evaluating the rank and order conditions are given in Green (2000, pg 671).

If rank condition is not satisfied then no matter what the order condition is, equation will be unidentified equation.

7.4.3 Estimation Method

After investigating identifiability of the model, if the model is either an exactly identified or an over identified model, then it is possible to estimate the model. However, as said before, since the right-hand side endogenous variables of the structural equations are correlated with the error terms then the OLS estimates of the structural equations are not consistent. Solution to find consistent estimators for the structural equation coefficients is the instrumental variables (IV) regression. Two stages least square (2SLS) method is the common IV regression method. Exactly identified and over identified equations can be estimated by using 2SLS to find consistent estimates of the coefficients for the structural equations. Estimation is done in two stages in 2SLS.

To estimate model (7.29) by 2SLS:

Stage 1: Right-hand side endogenous variable of model (7.29), Y_2, must be related to the endogenous variables which are X_1 and X_2. That is, the reduced form for the right-hand side endogenous variable must be estimated as:

$$\hat{Y}_2 = \pi_0 + \pi_1 X_1 + \pi_2 X_2 \qquad (7.33)$$

Then obtain the ordinary least square predictions of (7.33) and save the predicted values, $\hat{Y}_2$.

Stage 2: To estimate the structural equation (7.29), estimated values from stage 1 (7.33), $\hat{Y}_2$, will used in the structural equation (7.29) as instruments. That is, in equation (7.29), Y_2 will be replaced by $\hat{Y}_2$ and Y_1 will be regressed on the predicted value of $\hat{Y}_2$ and the included endogenous variables using ordinary least square estimation. Thus, estimated model will be

$$Y_1 = \alpha_0 + \alpha_1 \hat{Y}_2 + \alpha_2 X_1 + \varepsilon_1 \qquad (7.34)$$

where $\hat{Y}_2 = \pi_0 + \pi_1 X_1 + \pi_2 X_2$

Structural model (7.30) can be estimated by the same way.

In model (7.33), X_2 is the instrumental variable used to estimate the predicted value of $\hat{Y}_2$. Finding valid instruments is the essential point when using the 2SLS estimation. Instrumental variables should be used in order to find consistent estimates for the structural coefficients. A valid instrument, called z from now on, should satisfy the below conditions. These are,

$$Corr(z_i, u_i) = 0 \qquad (7.35)$$

and

$$Corr(z_i, X_i) \neq 0 \qquad (7.36)$$

where z_i is the instrumental variable, u_i is the disturbance term and X_i is the endogenous variable that is correlated with the disturbance term. z_i will be used instead of X_i.

Equation (7.36) is the relevance condition of an instrumental variable. Purpose is to find an instrument which is not weak. If the instruments are weak then this will cause 2SLS estimators to be biased and no longer reliable and also there will be problems with the sampling distribution of 2SLS estimator which cause statistical inferences to be meaningless (Stock and Watson, 2003).

Equation (7.35) is the exogeneity condition of an instrumental variable. That guarantees instrumental variables to be uncorrelated with the error term. That is, variations in the endogenous variables which are uncorrelated with disturbance terms are isolated by instrumental variables. Exogeneity in that sense is important (Stock and Watson, 2003).

When estimating the structural equations in (7.29) and (7.30), relevance and exogeneity conditions for the instrumental variables which are shown in (7.37) should be satisfied.

$$Corr(X_2, \varepsilon_1) = 0 \text{ and } Corr(X_2, Y_2) \neq 0 \qquad (7.37)$$

If the conditions in (7.37) are satisfied then validity of these conditions mean that X_2 is not a weak instrument and X_2 has no direct effect on Y_1, X_2 is indirectly effect on Y_1 through its effect on Y_2.

Another important point about instrumental variables is that, there must be at least as many instrumental variables as endogenous variables.

For instance if the purpose is to estimate structural equation (7.29) by 2SLS estimation, Y_1 is the independent variable in the model, Y_2 is the endogenous variable which is correlated with the disturbance term and must be related to the exogenous variables. X_1 is the included exogenous variable. X_2 is the instrumental variable which will be used to estimate the endogenous variable, Y_2, together with X_1. Thus, since there is only one endogenous variable, Y_2, along with the one instrumental variable X_2, then it is possible to estimate the structural equation (7.29) by using 2SLS estimation.

As before said in the "problem of identification" section, in order to evaluate identifiability of the structural equations, two conditions, rank and order conditions, should be checked. There is another way of investigating the identification problem. That is to compare the number of instruments with the number of endogenous variables. There are still three types of identification problems which can be occurred. There are considered in Stock & Watson (2003) as:

- If the number of instruments, m, is less than the number of endogenous variables, r, this is the indication of the under identification case.
- If the number of instruments is equal to the number of endogenous variables than this is the indication of the exact identification case.
- If the number of instruments is greater than the number of endogenous variables than this is the indication of the over identification case.

Again it is not possible to estimate an under identified model. Together with the number of instrument variables, validity of them is also important in estimating the structural equation coefficients. For this purpose, in order to evaluate the validity of the instrument variables, specification tests should be applied.

7.4.4 Specification Tests

When there are more instruments than the endogenous variables, or in other words when the model is an over identified model, over identifying restrictions should be tested when evaluating the validity of the instrumental variables. This is also same as testing the exogeneity of the instruments and this can be done by either Sargan Test or J-Test. When testing over identifying restrictions following Green (2000) the hypothesis is such that:

H_0 : Instruments are exogenous.

H_1 : Instruments are endogenous.

Testing the null hypothesis requires estimating a regression model in which residuals from 2SLS estimation of the structural equation is regressed on all exogenous variables including the instrumental variables together with included exogenous variables of the model. That is estimating the regression model in (7.38) such that:

$$\hat{u}_i^{2SLS} = \alpha_0 + \sum_{j=1}^{m} \alpha_j z_{ji} + \sum_{k=1}^{k} \beta_k X_{ki} + v_i \qquad j = 1, \cdots, m \quad (7.38)$$

$$k = 1, \cdots, k$$

where u_i^{2SLS} is the residuals from 2SLS estimation of the structural equation z_{ji} are the instrumental variables and X_{ki} are the included exogenous variables of the structural model. If Sargan Test is used to test the over identifying restrictions then the test statistic is:

$$S = TR^2 \quad (7.39)$$

where T is the total number of observations and R^2 is the determination coefficient from the regression (7.38).

If J-Test is used to test the over identifying restrictions then the test statistic is:

$$J = mF \tag{7.40}$$

where m is the total number of instrumental variables and F is the F-test statistic used to test the joint importance of instrumental variables that is:

$H_0 : \alpha_j = 0$

Both the Sargan Test and J-Test are distributed as χ^2 with degrees of freedom $m - r$, that is the number of over identifying restrictions or in other words, degree of over identification where m is the number of instrumental variables and r is the number of endogenous variables.

If the null hypothesis is rejected that is if the instruments are not exogenous then model might be misspecified because 2SLS estimation of the structural equation is based on invalid instruments. But if the null hypothesis is not rejected then this is the indication of consistent 2SLS estimators.

Testing over identifying restrictions is one of the specification tests. Another test for investigating validity of instruments is checking for weak instruments. This test is based on investigating the joint importance of instrumental variables in the first stage of 2SLS estimation. Test statistic is the F statistic. Results can differ according to F statistic. That is;

- F-statistic < 10 means that there's a weak instrument problem. In such a case, 2SLS coefficients will be biased and statistical inferences will be meaningless.
- F-statistic > 10 means that there's not any weak instrument problem.

7.5 Simultaneous Equations with Panel Data

Panel data models discussed in the previous section had only one regression model but due to the simultaneous nature of some economic variables, simultaneous equation estimation might be needed. In such a case, when data are panel data and simultaneous equation estimation is needed, due to the specific effects related to different cross-sectional units or time periods, classical simultaneous equation is no longer adequate (Krishnakumar, 1996).

In order to give a general idea about the simultaneous equations with panel data model a simplified version of Krishnakumar's simultaneous equation system can be considered.

Consider a linear system of two equations with two endogenous variables and K exogenous variables. Since the system is a complete system, number of endogenous variables and number of equations are same.

Let $i = 1, \cdots, N$ indicates the cross-sectional units , $t = 1, \cdots, T$ indicates the time periods and $m = 1, 2$ indicates the number of equations. Then a general model for the simultaneous equation system can be written as:

First structural equation:

$$
\begin{aligned}
&y_{111}\alpha_{111} + x_{111}\beta_{111} + \cdots + x_{k11}\beta_{k11} + u_{111} = 0 \\
&y_{112}\alpha_{112} + x_{112}\beta_{112} + \cdots + x_{k12}\beta_{k12} + u_{112} = 0 \\
&\vdots \\
&y_{11T}\alpha_{11T} + x_{11T}\beta_{11T} + \cdots + x_{k1T}\beta_{k1T} + u_{11T} = 0 \\
&y_{121}\alpha_{121} + x_{121}\beta_{121} + \cdots + x_{k21}\beta_{k21} + u_{121} = 0 \\
&\vdots \\
&y_{12T}\alpha_{12T} + x_{12T}\beta_{12T} + \cdots + x_{k2T}\beta_{k2T} + u_{12T} = 0 \\
&\vdots \\
&y_{1NT}\alpha_{1NT} + x_{1NT}\beta_{1NT} + \cdots + x_{kNT}\beta_{kNT} + u_{1NT} = 0
\end{aligned}
$$

This first structural equation consists of only one endogenous variable, K exogenous variables and the disturbance term.

Second structural equation:

$$
\begin{aligned}
&y_{211}\gamma_{211} + x_{111}\beta_{111} + \cdots + x_{k11}\beta_{k11} + u_{211} = 0 \\
&y_{212}\gamma_{212} + x_{112}\beta_{112} + \cdots + x_{k12}\beta_{k12} + u_{212} = 0 \\
&\vdots \\
&y_{21T}\gamma_{21T} + x_{11T}\beta_{11T} + \cdots + x_{k1T}\beta_{k1T} + u_{21T} = 0 \\
&y_{221}\gamma_{221} + x_{121}\beta_{121} + \cdots + x_{k21}\beta_{k21} + u_{221} = 0 \\
&\vdots \\
&y_{22T}\gamma_{22T} + x_{12T}\beta_{12T} + \cdots + x_{k2T}\beta_{k2T} + u_{22T} = 0 \\
&\vdots \\
&y_{2NT}\gamma_{2NT} + x_{1NT}\beta_{1NT} + \cdots + x_{kNT}\beta_{kNT} + u_{2NT} = 0
\end{aligned}
$$

Second structural equation also consists of only one endogenous variable, K exogenous variables and the disturbance term.

Each structural equation has the disturbance term u_{mit} which consists of three parts that is:

$$u_{mit} = \mu_{mi} + \varepsilon_{mt} + v_{mit} \qquad \begin{aligned} &m = 1, 2 \\ &t = 1, \cdots, T \\ &i = 1, \cdots, N \end{aligned} \tag{7.41}$$

For instance in the first structural equation the disturbance term can be given as:

$$u_{111} = \mu_{11} + \varepsilon_{11} + v_{111}$$

Following Baltagi (2005), structural equation of a simultaneous equation model can be written as follows:

$$y_1 = Y_1\alpha_1 + X_1\beta_1 + u_1 \tag{7.42}$$

where $y_1 = (y_{111} \cdots y_{11T} \cdots y_{1N1} \cdots y_{1NT})'$ and it represents the first structural equation.

Y_1 is the matrix of included right hand side endogenous variables.

X_1 is the matrix of included exogenous variables and if is thought to be a one-way panel data model then

$u_1 = Z_\mu \mu_1 + v_1$ where $\mu_1' = (\mu_{11}, \cdots, \mu_{N1})$ and $v_1' = (v_{111}, \cdots, v_{NT1})$

Identification problem for this system does not change; it is same as the simultaneous equation estimation without panel data. Same rank and order conditions needed to be satisfied. Over identification, just identification and under identification situations are still valid in the panel data simultaneous equation model (Krishnakumar, 1996).

In order to investigate the identifiability of the model in (7.42), let the number of right hand side endogenous variables is m, the number of included exogenous variables is k_i and the number of excluded exogenous variables is k_e then if the equation (7.42) is identified, k_e should be greater than or equal to m.

Estimation procedure for panel data simultaneous equation model is given in Baltagi (2005). Error component two-stage least square estimator (EC2SLS) was derived by him.

If the structural equation in (7.42) is written as:

$$y_1 = Z_1 \theta_1 + u_1 \tag{7.43}$$

then EC2SLS estimator can be given as:

$$\hat{\theta}_{1,EC2SLS} = W_1 \hat{\theta}_{1,W2SLS} + W_2 \hat{\theta}_{1,B2SLS} \tag{7.44}$$

where $\hat{\theta}_{1,W2SLS}$ is the within two-stage least square estimator and to obtain $\hat{\theta}_{1,W2SLS}$ firstly, equation (7.42) should be transformed by using Q, matrix which obtains deviations from individual means, then 2SLS estimation should be applied on this transformed equation using QX as the set of instruments. It is also known as the fixed effect two-stage least square. $\hat{\theta}_{1,B2SLS}$ is the between two-stage least square estimator and to obtain $\hat{\theta}_{1,B2SLS}$ firstly, equation (7.42) should be transformed by using P, matrix averages the observations across time for each individual, then 2SLS estimation should be applied on this transformed equation using PX as the set of instruments. W_1 and W_2 are the weights which can be found in Baltagi (2005) and these weights depends on the variance-covariance matrices of the transformed equations.

This gives the difference between 2SLS and EC2SLS, although 2SLS estimation does not require variance components, EC2SLS estimation requires variance components as weights.

CHAPTER 8

APPLICATION

8.1 Introduction

Since the aim of the study is to find the right set of variables and to solve the regression equation to discover the factors in predicting the fertility level differentials and the demographic transition in Turkey then from that point of view, in this application part, an econometric model of panel data simultaneous equation model will be constituted to provide econometric estimates to understand the pace of fertility decline. Panel data simultaneous equation model is needed because both fertility and female labor force participation affects one another. That is; female labor force participation affects fertility and fertility affects female labor force participation. Both fertility and female labor force participation are influenced by the same set of variables. Thus, fertility and female labor force participation are needed to be determined simultaneously. For that purpose, a two-equation system is needed, one for female labor force participation as a function of fertility and the other for fertility as a function of female labor force participation. In order to solve the simultaneous-equation model, error component two stage-least square (EC2SLS) procedures will be applied to obtain unbiased, consistent and asymptotically efficient estimators.

8.2 Data

In that study, DATA are panel data and data for the variables can be found in periods of five years from 1980[*] to 2000 for 67 provinces in Turkey, the provinces that are included in each region of Turkey are given in the Appendix B. There were 67 provinces before 1985 but the number of provinces had increased by 1990. The newly created provinces in 1990 are adjusted by adding the data for the new provinces back to their old provinces so that there are 67 provinces in 1990, 1995 and 2000 also (Tansel, 2001). Data are from State Institute of Statistics for various census years and provincial census books and State Planning Organization yearbooks.

[*] Since the study is a provincial based study, some of the variables such as Gross Domestic Product (GDP) variable before 1980 could not be included thus; the study is restricted between the years 1980-2000.

Since the political and the economic structure of the provinces in Turkey have been different from each other, the demographic transition has begun in different periods in these provinces and they have advanced to different levels in their demographic transition. Thus, fertility variations occur from one province to another as a result of social and cultural differences. Moreover, the average level of childbearing is not at the same level in all provinces, fertility levels are high in the East provinces compared to the provinces in the West. Therefore, it is useful to include regional and provincial dummy variables in order to see the regional and provincial differences in demographic transition because although total fertility rate has declined in Turkey between the years 1980-2000, rates among the provinces and regions vary considerably.

8.3 The Empirical Model

Together with previous fertility researches such as Mahdavi (1990), Panopoulou and Tsakloglou (1999), Lehmijoki (2003), theories of demographic transition which are economic theories, cultural theories and homeostatic theories are used to determine the variables which may effect the fertility equation. Investigating the fertility equation is important because since Malthus, there is a debate whether fertility determines the economic development or economic development determines fertility and when estimating the fertility equation, the most important subject is the relation between fertility and female labor force participation (Cramer, 1980) because there is a simultaneity between these two variables as stated in Standing (1978). Relative income hypothesis which was developed by Easterlin (1973) is taken as the main reason under the simultaneous nature of female labor force participation (FLPR) and fertility rate (FR). That is; the interaction between FR and FLPR are due to relative income hypothesis (Roy & Rubertson, 1982). Relative income, income that the young people earn to live their life before they become married, is based on comparing current income level with parent's income level and having at least the same status of life before marriage. According to that hypothesis, if young couples earn enough money to live the life which they had before marriage then they have a positive attitude towards marriage and childbearing but however if young couples don't earn enough money to live the life they desired then this causes young adults to decide not to marry and not to have children. If married couples don't earn enough money for the desired life then to support family income married women can enter the labor market and postpone having children as a result of this fertility levels decline (Roy & Rubertson, 1982). In other words, increases in FLPR causes decreases in FR.

Causality between FLPR and FR was also explained by Mahdavi (1990) using the socioeconomic theories of fertility stated by Leibenstein. That is; as people gain higher status in the society then these status changes cause changes in the demand for income due to higher expenditures and as a result of this FLPR increases and FR decreases. Interaction between FLPR and FR is due to the women's role in the society because woman is a worker outside the home but a mother at home.

Although above explanations give an idea about the simultaneous nature of FLPR and FR, there are still debate in fertility studies about the causal direction between FR and FLPR (Cramer, 1980). Some studies indicate that FR limits FLPR such as Sweet (1973) and Smith-Lovin and Tickamyer (1978), other studies indicate that FLPR limits FR such as Stolzenberg and Waite (1977). Another part of studies indicate that there can be causality both from FLPR to FR and from FR to FLPR (Standing, 1978).

Since single equation models of fertility might cause specification errors due to the simultaneous nature of FLPR and FR, a fertility equation should be estimated within a simultaneous equations system (Conger & Campbell, 1978). For this reason, following system of equations given in (8.1) and (8.2) will be investigated as the empirical model for the study:

$$\mathrm{FR}_{\mathrm{it}} = \alpha \mathrm{FLPR}_{\mathrm{it}} + \mathrm{X}_{\mathrm{it}}\beta + \mathrm{Z}_{\mathrm{it}}\gamma + \mathrm{u}_{1\mathrm{it}} \tag{8.1}$$

$$\mathrm{FLPR}_{\mathrm{it}} = \delta \mathrm{FR}_{\mathrm{it}} + \mathrm{X}_{\mathrm{it}}\theta + \mathrm{P}_{\mathrm{it}}\eta + \mathrm{u}_{2it} \tag{8.2}$$

$$\text{and } \mathrm{u}_{\mathrm{jit}} = \mu_{\mathrm{ji}} + \lambda_{\mathrm{jt}} + \varepsilon_{\mathrm{jit}} \quad \text{for} \quad j = 1,2;\; i = 1,\cdots,67;\; t = 1,\cdots,5 \tag{8.3}$$

where $\mathrm{FR}_{\mathrm{it}}$ is the variable representing fertility level and $\mathrm{FLPR}_{\mathrm{it}}$ is the variable representing female labor force participation for each province. These variables are the dependent variables of the equations (8.1) and (8.2), respectively.

In the first structural equation, $\mathrm{FLPR}_{\mathrm{it}}$ is the endogenous variable and in the second structural equation, $\mathrm{FR}_{\mathrm{it}}$ is the endogenous variable. There are two endogenous variables and two structural equations then this system is a complete system.

X_{it} represents the same set of exogenous variables affecting the two equations. These variables include URBAN, ASHARE, GPP, ILLITER and HSG. These variables appear in both equations to control cross-provincial correlation caused by factors affecting fertility and female labor force participation at the province level (Bono, 2002).

Z_{it} is the vector of exogenous variables affecting solely the fertility equation. These variables are IMR, CMR, CULTUR, CONTRA, POPDEN.

P_{it} contains a set of exogenous variables such as AVGHSHLD, MARITAL STATUS, UNEMP_M and UNEMP_F affecting only the female labor force participation equation.

Equation (8.3) represents the disturbance terms. u_{jit}'s are specified to include province specific time-invariant effects and time-specific effects to capture variations in FR and FLPR common to all provinces.

8.4 Variables

In order to give ideas about the determinants of FR and FLPR used in equations (8.1) and (8.2) together with independent variable names, symbol of the variables and expected signs will be given in table 8.1 and table 8.2, respectively.

8.4.1 Variables of the Fertility (FR) Equation

In the first equation, FR will be used as the dependent variable. Other independent variables are given in table 8.1.

Table 8.1: Determinants of FR together with expected sign and expected relationships

Independent variable	Symbol	Expected sign
Infant mortality rate	IMR	+
Child mortality rate	CMR	+
Urbanization	URBAN	-
Female labor participation rate	FLPR	-
Gross provincial product of a province	GPP	+ or -
Agricultural share	ASHARE	+
Illiterate woman	ILLITER	+
High school graduate woman	HSG	-
Social interaction variable	CULTUR	-
Population density of a province	POPDEN	+ or -
Percentage of contraceptive usage	CONTRA	-

In the first equation, different variables such as the crude birth rate, general fertility rate, total fertility rate, child-woman ratio, gross reproduction rate and average number of children per woman at "45-49" age group will be tried as the dependent variable (FR) in order to see which of these dependent variables will give the highest explanatory power.

Expected relationship between FR and IMR will be positive. Because when there is a decrease in infant mortality rate this will cause more children to survive and as a result of this parents don't need to have more children to guarantee the desired number of survived children. Parents also don't take precautions by having more children against possible death risks of their children. Quality of surviving children is more important than quantity no matter whether children are seen as additional workers for the family or support for their family's old ages (Panopoulou and Tsakloglou, 1999). As it was stated by Notestein (1945), if the decline in infant mortality fails then there is no hope of declining in fertility. That is; mortality was the necessary condition for the decline in fertility.

There will be a negative relationship between increased education and fertility. Educated parents especially educated mothers attitudes will affect the desired number of children (Schultz, 1973). Educated parents want to invest in child quality rather than child quantity and when they have brought their children up their knowledge and thoughts also affect their children and this will have a lowering effect in fertility levels. Educated women might use fertility control methods more than uneducated women. In order to capture the effect of education on fertility, included variables in the fertility equation will be high school graduate rate, HSG and woman without schooling rate, ILLITER. Due to reasons mentioned above, expected relationship between FR and ILLITER is positive however expected relationship between FR and HSG is negative. In order to support the negative relationship between fertility and education, the statement cited in Kulu(1985: 37) can be given as “It was emphasized that more literacy reduced fertility by 24%, five years of education by 33%, both 8 and 12 years of education by 50%, 16 years of education by 67% (Timur,1971)”.

Availability of ideas and information is expected to be negatively related to fertility which can be shown by the CULTUR variable. This variable is used since it is thought to have an important effect on the diffusion of ideas which can affect fertility and this variable is a way of social interaction to discover new ideas (Lehmijoki, 2003). For instance, it will affect people’s mind about contraceptive usage and as a result of this fertility levels might decline. For instance in Lehmijoki’s (2003) study number of radios used as the social interaction variable. However; in this study, percentage of public library users will be used as the social interaction variable.

Another explanatory variable which is thought to affect fertility is the urbanization which is shown by URBAN. Urbanization is likely to influence fertility negatively. One of the reasons is that diffusion of ideas towards fertility control is rapid in urban areas and since cost of living is expensive in these areas, couples prefer to have fewer children as a result of this fertility levels decline. The other reason of the negative relationship is the availability of the consumption goods related to fertility control methods in urban areas. Moreover, since children are not seen as an old-age security of their parents then urban women control their fertility and also one of the important aspects of modern life is the desire for small families rather than large families (Kulu, 1985: 39-40). Although expectation is the negative relationship, reverse ideas of the writers are also given in Panopoulou and Tsakloglou (1999). According to these ideas, determination of the relationship between GFR and URBAN is not easy.

GPP can affect FR in two ways. According to studies stated in Galor and Weil (1996) although male income levels have positive effect on fertility levels, female income levels have negative effect on fertility levels as a result of this the overall effect of an increase in men’s and women’s wages is ambiguous. For instance, increase in income level of a female will lead to an increase in the price of mother’s time and this will cause fertility levels to decline (Lehmijoki, 2003). Moreover, when parent’s income level is high, they don’t worry about their future then demand for children will be low. Since income has an important effect on education, educated people might want to have fewer children. Although these are the negative effects of GPP on FR together with the positive effect of male income levels on fertility levels, sign can not be determined before the study (Mahdavi, 1990).

As stated in Lehmijoki (2003), both negative and positive relationships can be possible between the FR and POPDEN which can be defined as the carrying capacity of the environment because from one point of view, if land is available then fertility levels increase and from other point of view, the reverse is valid. From another point of view, when population density is higher, interaction of people is easy and by this way people have great variety of thoughts and actions (Kulu, 1985: 38-39) as a result of this, fertility behavior can be affected from this variety of thoughts negatively or positively. For instance fertility levels can decrease by the increased usage of contraceptives or fertility levels can increase due to the widespread idea that children are old-age security of their parents.

As several studies have suggested, expected relationship between percentages of people in the agricultural labor force, which is shown by ASHARE and FR is positive (Lim, 2002). One reason is that, in order to perform agricultural activities additional workers are needed as a result of this fertility levels increase. Another reason is that, because parent's dependence to their children as labor is high as a result of this fertility levels are high.

FLPR is another factor which is thought to effect fertility levels. Doğan (1987) gave a broad review to explain the relationship between fertility levels and the female labor force participation levels. Doğan (1987: 24) concluded his review with the words *"This review shows that there may be a relationship which varies in size, shape and direction in different settings"*. Thus; it is difficult to say the direction and magnitude of the relationship.

Contraceptive usage is one of the characteristics of fertility and it is related to the fertility behavior through social and economic variables (Günaydın, 2003: 111-112). According to the findings of the study by Peker (1979), contraceptive usage and increased level of education are closely related variables. Increased levels of education cause contraceptive usage to increase (Peker, 1979: 161). According to another result, as education level increases, fertility levels decline (Peker, 1979: 159). By connecting these two ideas, it possible to say that education level increase causes contraceptive usage to increase which resulted with low levels of fertility. Thus, it is possible to say that increases in contraceptive usage are expected to decrease fertility levels further.

8.4.2 Variables of the Female Labor Force Participation (FLPR) Equation

In the second equation, FLPR will be used as the dependent variable. Other independent variables are given in table 8.2.

Table 8.2: Determinants of FLPR together with expected sign

Independent variable	Symbol	Expected sign
Fertility	FR	-
Urbanization	URBAN	-
Gross provincial product of a province	GPP	+ or -
Agricultural share	ASHARE	+
Illiterate woman	ILLITER	-
High school graduate woman	HSG	+
Female unemployment ratio	UNEMP_F	+ or -
Male unemployment ratio	UNEMP_M	+ or -
Average household	AVGHSLHD	+
Divorced, Single, Married, Widowed	DIVOR,SING MARR,WIDOW	+,+,-,+

Education is one of the important factors affecting FLPR (Schultz, 1973). Increased education is likely to increase FLPR. In order to capture this effect woman without schooling, ILLITER, is used as the independent variable. Thus there is a negative relation between ILLITER and FLPR. Percentage of high school graduates is another variable indicating education and HSG is expected to have a positive effect in the FLPR equation. Difference between educated and less educated women is that educated women can find satisfying jobs when compared to less educated women thus they prefer to work rather than stay at home so they have positive attitudes against small family size. It is possible to say if the female illiteracy rate is high than FLPR will be low (Tansel, 2002).

Fertility is one of the female demographic variables and fertility is expected to be negatively related to FLPR (Conger and Campbell, 1978). When there is an increase in FLPR, this will cause a decrease in FR because time devoted to home-centered activities rise when there are children at home by causing a decline in FLPR (Mahdavi, 1990). Working women also prefer to have fewer children due to opportunity cost of mother’s time. Increasing levels of FLPR cause postponements of marriages because when women gain their economic independence they prefer to live alone rather than to marry and to have children and as a result of this fertility levels decline (Bono, 2002).

The effect of unemployment ratio on FLPR is ambiguous because it depends on the relative strength of additional and discouraged worker affects (Conger and Campbell, 1978). When the unemployment level is high in a province, it is difficult for a woman to find a job and as a result of this women might decide not to look for a job and withdraw from the labor market. This is the discouraged worker affect and this will have a negative effect on FLPR. However, additional worker effect will have a positive effect on FLPR. That is, when men lose their jobs, in order to compensate family income women might enter the labor market.

In Turkey, expectation is the negative effect due to the dominant future of additional worker effect (Tansel, 2002). In order to evaluate the effect of unemployment on FLPR, not both of the unemployment ratios for men and women will be covered at a time, since both of them is thought to have the same effect on the equation then only UNEMP_F or UNEMP_M will be covered. Effect of unemployment rates of women are expected to be higher than men because it is hard for women to re-enter employment when they lose their jobs (Lim, 2002).

Relationship between FLPR and GPP is ambiguous and net effect can not be determined before. Due to the expansion of sectors in the economy GPP increases and this effect will cause increases in the female labor force participation. This is the positive effect of GPP on FLPR. However another effect of increases in GPP is the increases in leisure time which results with decreases in the female labor force participation. This is the negative effect of GPP on FLPR.

As it is seen from the equations (8.1) and (8.2), ILLITER, GPP and UNEMP variables enter both the fertility and the female labor force participation equations. For instance, as the percentage of women with no school decreases that is as the education level of women increases then this will cause more women to enter labor market and as women enter the labor market, fertility levels decline.

Urbanization is expected to increase the cost of living. Expectations of women in the urban areas are different from the women in the rural areas (Peker, 1979: 163-164), in order to catch the high standard of living in the urban areas, women will wanted to join the labor force thus; positive relationship is expected between urbanization and female labor force participation.

Detailed descriptions of the variables are given in the Appendix A.

8.5 Relationship between the Variables and the Theories of Demographic Transition

In most of the studies the determinants of fertility are given in the subsection of theoretical considerations part one by one, however since the core study of the thesis is the Lehmijoki's (2003) study, it is preferred to give the determinants of fertility by using three main theories of demographic transition. Thus, the determinants of fertility can be found in three main groups according to three main theories. By this way, it is easy to understand the influence of independent variables on fertility. For that reason, in this part, Table 8.3 represents which independent variable of FR comes from which of the three demographic transition theories. This will help to understand the expected relationships between dependent and independent variables in the fertility equation and to determine a combination of variables stated in these theories in order to fit a model that explains fertility and change in fertility to understand the effects of demographic transition on Turkey.

Table 8.3: Demographic Transition Theories and Determinants of FR

		Independent Variables
DEMOGRAPHIC TRANSITION THEORIES	Economic Theories of Demographic Transition	ASHARE
		FLPR
		ILLITER
		GPP
		UNEMP
	Cultural Theories of Demographic Transition	ILLITER
		HSG
		URBAN
		CULTUR
		GPP
	Traditional Theories of Demographic Transition	FLPR
		IMR
		CMR
		GPP
	Homeostatic Theories of Demographic Transition	POPDEN

Since FR is the dependent variable, only the relationships running from independent variables to fertility are included in table 8.3. Because of the simultaneity between FR and FLPR, FLPR is not included in table 8.3.

Provinces in the east part of Turkey have higher total fertility levels than the provinces in the west part of Turkey. Since fertility levels are thought to be different in different parts of Turkey, in order to see the heterogeneous structure it will be useful to divide the provinces in two sub samples, Provinces Prioritized in Development and other provinces. Provinces Prioritized in Development especially consist of the eastern provinces of Turkey. These two parts of Turkey will be evaluated separately in order to capture differences together with a model covering all the provinces of Turkey when estimating the structural equations. In other words, three different models will be estimated, one for the Provinces Prioritized in Development, one for the others and the other for the overall Turkey.

List of provinces in the sub sample Provinces Prioritized in Development and other provinces are given in the Appendix B.

Since both of the FR and FLPR are determined within the model, both are correlated with the disturbance term, so both FR and FLPR are endogenous variables. In this study it is thought that OLS cannot give consistent estimators due to the reasons mentioned in the methodology section of simultaneous equation estimation so panel data estimation should be applied due to the existence of panel data but however since there might be a causality both from FLPR to FR and from FR to FLPR panel data simultaneous equation estimation is thought to give the most precise results. In this study in order to estimate the general fertility model error component two stages least square (EC2SLS) estimation which is developed by Baltagi (2005) and mentioned in the methodology section will be used.

8.6 Results of the Empirical Model

In this application section firstly first-differenced models for the years 1980-1985, 1985-1990 and 1990-2000 will be given. Then pooled ordinary least square (OLS) regression model will be investigated. After that, panel data models will be investigated and finally, panel data simultaneous equation model will be given. When trying to find the right set of independent variables in predicting the fertility level differentials, five different fertility measures are used in estimating each equation. These five different fertility measures used to predict fertility models are total fertility rate (TFR), average children (AVGCH), child women ratio (CWR), crude birth rate (CBR) and gross reproduction rate (GRRT) and in the tables the estimation results which are best in estimating fertility differentials when different dependent variables are given.

Firstly, estimation results of the first-differenced fertility equations can be seen in tables 8.4, 8.5 and 8.6 for the years 1980-1985, 1985-1990 and 1990-2000, respectively. The validity of the results is related to some assumptions which are given in Wooldridge (2002: 279-281) and by assuming the validity of these assumptions, estimation results can be given as follows:

Estimation results of the first-differenced fertility equation for the period 1980-1985:

Table 8.4*: Estimation results of the first-differenced fertility equation for 1980-1985

Models		(1)	(2)	(3)	(4)
Independent Variables	FLPR	-.0017453 (-0.13)	-.0069422 (-0.57)	-2.857285 (-1.71)	-2.890668 (-1.8)
	IMR	.0426111 (2.01)	.0129678 (3.57)	.0709822 (0.15)	.056524 (0.12)
	CMR	-.0514359 (-1.47)	-	-	-
	GPP	-.2089494 (-1.09)	-.2056532 (-1.08)	6.575182 (0.27)	-
	CONTRA	.0117834 (3.33)	.0138447 (4.14)	-.0003341 (-0.00)	-
	URBAN	-.0031283 (-0.36)	-	-	-
	POPDEN	.002507 (1.65)	.0020648 (1.97)	-.03551 (-0.26)	-.0322058 (-0.25)
	CULTUR	.0003859 (0.29)	-	-.2971959 (-1.76)	-.2933819 (-1.78)
	ILLITER	.0065183 (0.88)	.0079732 (1.13)	2.167851 (2.33)	2.222967 (2.50)
	HIGH	-.1477446 (-1.82)	-.147501 (-1.98)	-35.76893 (-3.64)	-35.67343 (-4.45)
	ASHARE	-.0188909 (-1.67)	-	-3.832904 (-2.63)	-3.820216 (-2.75)
	CONSTANT	.0661641 (0.34)	.0187504 (0.10)	6.423593 (0.26)	7.077699 (0.39)
	R^2	0.6038	0.5639	0.4305	0.4297
	Adjusted R^2	0.5245	0.5121	0.3405	0.3621
	F	7.62	10.90	4.79	6.35

Note: AVGCH is taken as the fertility measure in models (1) and (2) and CWR is taken as the fertility measure in models (3) and (4).

In the first and the third equations all of the independent variables are regressed into the dependent variables, AVGCH and CWR, respectively. But most of the variables are found as insignificant. In the first equation only the contraceptive usage and the infant mortality rate found as significant at the 5% significant level and in the third equation only the illiteracy rate, high school growth rate and the percentage of agricultural share are found as significant at the 5% significant level. In order to have more accurate models some of the independent variables are eliminated from the first and the third equations and models (2) and (4) are constituted.

* Each estimation result in the table give the best regression models when both of the dependent variables, TFR, AWGCH, CWR,GRRT and CBR are considered.

In the second regression model, holding all other inputs constant one percentage increase in the infant mortality rate increases the fertility rate which is the average child by 1.2 percent at the 5 percent significance level and also a one percentage increase in the high school graduate rate of women is expected to decrease the average child number approximately by 15%. This percentage indicates the importance of education in fertility behavior. Educated mothers want to invest in child quality rather than child quantity and when they have brought their children up their knowledge and thoughts also affect their children and this will have a lowering effect in fertility levels.

In model (4), when the dependent variable is taken as the child women ratio, illiteracy rate of women and the percentage of women who are high school graduates are found as significant at the 5% significance and social interaction variable found as significant at the 10%significance level. Although agricultural share is found as significant, it does not have the expected positive sign. Holding all other inputs constant one percentage decrease in the illiteracy rate of woman is expected to decrease the fertility levels at least by 44%. These are very high effects for the education.

Generally, in all of the four regression models, female labor force participation rate is expected to have a negative influence on fertility levels but this influence is not found as significant this result is expected because there might be an endogeneity problem between fertility and female labor force participation. Infant mortality rate has the expected positive sign in all the regression models that is, when the infant mortality rate decreases, this will cause more children to survive and as a result of this, parents don't need to have more children to guarantee the desired number of survived children. Only the estimated coefficient of IMR from the equations (1) and (2) is found to be significant. In none of the models, income has significant effect in fertility behavior. The illiteracy rate of women has the expected positive sign and the percentage of high school graduate rate of woman has the expected negative sign in all of the models.

Estimation results of the first-differenced fertility equation for the period 1985-1990:

Table 8.5: Estimation results of the first-differenced fertility equation for 1985-1990

Dependent Variable		CWR	CWR
Independent Variables	FLPR	.8805193 (2.26)	.8624864 (2.32)
	IMR	.2131686 (0.44)	-
	CMR	.8221345 (0.74)	1.231843 (1.94)
	GPP	19.41084 (1.45)	18.95286 (1.56)
	CONTRA	-.6402985 (-0.85)	-.5708018 (-0.82)
	URBAN	-3.125343 (-2.29)	-3.074595 (-2.37)
	POPDEN	-.0227971 (-0.22)	-.0229526 (-0.23)
	CULTUR	-.5275498 (-2.37)	-.5488604 (-2.68)
	ILLITER	5.637643 (3.36)	5.580861 (3.54)
	HIGH	.8872605 (0.14)	-
	ASHARE	-2.103938 (-1.61)	-2.140765 (-1.73)
	CONSTANT	-36.56524 (-1.50)	-35.34176 (-1.83)
	R^2	0.5434	0.5417
	Adjusted R^2	0.4521	0.4693
	F	5.95	7.49

Note: In the parenthesis t-ratios are given.
The overall significance of the model is shown by F statistic.

In the first regression equation all of the independent variables are regressed into the dependent variables and in order to have a more accurate model some of the independent variables are eliminated from the first regression equation and model (2) is constituted. As the fertility measure, child woman ratio is used for this period since it gives the most accurate and significant model.

For this period, urbanization, changes in cultural variable, percentage of child mortality rate and the percentage of illiteracy rate of woman have the highest effect in fertility level differentials. Urbanization, child mortality and cultural variable gain importance for this period when compared to the 1980-1985 period. Although the contraceptive usage has the expected negative sign, it is found as insignificant. That is maybe due to an indirect effect of contraceptive usage on fertility levels. Increases in education levels cause contraceptive usage to increase which resulted with low levels of fertility. Thus, it is possible to say that increases in contraceptive usage are expected to decrease fertility levels further.

Surprisingly, female labor force participation is significant and it has got positive effect on fertility levels rather than expected negative effect. That is, maybe due to the need to earn more money because there are more children to look after when the child woman ratio increase. Percentage of agricultural share in a province is found as significant at the 10% level but the sign is negative rather than expected positive sign.

Holding all other variables constant, one unit increase urbanization is expected to decrease child woman ratio by three unit although a unit increase of the cultural variable is expected to decrease the child woman ratio by 0.5 unit.

Estimation results of the first-differenced fertility equation for the period 1990-2000:

Table 8.6: Estimation results of the first-differenced fertility equation for 1990-2000

Dependent Variable		CBR	CBR
Independent Variables	FLPR	-.01057 (-0.37)	-.0179872 (-0.65)
	IMR	.0554773 (1.54)	.0658932 (2.49)
	CMR	.009578 (0.13)	-
	GPP	-.3450197 (-0.26)	-.6935689 (-0.54)
	CONTRA	.1305734 (3.32)	.1166531 (3.20)
	URBAN	-.2695101 (-4.21)	-.2457093 (-4.08)
	POPDEN	-.0048148 (-1.40)	-.0050904 (-1.50)
	CULTUR	.0120443 (1.05)	-
	ILLITER	-.1187022 (-3.30)	-.1297662 (-3.74)
	HIGH	-.2173567 (-0.84)	-.1028872 (-0.43)
	ASHARE	-.0665133 (-1.28)	-
	CONSTANT	.9091848 (0.75)	.9437868 (0.78)
	R^2	0.4824	0.4612
	Adjusted R^2	0.3788	0.3869
	F	4.66	6.21

Note: In the parenthesis t-ratios are given.
The overall significance of the model is shown by F statistic.

Table 8.6 reports summary statistics for the estimation results of the first-differenced fertility equation for the period 1990-2000.

For this period, crude birth rate is used as the fertility measure and the estimated coefficients of urbanization and infant mortality rate are found as statistically significant and have the expected relationship with fertility levels. The estimated coefficients are -0.2457093 and 0.0658932, respectively. Holding all other variables constant, when there is a one percentage increase in urbanization then fertility levels are expected to decrease between the ranges 12.5 % and 36.6 %. The result between the urbanization and fertility levels are expected because expensive cost of living in urban areas cause fertility levels to decline and since children are not seen as an old-age security of their parents then couples in urban areas control their fertility.

Another important variable which is the infant mortality rate has the expected positive relationship with the fertility levels and holding all other variables constant, one percentage decrease in the infant mortality rate decreases the fertility rate by 6.5 percent at the 5% significance level. For the 1990-2000 period, one percentage decrease in infant mortality rate decreases the fertility levels by 5.3 percent more when compared to 1980-1985 period. Female labor force participation rate and the percentage of women who are high school graduates have the expected negative sign however influences of them on fertility levels are not found as significant for this period.

Surprisingly, although contraceptive usage and illiteracy rate are found significant at the 5% level in affecting fertility levels, they don't have the expected sign. Income is expected to influence fertility both negatively and positively thus; the negative sign of income level on fertility levels is expected because increases in income level of a female will lead to an increase in the price of mother's time and this will cause fertility levels to decline. However, for the period 1990-2000, negative influence of income on fertility levels is not found as significant at the 5% significance level.

Next, best estimation results of the pooled OLS regression models between the years 1980-2000 which consists of all the provinces in Turkey will be given in table 8.7.

Table 8.7: Estimation results of the pooled OLS regression model for 1980-2000

Dependent variables and models		TRF (1)	CWR (2)	CWR (3)	AVGCH (4)	AVGCH (5)
Independent Variables	FLPR	-.0042544 (-0.65)	-.3498838 (-0.42)	-2.305095 (-3.66)	-.0101126 (-1.31)	-.0229229 (-3.96)
	IMR	-.0179008 (-2.13)	.403561 (0.37)	-	.0170167 (1.70)	.0043597 (2.89)
	CMR	.0289177 (1.77)	-.3976666 (-0.19)	-	-.0233569 (-1.20)	-
	GPP	-.3092395 (-3.61)	-31.3835 (-2.85)	-30.84391 (-2.77)	-.701726 (-6.88)	-.7073438 (-7.03)
	CONTRA	-.0121092 (-3.24)	.096398 (0.20)	-	-.015786 (-3.55)	-.0163616 (-3.72)
	URBAN	.0120001 (2.05)	2.645098 (3.52)	-	.0164343 (2.36)	-
	POPDEN	.0003331 (1.20)	.0479715 (1.34)	.0612219 (1.70)	.0007318 (2.20)	.0007393 (2.24)
	CULTUR	-.0008581 (-0.58)	-.0226229 (-0.12)	-.0283389 (-0.15)	.0014745 (0.84)	-
	ILLITER	.0418611 (9.95)	9.275902 (17.15)	9.140864 (24.42)	.0430781 (8.59)	.0438495 (9.42)
	HSG	-.0389899 (-1.28)	2.217922 (0.57)	-	-.0255666 (-0.70)	-
	ASHARE	.0050037 (0.97)	1.79553 (2.71)	1.019122 (1.92)	.0203464 (3.32)	.0200709 (4.10)
	CONSTANT	2.793584 (3.12)	-91.87841 (-0.80)	220.9539 (5.75)	3.146571 (2.95)	4.976148 (10.36)
	R^2	0.7314	0.8502	0.8420	0.8087	0.8023
	Adjusted R^2	0.7199	0.8437	0.8383	0.8005	0.7969
	F	63.38	132.07	231.74	98.40	150.69

Note: In the parenthesis t-ratios are given.
The overall significance of the model is shown by F statistic.

In model (1), total fertility rate is taken as the fertility measure; in models (2) and (3), child woman ratio is taken as the fertility measure and in models (4) and (5), average child number is taken as the fertility measure. Both of the dependent variables, TFR, AVGCH, CWR, GRRT and CBR are considered when estimating the pooled OLS regression model and TFR, AVGCH together with CWR give the best regression models and in table 8.7 these regression models are given.

Generally, when all of the models in table 8.7 are evaluated, it is seen that female labor force participation rate has the expected negative sign in all of the models however the influence of female labor force participation is only found significant in the third and the fifth regression models. Agricultural share, illiteracy rate of woman, income variable and the population density variables have the expected signs in all the regression models. Infant mortality rate and the contraception usage variables have the expected signs positive and negative, respectively in most of the models. Surprisingly, percentage of urban share has the unexpected positive sign in all the regression models.

In the first, second and the fourth regression models all of the independent variables are regressed into the dependent variables and in order to have a more accurate model some of the independent variables are eliminated from these models and model (3) and model (5) are constituted.

In model (3) all of the coefficients are significant except the coefficient of the cultural variable and all of the coefficients have the expected signs. Population density and the percentage of agricultural share variables are significant at the 10% significance level and others are significant at the 5% significance level. Percentage of illiteracy rate of women is positively related to the fertility level and when there is a one unit decrease in illiteracy rate of women then fertility levels will decline by nine units. Agricultural share is also positively related to fertility levels. However, the effect agricultural share on fertility levels is not as important as the effect of illiteracy rate. Because when there is a one unit decrease in agricultural share then fertility levels will decline by only one unit.

Income level is also negatively related to the fertility level according to model (3). That is an increase in income level causes fertility levels to decline as expected. Population density which can be defined as the carrying capacity of the environment has a positive effect on fertility behavior at the 10% significance level. It is found that, one unit increase in population density will increase fertility levels by 0.06 units. That is because; if land is available then fertility levels can increase. Cultural variable and the fertility level are negatively related as expected. However, this relationship is not found as significant.

In model (5) all of the coefficients have the expected signs and all of them are significant at the 5% significance level. Model (5) is the best pooled OLS regression model. The effect of an increase in the contraception usage by one percent is to decrease fertility level by 1.6 percent and the effect of a decrease in the illiteracy rate of woman by one percent is to decrease fertility level by approximately 4.4 percent. From that result, it is possible to say that increases in education levels are more important than contraception usage in lowering fertility levels. Agricultural share has the expected positive relationship with fertility levels. One percentage decrease in the agricultural share of population will decrease the fertility levels by 2%. Infant mortality rate has also an effect on fertility behavior. It is found that, one percentage decrease in infant mortality levels will decrease the fertility levels by 0.4 percent.

Relationship between the income level and the fertility level is negative as expected. One reason for that is when parent's income level is high, they don't worry about their future then demand for children will be low. This is also valid in Turkey because when there is a one percentage increase in the income level, it will decrease the fertility level by 70%.

When all of the independent variables are evaluated, education level of women is found as the most significant and the strong variable. It can be said that, women with high educational levels have lower fertility levels. And when urban variable has not taken into account then as in model (5), then female labor force participation become a significant variable.

Table 8.8: Estimation results of the pooled OLS regression model for the 'others' and Provinces Prioritized in Development for 1980-2000.

Models		Others	Provinces Prioritized in Development (PPD)
Independent Variables	FLPR	-.0361869 (-6.47)	.000463 (0.05)
	IMR	-.0314057 (-5.17)	-.0029742 (-1.27)
	CMR	.0561641 (4.49)	-
	GPP	-.1141479 (-2.44)	-1.033572 (-3.90)
	CONTRA	-.0206464 (-5.91)	-.0067458 (-1.26)
	URBAN	-.0077687 (-1.97)	.0258569 (2.34)
	POPDEN	.0002124 (1.57)	-.0013367 (-0.65)
	CULTUR	-.0012096 (-0.99)	-.0011344 (-0.50)
	ILLITER	.0428248 (9.90)	.0307712 (5.19)
	HSG	-	-.1089957 (-2.06)
	ASHARE	.0106307 (3.42)	-
	CONSTANT	5.426473 (8.54)	2.896551 (2.53)
	R^2	0.8476	0.6530
	Adjusted R^2	0.8337	0.6303
	F	60.64	28.85

Note: In the parenthesis t-ratios are given.
The overall significance of the model is shown by F statistic.

'Others' category is consisted of the provinces in the west region and they are more developed provinces when compared to the provinces in the Provinces Prioritized in development category. Thus, as it is expected that independent variables will have different influences in their fertility behaviors two different regression models are estimated for each of them. Name of these provinces can be found in the Appendix B.

TFR are taken as the fertility measure in models (1) and (2) in table5. Model (1) is the pooled OLS regression model for the 'others' provinces and model (2) is the pooled OLS regression model for the Provinces Prioritized in Development.

In the regression model for the 'others' provinces, all of the variable coefficients except the infant mortality rate, population density and the cultural variable are important. Thus; it can be said that although economic, cultural and traditional theories of demographic transition are supported in the 'others' provinces, homeostatic theory of demographic transition is not supported by the econometric model constituted. Although the urbanization variable is significant at the 10% significance level, other variables are significant at the 5% significance level and only the infant mortality rate has the unexpected coefficient sign. One percentage increase in urbanization holding other variable coefficients constant will decrease total fertility rate by 0.7 percent. This is expected because since these provinces are developed provinces urbanization does not expected to change their fertility behavior much.

In all of the independent variables, income level which is indicated by GPP has the most greatest effect because when there is a one percentage increase in income level of a province in 'others' category then this increase will cause a decrease by 11.41 % in the total fertility rate of a province. Thus; in all of the theories of demographic transition, economic theories of demographic transition is the most significant theory.

Holding all other variables constant, when there is a one percentage decrease in the illiteracy rate of women together with the decrease in the agricultural share of the province then this will cause total fertility rate of the provinces in 'others' category to decrease by 5.28 %.

The greater the number of child mortality levels in the 'others' provinces, the greater the total fertility levels. According to estimation results, a one percentage increase in the contraception usage would result in a reduction in fertility levels by 2 % and increasing the female labor participation rate by 1% would result in a decline in total fertility rate by 3.61 percent.

In the regression model for the Provinces Prioritized in Development, income level, urbanization, percentage of illiterate women and percentage of high school graduates are found as significant variables. Thus; it can be said that although economic, cultural and traditional theories of demographic transition are supported in the provinces prioritized in development, homeostatic theory of demographic transition is not supported by the econometric model constituted. Increasing the percentage of high school graduation by 1% would result in a decline in total fertility rate by approximately 11% and other things being equal, the impact of a 1% decrease in the value of illiterate women percentage will decrease the total fertility rate of Provinces Prioritized in Development by 3%.

Although urbanization is significant at the 5% significance level, it doesn't have the expected negative relationship. Another important variable in the regression model for Provinces Prioritized in Development is the income variable. The effect of income level on fertility behavior of Provinces Prioritized in Development category is greater when compared to the 'others' provinces category. Although cultural variable, female labor force participation variable, population density variable and the contraception usage variable have the expected signs, they are not significant according to the estimated regression.

Infant mortality rate, income, contraception usage, cultural variable, percentage of illiteracy rate of women has the same signs in both of the equations for the 'others' provinces and the Provinces Prioritized in Development.

After investigating the best pooled OLS regression results from table 8.8 next, the results from estimating the panel data models using all of the provinces of Turkey will be given in table 8.9.

Table 8.9: Estimation results of panel data models for the 1980-2000

Models		Two-way Fixed Effect model TFR (1)	Two-way Fixed Effect model CWR (2)	Two-way Fixed Effect model GRRT (3)	Two-way Fixed Effect model CBR (4)
Independent Variables	FLPR	.0049845 (0.91)	.5916832 (1.34)	.0024267 (0.91)	.0065593 (0.20)
	IMR	.0063417 (2.28)	-	.0030393 (2.25)	.0316567 (1.94)
	CMR	-	.5150501 (1.33)	-	-
	GPP	-.3267113 (-2.28)	26.02512 (2.21)	-.1626612 (-2.43)	-2.672869 (-3.22)
	CONTRA	-	-.048098 (-0.13)	-	.0796845 (2.94)
	URBAN	-.027703 (-3.43)	-1.748519 (-2.68)	-.0136819 (-3.49)	-.1754215 (-3.68)
	POPDEN	.000428 (0.91)	.0160429 (0.42)	.0002155 (0.95)	.0023417 (0.85)
	CULTUR	-.0004765 (-0.29)	-.2187978 (-1.64)	-.0002207 (-0.27)	-.0062217 (-0.64)
	ILLITER	.0000271 (0.00)	1.918883 (3.81)	-	-
	HIGH	-.1129689 (-3.29)	-	-.0548876 (-3.32)	-.6693247 (-3.31)
	ASHARE	-.0416628 (-5.28)	-2.222089 (-3.63)	-.0204827 (-5.37)	-.2304989 (-5.00)
	CONSTANT	5.633491 (5.93)	452.0644 (5.41)	2.763624 (6.00)	37.51759 (5.79)
	R^2	0.9286	0.9844	0.9289	0.8931
	Adjusted R^2	0.8991	0.9780	0.9001	0.8490
	F overall	31.51	152.86	32.25	20.24

Note: In the parenthesis t-ratios are given.
The overall significance of the model is shown by F statistic.

Investigating the panel data models will give more accurate results when compared to the pooled OLS regression estimations because panel data models allow seeing the time-specific effects and the province-specific effects. For this purpose, panel data models are constituted and in model (1) TFR is taken as the dependent variable, in model (2) CWR is taken as the dependent variable and in models (3) and (4), GRRT and CBR are taken as the dependent variables, respectively.

The appropriate specification of panel data models is determined as the two-way fixed effect panel data models. In order to determine which specification of panel data models to use, firstly; one way fixed effect regression model with time-specific effects is estimated to see whether fixed effects model indicates important time-specific effects or not. Choosing the appropriate specification of panel data models has the same procedure no matter which dependent variable is used thus; to see how the appropriate specification of panel data models is determined will be given by using the regression model which take child woman ratio (CWR) as the dependent variable that is model (2). According to the F test statistic results of the one way fixed effect model with time specific effects which take CWR as the dependent variable F is estimated as 26.85. This F statistic tests whether all time dummy coefficients are statistically significant or not and it yields an $F = 26.85$ which is statistically significant. Thus; the null hypothesis is rejected and time specific effects are found as significant. That is although pooled OLS regression results are found as significant from table 4, F test statistic results indicate that time dummies are jointly significant so pooled OLS regression results can suffer the omission of time specific effects. Thus; it can be said that one way fixed effect regression results with time dummies should be preferred to the pooled OLS results. After that, one way random effect model including the time specific effects is estimated and in order to compare the one way fixed effect model with time specific effects which take CWR as the dependent variable with the one way random effect model with time specific effects which take CWR as the dependent variable, Hausman specification test is conducted. According to Hausman test results χ^2 is found as 174.77 at the 95% significance level that is the null hypothesis is rejected which suggest using fixed effect model rather than random effect model that is one way fixed effect model with time specific effects is preferable to one-way random effect model with time specific effects.

Finally, in order to see whether to use one-way fixed effect model with only time specific effects or to add province specific effects and to use two-way fixed effect model with both time specific and province specific effects, time variables are added to one-way fixed effect model and significance tests are done. Significance test results indicate that (F =17.84) time specific effects are important together with the province specific effects. Thus; one-way fixed effect model only with time specific effects are no longer valid and two-way fixed effect model with time specific effects and province specific effects should be estimated.

In table 8.10, the results of the F-statistics together with the Hausman test statistics are given according to different dependent variables.

Table 8.10: F test statistics and Hausman test statistics

	TFR	CBR	CWR	GRRT
The existence of fixed province - specific effect	$F_0 = 5.40 >$ $F_{190}^{66} = 1.39$	$F_0 = 4.06 >$ $F_{190}^{66} = 1.39$	$F_0 = 21.21 >$ $F_{190}^{66} = 1.39$	$F_0 = 5.46>$ $F_{190}^{66} = 1.39$
The existence of fixed time-specific effect	$F_1 = 30.88 >$ $F_{253}^{3} = 8.53$	$F_1 = 30.22 >$ $F_{253}^{3} = 8.53$	$F_1 = 26.85>$ $F_{253}^{3} = 8.53$	$F_1 = 30.70>$ $F_{253}^{3} = 8.53$
The existence of both time specific effects and province-specific effects	$F_2 = 7.52>$ $F_{187}^{70} = 1.39$	$F_2 = 7.92>$ $F_{187}^{70} = 1.39$	$F_2 = 23.38>$ $F_{187}^{70} = 1.39$	$F_2 = 7.58>$ $F_{187}^{70} = 1.39$
The existence of fixed time specific effects given province-specific effects	$F_3 = 19.92 >$ $F_{187}^{3} = 8.53$	$F_3 = 39.54 >$ $F_{187}^{3} = 8.53$	$F_3 = 9.80>$ $F_{187}^{3} = 8.53$	$F_3 = 19.78 >$ $F_{187}^{3} = 8.53$
The existence of fixed province specific effects given time specific effects	$F_4 = 5.03 >$ $F_{187}^{66} = 1.39$	$F_4 = 5.38 >$ $F_{187}^{66} = 1.39$	$F_4 = 17.98 >$ $F_{187}^{66} = 1.39$	$F_4 = 5.08 >$ $F_{187}^{66} = 1.39$
Hausman Test statistic	$\chi^2 = 259.83$	$\chi^2 = 429.94$	$\chi^2 = 174.77$	$\chi^2 = 235.45$

Note: F statistics are compared with the table statistics at the 5% significance level

In order to estimate the appropriate specification of panel data models which is determined as the two way fixed effect model with both province and time specific effects, least square dummy variable approach is used and Istanbul is taken as the base province.

In all of the models the effect of female labor force participation rate on fertility levels is estimated as positive however the expected relationship between them is negative. This unexpected result is may be due to the simultaneous nature between them which is not taken into account in estimating the fertility equation. Infant mortality rate and the urbanization have the expected signs which are positive and negative respectively in all of the models. Both of the population density variable, cultural variable, illiteracy rate variable and the high school graduate rate variable have the expected signs. Only the percentage of agricultural share in a province has the unexpected negative sign.

In model (1), urbanization, income, infant mortality rate, percentage of high school graduates and agricultural share variables are significant at the 5% significance level. Holding all other variables constant, when there is a one percentage decline in infant mortality levels then this will cause total fertility levels to decrease by 0.6 %. According to the estimation results from (1), a one percentage increase in the level of urbanization would result in a reduction in fertility levels by approximately 3% and increasing the percentage of high school graduation of woman by 1% would result in a decline in total fertility rate by 11.3 %. The greater the income levels in Turkey, the lower the fertility levels. That is according to the model (1), a 1% increase in gross provincial product will decrease the total fertility rate by 32.6 %.

As it is seen from the percentages, the most significant and the highest relation is between the income level and the fertility levels. After the effect of income level, education level has the highest effect in affecting fertility levels. Increasing the high school graduation levels is more important than increasing the illiteracy rate. Urbanization and the infant mortality rates have the lowest effect in fertility levels when compared with the effects of income and education.

In model (2), gross provincial product, illiteracy rate, urbanization and agricultural share are significant. Agricultural share variable doesn't have the expected sign. However; urbanization, gross provincial product and the illiteracy rate have the expected coefficient signs. A one unit decrease in the illiteracy rate of women is expected to decrease the child woman ratio by 1.92 units and a one unit increase in urbanization will decrease fertility by 1.74 units. It is possible to say that, urbanization and the increased illiteracy rate has close effects in opposite directions. The estimated coefficient of gross provincial product is 26.02512; the positive coefficient sign is not surprising because both of the signs are possible for the GPP variable. Holding all other variables constant, increases in income levels result with increases in the fertility levels.

All coefficients are significant except the female labor force participation, population density and the cultural variable and the expected coefficient signs are valid except agricultural share variable. Income level has again the most important effect on fertility levels; it is expected to decrease fertility levels by 16.3% when there is a 1% increase in gross provincial product. After income level, high school graduation has the highest effect on fertility levels. Increase in the percentage of high school graduation will decrease fertility levels by 5.5%. A one percentage increase in infant mortality levels is expected to decline fertility levels by 0.3% and finally, another variable which is negatively related to fertility level is the urbanization.

In model (4), crude birth rate is taken as the fertility measure. According to that model, percentage of agricultural share, percentage of high school graduates, infant mortality rates, urbanization, contraception usage and the gross provincial product are significant variables. However, percentage of agricultural share and the contraception usage variables don't have the expected coefficient signs. Holding all other variables constant, when there is a one percentage decline in infant mortality levels then this will cause crude birth rates to decrease by 3.2 %. According to the estimation results, a one percentage increase in the level of urbanization would result in a reduction in fertility levels by approximately 2%. Increasing the percentage of high school graduation of women by 1% would result in a decline in total fertility rate by approximately 67 %. The greater the income levels in Turkey, the lower the fertility levels. Again, the most important variable is the income level and the second important variable is the education level. Urbanization and infant mortality levels are again important and have close opposite effects.

After investigating the results of panel data models using all of the provinces in Turkey, panel data estimation results of 'others' provinces will be given but before giving the estimation results of 'others' provinces, F statistics results in choosing the appropriate model will be given in table 8.11. For the 'others' provinces the appropriate specification is the one-way fixed effect model with only province specific effects. In table 8.11, the results of the F-statistics together with the Hausman test statistic are given.

Table 8.11: F test statistics and Hausman test statistics for 'others' provinces

	The existence of fixed individual-specific effect	The existence of fixed time-specific effect	Hausman Test statistic
TFR	F_{11}=4.82 > $F_{79}{}^{29}$ = 1.79	F_1=5.58< $F_{105}{}^{3}$ = 8.57	χ^2=33.82
CBR	F_{22} = 3.72 > $F_{79}{}^{29}$ = 1.79	F_2=7.21< $F_{105}{}^{3}$ = 8.57	χ^2=24.99
GRRT	F_{33} = 5.14> $F_{79}{}^{29}$ = 1.79	F_3=5.50< $F_{105}{}^{3}$ = 8.57	χ^2=42.56

Note: F statistics are compared with the table statistics at the 5% significance level

As it can be seen from table 8.11, there is not any important fixed time effect however; province specific effects are significant in 'others' provinces.

Table 8.12: Estimation results of ‘others’ provinces panel data models for the 1980-2000

Models		One-way Fixed Effect model TFR (1)	One-way Fixed Effect model GRRT (2)	One-way Fixed Effect model CBR (3)
Independent Variables	FLPR	-.0029746 (-0.37)	-.0187859 (-6.99)	.0147647 (0.21)
	IMR	-.0291433 (-4.53)	.00224 (0.41)	-.2206469 (-3.87)
	CMR	.0486769 (4.07)	-.0014752 (-0.15)	.3496261 (3.30)
	GPP	-.1460724 (-1.66)	-.0569757 (-2.47)	-1.562419 (-2.00)
	CONTRA	-.0116755 (-2.85)	-.0083523 (-4.56)	-.0931246 (-2.56)
	URBAN	-.0085607 (-1.64)	-.0050588 (-2.67)	-.1094265 (-2.37)
	POPDEN	-.0002495 (-0.94)	.0001093 (1.75)	-.0026514 (-1.12)
	CULTUR	-.0019642 (-1.44)	.0000132 (0.02)	-.0157048 (-1.30)
	ILLITER	.0453021 (7.94)	.0202123 (9.43)	.2384805 (4.72)
	HIGH	.0125586 (0.51)	-.0004375 (-0.05)	.0046229 (0.02)
	ASHARE	-.0036186 (-0.38)	.0047423 (2.46)	-.0530107 (-0.63)
	CONSTANT	4.165323 (4.98)	1.960401 (5.18)	39.57889 (5.34)
	R^2	0.8692	0.7918	0.7378
	F overall	47.71	36.31	20.21

Note: In the parenthesis t-ratios are given.
The overall significance of the model is shown by F statistic.

In table 8.12 best estimation results for the ‘others’ provinces are given, in these best estimation results, TFR is taken as the dependent variable in model (1), GRRT is taken as the dependent variable in model (2) and CBR is taken as the dependent variable in model (3). In all of the models, contraception usage has the expected negative coefficient sign in the others provinces group. Moreover, in all of the models, gross provincial product and urbanization have the expected negative signs and illiteracy rate has the expected positive sign.

According to model (1) in which the TFR is the dependent variable, contraceptive usage, infant mortality rate, child mortality rate and the illiteracy rate is found to be important variables however; infant mortality rate does not have the expected coefficient sign. According to the model, when there is a one percentage increase in the contraceptive usage in the others provinces then this will decline the TFR by 1.2 %. Decreases in child mortality levels and the illiteracy rate will cause decreases in fertility levels by 4.8% and 4.5%, respectively. Thus; again the most important factor is the education then child mortality rate and contraception usage ‘in others’ provinces.

In model (2), important factors are the contraception usage, urbanization, gross provincial product, female labor force participation illiteracy rate and the percentage of agricultural share in a province. One percent decrease in illiteracy rate will cause 2.0% decrease in fertility levels. The other most important factor affecting the fertility levels is the GPP in the others category, fertility levels are negatively related to the GPP. When there is one percentage increase in contraception usage and urbanization then this joint effect will decrease fertility levels by 1.3%.

In model (3), crude birth rate is taken as the dependent variable. When crude birth rate is taken as the dependent variable then, important factors in affecting fertility levels are GPP, contraception usage, urbanization, child mortality rate and illiteracy rate. Inside all these significant variables, the most important factor is the gross provincial product of a province. Then, the second important factor is the child mortality rate and illiteracy rate decreases. Urbanization and the contraceptive usage are less significant when compared to other significant factors. One percentage decrease in illiteracy rate and child mortality rate will decrease the crude birth rate by 23.8% and 34.9%, respectively and one percentage increase in urbanization and contraception usage rate will decrease the crude birth rate by 10.9% and 9.3%, respectively.

Next, for the provinces prioritized in development the appropriate specification is the two-way fixed effect model with both time and province specific effects different from ‘others’ provinces. In table 8.13, the results of the F statistics together with the Hausman test statistic are given.

Table 8.13: F test statistics and Hausman test statistics for provinces prioritized in development

	TFR	GRRT
The existence of fixed province - specific effect	$F_0 = 4.73 > F_{100}^{36} = 1.58$	$F_{00} = 4.75 > F_{100}^{36} = 1.58$
The existence of fixed time-specific effect	$F_1 = 23.06 > F_{133}^{3} = 8.53$	$F_{11} = 23.11 > F_{133}^{3} = 8.53$
The existence of both time specific effects and province-specific effects	$F_2 = 6.67 > F_{97}^{40} = 1.58$	$F_{22} = 6.72 > F_{97}^{40} = 1.58$
The existence of fixed time specific effects given province-specific effects	$F_3 = 3.94 > F_{97}^{36} = 1.58$	$F_{33} = 3.97 > F_{97}^{36} = 1.58$
The existence of fixed province specific effects given time specific effects	$F_4 = 12.43 > F_{97}^{3} = 8.55$	$F_{44} = 12.53 > F_{97}^{3} = 8.55$
Hausman Test statistic	$\chi^2 = 42.76$	$\chi^2 = 42.84$

Note: F statistics are compared with the table statistics at the 5% significance level

As it can be seen from table 8.13, there are both fixed time effects and province specific effects in provinces prioritized in development.

In table 8.14, estimation results of panel data models for the period 1980-2000 of the provinces prioritized in development will be given.

Table 8.14: Estimation results of panel data models for the period 1980-2000 of provinces prioritized in development

Models		TFR (1)	GRRT (2)
Independent Variables	FLPR	.0026573 (0.35)	.0013744 (0.37)
	IMR	.0071064 (0.72)	.0033054 (0.69)
	CMR	.0021396 (0.12)	.0013361 (0.15)
	GPP	-.1182851 (-0.32)	-.0585526 (-0.33)
	CONTRA	.0159423 (1.73)	.0077942 (1.73)
	URBAN	-.0629478 (-3.38)	-.0307833 (-3.39)
	POPDEN	.0039308 (0.71)	.0019325 (0.71)
	CULTUR	-.0003678 (-0.14)	-.0001932 (-0.15)
	ILLITER	-.0045076 (-0.52)	-.002292 (-0.54)
	HIGH	-.1738808 (-2.40)	-.0846725 (-2.40)
	ASHARE	-.0485433 (-4.13)	-.0237465 (-4.14)
	CONSTANT	11.50382 (5.82)	5.628986 (5.85)
	R^2	0.9078	0. 9081
	Adjusted R^2	0.8602	0.8607
	F overall	19.09	19.17

According to the estimation results of provinces prioritized in development, IMR, CMR, GPP, URBAN, CULTUR, HIGH have the expected coefficient signs.

Although all of these factors have expected coefficient signs, only the percentage of high school graduation rates and urbanization are found to be important in explaining fertility level differentials in provinces prioritized in development. One percentage increase in urbanization level is expected to decrease fertility levels by approximately 6.3% and one percentage increase in high school graduation levels is expected to decrease fertility levels by 17.3%. Education is found to be the most significant factor in affecting fertility levels according to model (1) in which TFR is the dependent variable.

In model (2) gross reproduction rate is the dependent variable. When GRRT is taken as the dependent variable then effect of urbanization and high school graduation will be less when compared to their effect on total fertility rate. One percentage increase in urbanization level is expected to decrease fertility levels by approximately 3.7% and one percentage increase in high school graduation levels is expected to decrease fertility levels by 8.4%.

One of the purposes of this study is to estimate a simultaneous equation panel data model to capture the simultaneous nature between female labor force participation and fertility. However to estimate such type of models two restrictions should be satisfied. These restrictions are the endogeneity restriction and the weak instrument restriction. For this purpose in this study, by using average household number, unemployment rate of women, unemployment rate of men, marital status and different combinations of them as the instrumental variables many different panel data simultaneous equations models are estimated and it is possible to see one of them in table 8.15.

Table 8.15: EC2SLS model to estimate the fertility levels in Turkey

Dependent variable	Total Fertility Rate (TFR)	EC2SLS
Independent variables	FLPR	-.2292324 (-2.42)
	GPP	-2.178977 (-3.80)
	CONTRA	-.0846293 (-3.63)
	URBAN	-.0814053 (-1.27)
	IMR	-.022991 (-2.33)
	PDEN	.0024141 (.22)
	CULTUR	-.0099563 (-1.03)
	ILLITER	.1520358 (5.46)
	HSG	-.028609 (-0.15)
	ASHARE	.0382136 (0.95)
	CONSTANT	38.79409 (5.10)

Note: In the parenthesis t-ratios are given.

In table 8.15, to estimate the simultaneous equation panel data model, unemployment rate of women and percentage of married woman are used as the instrumental variables. However, two restrictions are not satisfied together. Sargan statistic is found as 13.18 for the model in table 8.15 and this statistic is greater than $\chi^2_1 = 3.84$ at the 5% significance level that is;

instrumental variables are endogenous however they should be exogenous. Thus; although many models are estimated, it is not possible to find an appropriate panel data simultaneous equation model by using the average household number, unemployment rate of women, and unemployment rate of men, marital status and different combinations of them in this study. A simultaneous equations panel data model might be estimated by using different set of instrumental variables.

CHAPTER 9

CONCLUSION

The gross provincial product of a province which shows the income level of a province is the most significant factor in lowering fertility levels and accelerating the demographic transition process. Income levels should be increased and economic development of the province should be provided if fertility declines are to be achieved. The greater the income levels in Turkey, the lower the fertility levels. According to the study findings the effect of income level on fertility behavior of the provinces prioritized in development is greater than the effect of income level on fertility behavior of the other provinces. Moreover, since the income level of a province and fertility behavior is found to be negatively related then increasing the income level by investing the provinces prioritized in development in Turkey will cause fertility levels to decline more than the other provinces' fertility levels. That is, according to the findings of the study, increased income levels of provinces prioritized in development which is least developed provinces of Turkey will cause greater fertility level declines when compared to the fertility level declines of other provinces due to their increased income level. According to the study findings, the effect of income level increases is much more important in the Eastern provinces of Turkey than the Western provinces of Turkey. If a province in Turkey is an economically developed province then probably fertility levels will decline because since couples earn enough money as a result of economic development then they do not need large numbers of children to earn money for the family. Thus; importance should be given to increase the gross provincial product of a province by creating new job opportunities because increasing income levels have the greatest importance in facilitating the demographic transition process earlier.

The second most important factor related to fertility level declines is the educational improvements. Findings of the study support the idea that women with high education levels have lower fertility levels. That is because educated mothers' attitudes affect the desired number of children and educated mothers want to invest in child quality rather than child quantity in Turkey. Increasing the literacy rate of women is found to be a significant factor in lowering fertility levels however; consideration should be given to increase the level of women with high school graduation because increased levels of high school graduation decrease fertility levels more than the increased levels of literacy rate of women. When there is 1% decrease in the illiteracy rate of women together with the decline in the agricultural share of the province then this will cause fertility levels of the provinces to decrease by 5.28%. The purpose should not be only to increase the literacy rate of women in Turkey. The aim should be to increase the education level of women together with increasing the literacy rate of women.

Increased urbanization levels and decreased infant mortality levels are also important factors in lowering fertility levels. However; these two factors are not as significant as the increased Gross Provincial Product of the province and the increased education levels of women in the province. For instance, when total fertility rate (TFR) is taken as the fertility measure then holding all other variables constant, one percentage decline in infant mortality levels will decrease total fertility levels by 0.6% and one percentage increase in the level of urbanization would result in a reduction in fertility levels by approximately 3%. According to the findings of the study, increased levels of urbanization is much more important than the decreased levels of infant mortality rates in lowering fertility levels to succeed demographic transition.

To summarize, the most significant relationship is between the gross provincial product of the province and the fertility level of the province. A 1% increase in gross provincial product of the province will decrease the fertility level by 32.6%. Education level has the second highest effect in fertility level declines. Increasing the high school graduation rate by 1% would result in a decline in fertility levels by 11.3%. Increasing the high school graduation rate of woman is more important than decreasing the illiteracy rate of woman. In Turkey, the effects of increased urbanization and decreased infant mortality rate are lower than the effects of gross provincial product and education on fertility levels.

Different factors are at work in different years in Turkey between the years 1980-1985, 1985-1990 and 1990-2000 related to fertility level declines.

In the 1980-1985 period, when the average number of children is taken as the dependent variable then the effects of the infant mortality rate and the high school graduation rate of women are found to be the most important factors. When the dependent variable is taken as the child women ratio in the 1980-1985 period then illiteracy rate of women and the percentage of high school graduate rate of women are found to be significant at the 5%. Holding all other inputs constant one percentage decrease in the illiteracy rate of woman will decrease the fertility levels at least by 44%.

In the 1985-1990 period, urbanization, child mortality and cultural variable gain importance when compared to the 1980-1985 period. Holding all other variables constant, one unit increase in urbanization is expected to decrease child woman ratio by three unit although a unit increase of the cultural variable is expected to decrease the child woman ratio by 0.5 unit. Female labor force participation rate has negative and insignificant influence on fertility levels for the period 1980-1985. Surprisingly, female labor force participation is significant and it has got positive effect on fertility levels rather than the expected negative effect. That is maybe due to the need to earn more money because there are more children to look after when the child woman ratio increases.

In the 1990-2000 period, urbanization and infant mortality rate are found to be statistically significant and have the expected relationship with fertility levels. Holding all other variables constant, when there is one percentage increase in urbanization level then fertility levels will decrease between the ranges 12.5% and 36.6% and also one percentage decrease in the infant mortality rate decreases the fertility rate by 6.5%. In the 1990-2000 period, one percentage decrease in infant mortality rate decreases the fertility levels by 5.3% more when compared to 1980-1985 period. During this period, female labor force participation rate has the expected negative sign however influence of it on fertility levels is not significant for the 1990-2000 period.

One of the purposes of this study is to investigate the influence of female labor force participation rate on fertility levels. The expected relationship between fertility and the female labor force participation is negative. In most of the models estimated female labor force participation rates are found to be negatively related to fertility levels however; female labor force participation rate is not a significant factor in explaining fertility levels. This result is expected because that might be due to the simultaneous nature between the fertility levels and the female labor force participation rates. That is; female labor force participation rate affects fertility levels and fertility levels affect female labor force participation rates. Both fertility and female labor force participation are influenced by the same set of variables. Thus, fertility and female labor force participation should be determined simultaneously. For that purpose, error component two stage-least square (EC2SLS) model is estimated. However, due to the instrumental variables problems it is not possible to estimate a proper panel data simultaneous equation model. A panel data simultaneous equations model might be estimated by using different sets of instrumental variables in the future studies. Moreover, according to the estimated econometric models, it is possible to say that insignificant relationship between female labor force participation and fertility is an indication of the simultaneous nature between female labor force participation rate and fertility levels.

According to the study findings, different factors are at work in different parts of Turkey related to fertility behavior of people in Turkey. That is; factors affecting fertility levels are different in the provinces prioritized in development and the "other" provinces. Although one-way fixed effect model with province specific effects is the appropriate model in the other provinces, two-way fixed effect model with both time specific effects and province specific effects is the appropriate model in the provinces prioritized in development. The fertility model for the provinces prioritized in development has the same pattern with the fertility model for Turkey. Because both time specific effects and province specific effects are also important factors in fertility behavior of Turkey as in the provinces prioritized in development.

The most significant variable is the income level in the "other" provinces. The greater the gross provincial product of a province the lower the fertility levels of the province. The second most important factors are the declines of the child mortality rate and the declines of the illiteracy rate of women in the other provinces. Decreases in child mortality rate and the illiteracy rate of women will cause decreases in fertility levels by 4.8% and 4.5%, respectively. Urbanization and contraceptive usage are less significant in the "other" provinces when compared to the other significant factors affecting fertility level declines.

The most significant variable is the education in the provinces prioritized in development. Increases in the percentage of high school graduation rate of women and urbanization are found to be significant in explaining fertility level declines in provinces prioritized in development. 1% increase in urbanization level will decrease fertility levels by approximately 6.3% and 1% increase in high school graduation rate of women will decrease fertility levels by 17.3%.

Modernization brings knowledge about contraception usage. Couples are not forced to use any kind of contraceptive in Turkey, they are completely free in using the contraceptives or not. However, the contraception usage information is available for free to the women who want to utilize them. As a result of modernization, couples who wanted to control their fertility but do not know how to do this will have knowledge about contraception usage. According to the study results, although contraception usage is a significant factor in the "other" provinces; it is not a significant factor in provinces prioritized in development. One percentage increase in contraception usage will decrease fertility levels by 1.2% in the "other" provinces. The reason for the insignificancy of contraception usage in the provinces prioritized in development may be due the husbands' behavior. Most husbands insist on fathering a son, especially in the East part of Turkey which are mostly the provinces prioritized in development.

Important aspects of modern life which comes with the increased urbanization and declines in the proportion of nonagricultural production in Turkey increase the desire for small families rather than larger families. Thus; urbanization variable is found to be significant for both the “other” provinces and the provinces prioritized in development. Although one percentage increase in urbanization will decrease fertility levels by 0.8% in the “other” provinces; it will decline fertility levels by 6.3% in the provinces prioritized in development. That is; increased urbanization is more important in the less developed provinces prioritized in development than the more developed “other” provinces.

To sum up, urbanization is found to be very important in the 1985-1990 period and it continued to preserve its significance later on by a smaller amount. Infant mortality rates are found to be statistically important in the 1980-1985 and 1990-2000 periods both. Female labor force participation is only found to be significant in the 1985-1990 period. In different periods, variables have different effects on fertility behavior in Turkey that is; one percentage decrease in infant mortality rate decreases the fertility levels by 5.3 percent more in the 1990-2000 period when compared to the 1980-1985 period.

According to the findings of the study, although economic, cultural and traditional theories of demographic transition are supported in the “other” provinces and the provinces prioritized in development, homeostatic theory of demographic transition is not supported by the econometric models constituted in the study.

Study results supported the statement that took part in the Tusiad 1999 report which attributed the rapid decline in fertility levels in recent years to the social and economic conditions which have driven couples to have fewer children rather then the actions and policies of the state. As an indication of this support the gross provincial product of a province and educational improvements are the most important factors related to fertility level declines rather than the contraception usage which is a factor related to the implementation of family planning programs in Turkey.

As a result of modernization or urban industrialism, health conditions have improved in Turkey and this cause infant mortality levels to decline considerably. Decreasing mortality levels cause fertility levels to decline in Turkey because more children survive as a result of improved health conditions and parents do not need to have more children to guarantee the desired number of survived children. Although this is the case, infant mortality levels don't affect fertility levels as much as other independent variables. However; infant mortality levels are still important factors in lowering fertility levels so precautions should be taken to lower infant mortality levels in Turkey.

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APPENDICES

Appendix A: Variable Definitions

Dependent variables:

TFR: Total fertility rate

CBR: Crude birth rate

AVGCH: Average number of children per woman at "45-49" age group

CWR: Child-woman ratio

GRRT: Gross reproduction rate

Independent variables:

GPP: Gross provincial product of a province that is used as the measure of the level of development of a province.

IMR: Infant mortality rate of a province.

CMR: Child mortality rate of a province.

URBAN: Percentage of urban share of population of a province.

ILLITER: The percentage of illiteracy rate of women.

HSG: Percentage of high school graduates in a province.

FLPR: Female labor force participation rate.

UNEMP_M: Unemployment rate of men.

UNEMP_F: Unemployment rate of female.

A_SHARE: Percentage of provincial employment in agricultural sector.

CULTUR: Percentage of public library users in a province.

POPDEN: Population density of a province.

AVGHSHLD: Average size of households:

CONTRA: Percentage of current contraceptive users in a province.

SINGLE: Percentage of single women in a province.

MARRIED: Percentage of married women in a province.

WIDOWED: Percentage of widowed women in a province.

DIVORCED: Percentage of divorced women in a province.

Appendix B: List of Provinces Prioritized in Development and Other Provinces

Source: http://www.dpt.gov.tr/bgyu/koy/koy2003.html, 2003 [2]

List of Provinces Prioritized in Development:

Adıyaman, Ağrı, Aksaray, Amasya, Ardahan, Artvin, Bartın, Batman, Bayburt, Bingöl, Bitlis, Çanakkale (Bozcaada ve Gökçeada İlçeleri), Çankırı, Çorum, Diyarbakır, Elazığ, Erzincan, Erzurum, Giresun, Gümüşhane, Hakkari, Iğdır, Kahramanmaraş, Karabük, Karaman, Kars, Kastamonu, Kırıkkale, Kırşehir, Kilis, Malatya, Mardin, Muş, Nevşehir, Niğde, Ordu, Osmaniye, Rize, Samsun, Siirt, Sinop, Sivas, Şanlıurfa, Şırnak, Tokat, Trabzon,Tunceli,Van,Yozgat,Zonguldak.

List of Other Provinces:

Adana, Afyon, Ankara, Antalya, Aydın, Balıkesir, Bilecik, Bolu, Burdur, Bursa, Çanakkale, Denizli, Edirne, Eskişehir, Gaziantep, Hatay, Isparta, Içel, İstanbul, İzmir, Kayseri, Kırklareli, Kocaeli, Konya, Kütahya, Manisa, Muğla, Sakarya, Tekirdağ, Uşak.

[2] Bold area that is the eastern part of Turkey shows the Provinces Prioritized in development at the map. Colour light area shows that is the western part of Turkey shows the other provinces.