CHAPTER I
INTRODUCTION

Mortality tables, the other name is life tables, are descriptive tables that determined how many person will die and how many persons will live between two ages or age groups from the results of survival or death statistics of any population (Turkish Life Insurance Regulation, 1996). The most significant application field for the mortality tables is the life insurances. The insurance premiums can only be calculated with this essential element; however, in Turkey, mortality tables which don't represent the reality of Turkey have been used both in insurance sector and in social security institutions. Hence, it is evident that the insurance premiums calculated by the foreign tables will be different. This situation shows that the insurance company or the insured person might suffer unfairly. Therefore, the formation of the mortality tables for Turkey, which represent the death rate of the country, is needed in order to identify the current financial situation of the insurance firm and to calculate the insurance premiums correctly.

In life insurances, it is not easy to calculate the cost of the payments or guarantees for the insured person, as calculation cost of other goods, because it is not known whether the risk that is the subject of the insurance would be realized or not and when it would happen. Therefore, the cost estimates of the insurance firms depend on the realization of some biometric events such as death or disablement (Özsoy, 1970). The insurer takes over a specific risk in return for the premium he takes from the insured. In such a circumstance, the insurance premiums should have a value representing the reality in order for both sides to face no monetary loss. Hence, the mortality tables can be defined as the most vital element in summing up the premiums representing the reality.

Although the mortality tables are such an important element in life insurance sector, today there is still no mortality table in insurance sector, prepared in accordance with the Turkish mortality conditions. As known, the mortality tables of

the developed countries dated back to 300 years. First of all, John Graunt, an English statistician, prepared the first known mortality table with his work "Natural and Political Observations Made upon the Bills of Mortality" in 1662. Then, in 1693, Edmond Halley formed a mortality table based on the birth and death records of the city of Breslau and with his work he contributed so much to the science of actuary. The second life table that was based on population and death data classified according to age and prepared scientifically was formed by Joshua Milne in 1815. This table is based on the death observations made between 1779 and 1787 in the two regions of the city of Carlisle in England. These tables which were firstly prepared for the Scandinavian countries and for Europe, in particular, have recently been formed intending for many countries and continents (Nomer and Yunak, 2000).

Yet in Turkey, these kinds of studies have remained limited. Studies with suitable findings to form mortality tables in Turkey started in 1950s. Researchers such as Wiesler (1951), Gürtan (1966), Alpay (1969), Oral (1969), Özsoy (1970), Öcal (1974), Demirci (1987), Hancıoğlu (1991), Duransoy (1993), Hoşgör (1992, 1997), Türkyılmaz (1998, 2003), Toros (2000), Demirbüken (2001) and Coşkun (2002) have made important studies related to the subject. Despite all these studies, the authorities of Underscretariat of Turkish Treasury, General Directorate of Insurance state that the insurance firms are not allowed to use the life tables formed for Turkey since they do not withstand data belonged to sufficient period of time and as they are usually calculated with indirect methods (Ataman, 2002). Therefore, we see that this deficiency in the insurance sector is filled with mortality tables of foreign origin. However, these tables are far from representing Turkey since they don't involve the data belonging to Turkish people.

Four different types of mortality tables are used in Turkey by the insurance companies today. These tables are Commissioners Standard Ordinary (CSO) 1980, Commissioners Standard Ordinary (CSO) 1953 – 1958 General German Mortality Table (ADST) 1949 – 1951 and Swiss Male Mortality Table (SM) 1948 – 1953. As

seen, three of these tables present the mortality rate of the years of 1950s. Although more than fifty years passed, we see that these tables are still being used in Turkey.

The most important purpose of this thesis study to be prepared is to form a mortality table that can be used in life insurance sector and is prepared by totally using the mortality data of Turkey. The death rates used for the preparation of this table were calculated from the data in 2003 Turkey Demographic and Health Survey (TDHS – 2003) which was made by Hacettepe University Institute of Population Studies. As the adult mortality couldn't be calculated directly in TDHS – 2003 survey, infant mortality rate and under – 5 mortality rates were used.

First of all, according to the infant mortality rates of five – year period (1998 – 2003) calculated for both genders in 2003 Turkey Demographic and Health Survey, life tables will be established from Coale and Demeny's West Model Life Tables by using the interpolation formula. Then, preparing a second mortality table has been thought to be suitable in order to make a comparison with the previously constructed mortality table. Therefore, the method of orphanhood which gives results regarding the adult mortality indirectly will be used. The levels of adult mortality that will be calculated with orphanhood method will help to construct a second mortality table together with the values of early age mortality rates achieved from TDHS – 2003.

After regulating the mortality tables for Turkey, the commutation tables that are the fundamental element in calculating the insurance premiums, will be generated. These tables are formed by adding a technical interest on the mortality tables and they are used in calculating the life insurance premiums. Lastly, by making use of the death rates of the Turkish mortality tables, life insurances that are made against the probability of living and dying with a defined interest factor, and current tables will be compared in terms of premiums.

This thesis is thought to have a positive contribution to the current literature in terms of generating a reliable mortality table that can be used by the life insurance companies.

This thesis consists of eight chapters. In the first chapter, that is the introduction chapter, some general information is given regarding the subject. The second chapter includes information on data sources and methodology. In the third chapter, information about living, dying and endowment life insurances is given. The history of mortality tables in Turkey and the mortality tables used by insurance companies are presented in the fourth chapter. In the fifth chapter the implementation of the two methods used in the preparation of the mortality tables is done. The commutation tables that are forms by the integration of interest factor in the mortality tables are generated in the sixth chapter and in the seven chapters the mortality tables used by the insurance companies and the mortality tables of Turkey prepared for both genders are compared. And in the last chapter is included conclusion.

CHAPTER II
DATA SOURCES AND METHODOLOGY

A. DATA SOURCES

1. Mortality Data in Turkey

Unsatisfactory deaths and births records are one of the main problems in Turkey. Because of this reason, reliable births and deaths statistics can not be complied and reliable information about mortality levels can not be produced (Aydın, 2003). The recording of deaths is important either persons or societies. The registration of deaths is obligatory which document the end of life and liabilities /rights. Moreover, it is important to start rights of inheritors. Today, this information is used to calculate the life insurance or social insurance claims, to adjudicate the property ownership and inheritance claims and to make several surveys related to death or human health (Demirbüken, 2001). In Turkey, mortality data can be taken from the several different sources. These sources are vital registration data (MERNIS), State Institute of Statistics' death statistics, burial registrations, The Ministry of Health's records, censuses and surveys, which provide information as a mortality data in Turkey.

The MERNIS (Centralized Population Administration System) Project is the first important mortality source, which is part of the vital registration system. The MERNIS run by the General Directorate of Population and Citizenship Affairs (GDPCA) of the Ministry of Interior, which is responsible for keeping the registration of population in Turkey via the District Directorates of Population (DDP). The DDP keep the vital events and transfer to the GDPCA in Ankara. In urban place and settlements where health institutions and health centers, health personnel are responsible for reporting deaths to the DDP in 10 days of the occurrence of the death. In rural areas muhtar is responsible for reporting of deaths to the DDP. Hospitals, health divisions of the municipalities, municipal medical officers

and muhtars prepare the MERNIS Death Minutes with three copies. One copy is kept in the issued place. Other two copies are given to relative of the deceased. Relative of the deceased apply to the relevant DDP. The DDP deletes the deceased from the family ledgers. The DDP takes a second copy of death minutes and send third copy to GDPCA.

The other two important mortality sources are State Institute of Statistics' (SIS) death statistics and burial registrations. The death statistics are published every year using the second section of the Death Form by the SIS. The Death Form constitutes from three detachable sections. First section of the death form, the counterfoil, is filled by the responsible organization where the death form has been prepared. The second section of the death form, the SIS death statistics form, is sent to the SIS central bureau via the Health Directorates in province centers and Health Clinics in district centers in the first week of the following month. SIS statistics provide mortality information about province and districts centers. Thus, complete information about mortality is not available for all country. The third section of the death form which goes to the cemetery bureau in order to get permission to bury deceased (Demirbüken, 2001). The third section of the death form as a burial permit is sent to the Chief of the Archives of the Cemetery. The Chief of the Archives of the Cemetery registers information of the deceased in the Death Ledger Book and enter to computer and transfer the records to the Department of the Data Processing of the Main Municipality of Ankara City. And finally, storing the all documents is made.

The other mortality source is the population censuses. In 1975, 1980, 1985, 1990 and 2000 censuses have provided information about infant mortality. But in 2000 census, the question "Was there a member of this household who died in the last year (from 22th October 1999 till now)?" is also about general mortality in that family that was the first time asked to household head. But the answers of these questions have not been published yet.

On the other hand, The Ministry of Health's record has also provided information about mortality. This information is taken from the first part of Death Form, which is called a counterfoil. Hospitals, health clinics and municipalities send these forms to Health Directorates in province centers. After evaluation of these forms, they are sent to The Ministry of Health.

The last mortality data has taken from the surveys. In Turkey, first demographic survey has been applied by The School of Public Health for the years 1965-1966. Later, The School of Public Health applied the second national survey for the years 1966-67 as "Turkey Population Survey". In 1974-75 and 1989, The State Institute of Statistics has prepared "Turkey Population Survey". Besides, Hacettepe University Institute of Population Studies managed eight surveys in 1968, 1973, 1978, 1983, 1988, 1993, 1998 and 2003.

Consequently, taking reliable mortality data related to Turkey includes several problems. One of the problems is different registration procedures in urban and rural areas. Muhtar is responsible for reporting deaths to the DDP in rural areas if medical doctors or medical personnel are not present there. Owing to fact that, different person can be responsible for reporting deaths in rural areas. Additionally, muhtars may not have well education level, so reliable information can not take from the most of rural areas. The other problem is that the MERNIS based on the family ledgers system. Migration movements do not affect the MERNIS records if persons do not change their family ledgers. Therefore, although any person lives permanently in one district, he/she can appear in another district as a family ledger (Wunsch and Hancıoğlu, 1995). On the other hand, in spite of the fact that death records provided by health personnel or muhtar are not filled out, several people still appear as alive who died several decades ago. The other mortality data source is national population census. Although the last national population census, 2000 General Population Census, has mortality question for adults, the results of this question have not published yet. Therefore, it can be seemed as a problem to take information about mortality data.

Therefore, in this thesis, 2003 Turkish Demographic and Health Survey will be used as a main data and 1998 Turkish Demographic and Health Survey will be used as a supplementary data to make mortality estimations and to construct mortality and commutation tables.

2. Main Data Source: 2003 Turkish Demographic and Health Survey

The 2003 Turkey Demographic and Health Survey (TDHS-2003) will be used as an important source in this study. TDHS-2003 is a national representative sample survey which is designed to provide information about infant and child mortality, levels and trends on fertility, family planning and maternal and child health. The results of the survey are presented as an urban and rural residence at the national level for the five regions in the country. Besides, the TDHS-2003 sample also provides information about 12 geographical regions (NUTS1) to analyze and compare with European Country within the context of Turkey's move to join the European Union.

The TDHS-2003 is the latest national level population and health surveys that have been executed by Hacettepe University Institute of Population Studies (HUIPS). The primary objective of the TDHS-2003 is to provide information about socioeconomic characteristics of households and women, fertility, mortality, marriage patterns, family planning, maternal and child health, nutritional status of women and children, and reproductive health. Detailed information is provided from a sample of ever-married women in reproductive ages (15-49). The TDHS-2003 was designed to produce information in the field of demography and health which can not collect from other sources. Especially it has been useful to obtain direct and indirect factors that determine levels and trends infant and childhood mortality.

Two main questionnaires were used in the TDHS-2003. These are the Household Questionnaire and the Individual Questionnaire for ever-married women in reproductive ages. The contents of the questionnaires were based on the

International MEASURE/DHS+ survey project model questionnaires and previous Turkish population and health surveys questionnaire. One of the main objectives during the preparing of questionnaire is to provide comparability with the TDHS-1998 and TDHS-1993 surveys' findings (HUIPS, 2004).

The Household Questionnaire was applied to enumerate all members and visitors of selected household to collect information about socio-economic level of the households. The Household Questionnaire was constituted from four parts. In the first part of the household questionnaire, the basic information such as age, sex, marital status, educational and working status and relationship to the head of household collected for each person in the household. The objective of the first part of the Household Questionnaire is to collect the information about socio-economic level of the households and to identify suitable women for the Individual Questionnaire. In the second part of the household questionnaire was related to welfare of old age person in the households which are related to income, health insurance and physical capabilities. In the third part, questions were included about dwelling unit and ownership of variety consumer goods. Beside in this part, İstanbul Metropolitan Module was contained which includes questions about availability of electricity, water and natural gas. In the final part of the Household Questionnaire question were included about the storage of the salt to cooking at home. So, the salt iodization tests were applied among the households (HUIPS, 2004).

On the other hand, the Individual Questionnaire was related to ever-married women in reproductive ages. The Individual Questionnaire covered information about reproductive history, marriage, contraceptive methods, abortions and causes, maternal health care and breastfeeding, immunization and acute respiratory infections, fertility preferences, husband's characteristics, women work and status, knowledge of sexually transmitted diseases and AIDS, maternal and child anthropometry.

The sample design and sample size of the TDHS-2003 make possible to analyze for whole Turkey, urban and rural areas and five demographic regions of the country which are West, East, Central, South and North regions. The TDHS-2003 sample also provides information about 12 geographical regions (NUTS1) for a limited number of variables which were adopted at the second half of the year 2002 to analyze and compare with European Country within the context of Turkey's move to join the European Union (HUIPS, 2004).

In the selection of the TDHS-2003 sample, the approach of a weighted, multistage, stratified cluster sampling method was used. The distribution of the target sample was based on the results of the 2000 Turkey General Population Census. The first information on all settlements in Turkey was constituted from the 2000 General Population Census. The results of the 2000 General Population Census has provided a computerized list of all settlements, their populations and the number of households (provincial and district centers, sub-districts and villages). In the sampling frame, settlements were divided into two groups. The first group includes settlements with populations more than 10,000 as "urban", and the second includes settlements with populations less than 10,000 as "rural". On the other hand, structure schedule data was collected from State Institute of Statistics' 2000 structure schedule data for municipality place. This data was also updated in the year of 2002 (HUIPS, 2004).

Using the updated household lists, a fixed number of households were selected in each cluster by systematic random sampling method (25 in settlements over 10,000, 15 in settlement less than 10,000, and 12 in the İstanbul Metropolitan clusters). All ever-married women at ages 15-49 who generally live in the selected households and/or present in the household on the night before the interview were included for the Individual Questionnaire (HUIPS, 2004).

The target size of the TDHS-2003 was set as 13,160 households which is 30 percent larger than of the TDHS-1998. This increase mainly related with the designation of new strata. İstanbul and Southeast Anatolia region and adjustment of

optimum allocation among the NUTS 1 regions. The TDHS-2003 data collecting was carried out by 14 teams. Each team was consisted of 3-5 female interviewers, one male measurer, one field editor and a team supervisor. 13,049 households were selected for the TDHS-2003. At the time of listing phase of the survey, 11,659 households were considered occupied and, thus available for interview. 93 percent (10,836 households) of the 11,659 households' interview was successfully completed. 8,447 women were identified as eligible for the individual interview (they were ever-married, 15-49 ages and present in the household on the night before the interview). 8,075 of them were completed successfully interviewed (the other women could not find at home although repeated visits) (HUIPS, 2004).

3. Secondary Data Source: 1998 Turkish Demographic and Health Survey

1998 Turkey Demographic and Health Survey (TDHS-1998) will be used as a secondary source in this study. TDHS-1998 shows similarities with TDHS-2003. The results of the survey are presented as an urban and rural residence at the national level for the five regions. But 12 geographical regions (NUTS 1) were not included in this survey.

Four questionnaires were used in the TDHS-1998. These were the Household Questionnaires, Ever-Married Women Questionnaires, Never-Married Women Questionnaires and Husband Questionnaires. In the selection of the TDHS-1998 sample, the approach of a weighted, multistage, stratified cluster sampling method was used. The target size of the TDHS-1998 was set as 9,970 households and 8,596 of them were applied in the survey. The interview was completed successfully with 94 percent of 8,596 households. 9,468 women were determined to interviewing. 8,576 of women were identified as eligible. In the half of the selected households, husbands of currently married eligible women who were present in the household on the nigh before the interview or who usually lived in that particular household were eligible for the husband survey. (HUIPS, 1999).

B. DATA QUALITY

The important indicator to determine the data quality from the surveys is missing on key variable. Among births in the 15 year preceding the TDHS-2003, 4 percent are missing information on year of birth. Information on age at death is missing for just 1 percent of these births. Marriage age or date was not taken from less than 1 percent of ever-married women. Height or weight measurements are missing for nearly 8 percent of the children under age 5. Compared with data from TDHS-1998, these figures show that the missing information is very limited in the survey (HUIPS, 2004).

One of the most powerful interviewing tools is the birth history for collecting information on births and deaths. Complete information on birth dates were collected almost all births occurring since 2001 and nearly 94 percent of births during 1998-2000. On the other hand it can be said that the complete information on birth dates were collected accurately from the TDHS-1998 data. The TDHS-2003 and the TDHS-1998 data appear to be good quality with respect to the completeness of the information collected on dates of birth and ages at death. A detail inspection of the birth history data from the TDHS-2003 and the TDHS-1998 point out age heaping at death was also minimal. One of the commonly observed failures of the sampling surveys is age heaping at death to 6, 12, 18 and 24 months. Therefore, infant deaths may record as a child dates because of the respondents heaping the age at death to 12 months or interviewers recording ages of death as “1 year”. This situation causes calculated bias rates. These biases are not seen much more during 10 years before the 2003 survey (HUIPS, 2004).

The other evaluation related to reliability of birth history is calculation of sex ratios at birth for all five births. This ratio is expected to fluctuate around 105 male births per 100 female births. The overall sex ratio is calculated 104.4 for all births in the birth history for the TDHS-2003 and 105.6 for the TDHS-1998. On the other hand, sex ratio of death for age 0-1 interval is 1.08 for ten years preceding the

TDHS-2003. This shows that male mortality rate is higher than female mortality rate for infant mortality, which is expected situation for early age mortality. When investigating the sampling errors of TDHS-2003 and 1998, infant mortality rate (IMR) during 4 years before the survey is calculated 28,767 for the TDHS-2003 and 42.702 for the TDHS-1998. Standard error of the IMR is calculated 2.914 for the TDHS-2003 and its confidence limits are calculated between 22.938 and 34,596 which refer 11.658 years interval in 95 percent confidence limit. Standard error of the IMR is calculated 4.659 for the TDHS-1998 and its confidence limits are calculated between 33.384 and 52.020. This numeral refers to 18,636 years interval which is larger interval than the TDHS-2003 in 95 percent confidence limit.

C. METHODOLOGY

1. Infant Mortality Rate Calculation

Infant mortality rate describes the probability of dying in the first year of life. Infant mortality rates are important indicator to evaluate ongoing health program and formulating future policies. Levels of infant and child mortality are not only indicators related to health conditions but also important indicators of level of development of societies. Infant mortality rates and under-5 mortality rates are used widespread to evaluate the level of development which are included the Millennium Development Goals. The infant mortality rates have another significant role in Turkey in addition to determining of social development and health conditions. Infant and child mortality have an important advantage because of the lack of reliable data about adult mortality in Turkey. Therefore, infant and child mortality data are the basic factors to calculate adult mortality with indirect estimations.

Although, infant mortality rate is identified as a “rate”, it is actually described as a “ratio”. Because numerator does not occur the exposure of risk in denominator. Some of deaths under age 1 may be occurred during the previous year, while some of births may die in the next year (Newell, 1994). Shryock and Siegel (1973) call this

the “conventional” IMR to distinguish it from other measures which more precisely relate the births and deaths. If date of birth is asked on death registrations forms rather than just age, the year of birth of those dying is available, so a “true” IMR can be calculated. True IMR can be identified the probability of dying during the first year of life (Newell, 1994).

When investigating period of mortality, for the late 1930’s, various indicator of mortality can not be estimated clearly due to the lack of variables. The mortality indices can be estimated with greater confidence after 1950’s. Shorter and Macura (1982) has developed an indirect method of estimating trends that uses the birth-survival and pregnancy histories based on material of national sample surveys. These birth survival histories collected by the 1968 Hacettepe Survey. Later, Turkish Fertility Survey and periodic Turkey Population and Health Surveys have given important results related to infant mortality rate.

Table I.1 Infant Mortality Rate Trend in Turkey According to Source of the Data

Date	IMR	Source of Data	Estimation
1950-1955	233	1968 Hacettepe Survey, Macura's Survival Estimation	Indirect Estimation
1955-1960	203	1968 Hacettepe Survey, Macura's Survival Estimation	Indirect Estimation
1960-1965	176	1968 Hacettepe Survey, Macura's Survival Estimation	Indirect Estimation
1965-1970	153	Turkish Demographic Survey, School of Public Health	Direct Estimation
1972-1977	134	Turkish Fertility Survey 1978	Direct Estimation
1979-1982	95.31	Turkish Population and Health Survey,1983	Direct Estimation
1983-1988	77.72	Turkish Population and Health Survey,1988	Direct Estimation
1988-1993	52.6	Turkey Demographic and Health Survey,1993	Direct Estimation
1994-1998	42.7	Turkey Demographic and Health Survey,1998	Direct Estimation
1999-2003	29	Turkey Demographic and Health Survey,2003	Direct Estimation

Although infant mortality rate has gradually declined, it is still at a very high level compared to the level of general mortality (Tunçbilek, 1988). Table 1. shows the trend of infant mortality rates according to source of data.

In 1998 and 2003 TDHS, infant mortality rate has calculated as a true infant mortality rate. The estimated infant mortality rate is 29 per 1,000 live births between the period of 1998 and 2003 according to the TDHS-2003. This period prefers five years time interval. 59 percent of infant deaths occurred during the neonatal period (first four week after birth). But when investigating the infant mortality rate according to each gender, infant mortality rates are higher than 29 per thousand. Because time period of male and female infant mortality rate refer 10 years time period to increase the number of respondents which are 39 per thousand for male, 36 per thousand for female. But in this study, it is intended to use five years period between 1998 and 2003 year in order to take more close current results. Thus, it is needed five years data for each gender instead of ten years data for each gender. In this point of view, infant mortality rates have calculated 28.8 per thousand for female and 30.1 per thousand for male for 5 years proceeding from the TDHS-2003 survey.

2. Orphanhood Method

Although there have been to increase at population studies in recent years, the requirement of basic data for such studies are not available or too deficient in many countries. The inadequacy of registration statistics and difficulty of collecting accurate data directly causes that indirect methods of analysis, particularly those based on orphanhood, represent an important source of adult mortality estimates in developing countries (Timæus, 1990). Especially the lacks of accurate vital registration and censuses have led demographers to project indirect methods to estimate basic demographic parameters from incomplete or inaccurate data. Although, these methods can not be considered as substitutes for the mortality measures obtained from complete and accurate vital registration system, in the

absence of such data, these would provide reasonable basis for demographic analyses and other purposes (Sivamurthy and Seetharam, 1980).

The plausible information about orphanhood for the measurement of adult mortality was first explored by Henry in 1960. He developed the ideas of Lotka, who had considered the reverse problem, estimating orphanhood from data on mortality (Timæus, 1990). He argued that if the information on infant and child mortality can be obtained by asking the mothers about the survival of their children, why can not be done the same for adult mortality by asking the children about the survival of their parents? (Blacker, 1977). Henry's idea was taken up by Brass, who established an equation relating the female probability of surviving from age 25 to age 25 + n to proportions of respondent in two contiguous five year age groups whose mother was still alive at the time of the interview (United Nations, 1983). Final version of Brass's methods is published by Brass and Hill (1973). Later, Hill and Blacker, working under the Brass' guidance, developed an equation to estimate adult male mortality from proportions of persons with fathers alive.

Orphanhood approach has obvious advantages. The questions, "Is your mother alive?" and "Is your father alive?" are simple and easy to answer. These questions does not include date of the death or reference period and can be answered by outspokenly "Yes" or "No"; they takes little place on the questionnaires and the results are simple to code, punch and tabulate. Furthermore, every additional question inserted in survey has an additional cost, but the cost of the orphanhood questions are minimal (Blacker, 1977). These questions applied in the survey questionnaire of African countries in 1960's with the opinion of Brass and Hill. The quality of the answers for these questions would be better than the direct questions about the deaths 12 months preceding the survey.

For orphanhood method, it is needed the mean age at maternity for females and mean age at conception for males and the proportion of not orphaned respondent by five year age groups form males and females. Estimates of adult mortality taken

from close relatives that represent averages of the mortality experienced during the relatives were exposed to the risk of dying (United Nations, 1983). Respondents' mothers must have been alive at the birth of the respondents. Thus, the period of exposure to die is the age of respondent (Coşkun, 2002). But there is a difference for the paternal orphanhood. Although, the risk of dying for mothers has started with the birth of their child, the risk of dying for fathers has started with conception of the child. For this reason, approximately nine moths should be incorporated in calculations.

Brass established an equation relating to the female probability of surviving from age 25 to 25+n. This equation has the form:

$$l_{(25+n)} / l_{(25)} = W_{(n)} \cdot S_{(n-5)} + (1-W_{(n)}) \cdot S_{(n)}$$

Where, S(n) is the proportion of respondents aged from n to n+4 with mother alive. W(n) is a weighting factor which is employed to make allowance for typical age patterns of fertility and mortality. Brass and Hill (1973) are calculated the set of W(n) values from the African standard mortality pattern and model fertility schedules of fixed shape but variable age locations. The weighting factor depends on value of n and the mean age of childbearing.

Later, Hill and Trussell (1977) have performed another estimation by using regression coefficients. This equation has the form:

$$l_{(25+n)} / l_{(25)} = a_{(n)} + b_{(n)} \cdot M + c_{(n)} \cdot S_{(n-5)}$$

a(n), b(n) and c(n) are the regression coefficient which is calculated with four different Coale-Demeny mortality patterns as standards. These regression coefficients were calculated only for females. Thus, estimating of adult mortality is not available with this equation for males (Coşkun, 2002).

In case of calculating adult male mortality, the value is replaced by the values 32.5 or 37.5. Because the men are usually older than women at the birth of their children. So the survivorship probabilities are estimated from the following two formulas:

$$l_{(35+n)} / l_{(32,5)} = W_{(n)} \,.\, S_{(n-5)} + (1-W_{(n)}) \,.\, S_{(n)}$$

$$l_{(40+n)} / l_{(37,5)} = W_{(n)} \,.\, S_{(n-5)} + (1-W_{(n)}) \,.\, S_{(n)}$$

If the mean age of paternity is less than 36, the first equation is used; on the other hand if the mean age is greater than 36, the second equation is used.

On the other hand, the reference date of the mortality level is calculated. The formula is changed separately for females and males. For females, the formula is:

$$t_{(n)} = n\,(1.0 - u_{(n)}) / 2.0$$

where,

$$u_{(n)} = 0.3333.\ln({}_{10}S_{(n-5)}) + Z_{(M+n)} + 0.0037.(27-M)$$

The value of $Z_{(M+n)}$ is provided by interpolation by using value of the standards function table.

For males, the formula is:

$$t_{(n)} = (n + 0.75) \,.\, (1.0 - u_{(n)}) / 2.0$$

Where,

$$u_{(n)} = 0.3333.\ln({}_{10}S_{(n-5)}) + Z_{(M+n)} + 0.0037.(27-M+0.75)$$

In this case ${}_{10}S_{(n-5)}$ represents the proportion of respondents in the age group from n-5 to n+4 with mother alive; on the other hand, n is the mid-point of the 10 year age group being considered.

On the other hand, the Orphanhood method also includes some potential sources of bias:

- Mortality and fertility data stay under the real values. Because, if there are more than one children in the house, reporting will be done overestimate. On the other hand, if there are not any surviving children, reporting will not be realized in that house.

- Mortality and fertility levels are considered constant in the past and the structure of migration is considered to reflect that structure of population.

- Adoption effect can create a serious bias. For example, if children do not know or remember the real parents, the answer of the respondent will create a bias.

Additionally, one of the problems faced when estimating adult survivorship probabilities from data on the survival of parents is reference time. The estimates refer to distant point in the past. According to Zlotnik and Hill (1981), if information of orphanhood has been collected by two censuses or surveys between the five or ten years periods, the hypothetical intersurvey cohort of respondents can be calculated. Shortly, “hypothetical cohort” method is occurred to estimate the adult mortality between the censuses or surveys. This method has additionally advantages than the

Brass' method. Firstly time reference time of the estimates stay between two surveys. The other advantage of synthetic cohorts is that deaths are reported fully during the intersurvey and omission of more distant deaths will have no effect on the result. Therefore, synthetic cohort data on the survival of the parents are less vulnerable than lifetime data to the adoption effect that is underreporting of orphanhood by respondents (Timæus, 1991).

The proportions of not orphaned among a hypothetical intersurvey cohort of respondents are calculated from this formula:

$$S_{(n,s)} = S_{(n,2)} \qquad \text{for } n < T;$$

$$S_{(n,s)} = S_{(n-T,s)} \cdot S_{(n,2)} \; / \; S_{(n-T,1)} \qquad \text{for } n \geq T.$$

In this formula, "T" is defined by length of interval between the surveys. S(n,1) is the proportion of persons in the age group from n to n+4 whose mother alive at the time of the first survey and S(n , 2) is at the second survey with same rationale. Proportions of not orphaned among a hypothetical intersurvey cohort is constructed with these formulas and also the other calculations are the same with Brass's orphanhood method.

In Turkey, the questions about survival of the parents were not asked in any censuses but it has been applied in the surveys. These surveys were 1973, 1974-75 TPS, 1978 TFS, 1983 TPHS, 1988 TPHS, 1993 TDHS, 1998 TDHS and 2003 TDHS. The first application of the Orphanhood method was applied in doctoral dissertation (Hancıoğlu, 1990) that he used classic orphanhood method employing the 1983 TPHS and 1988 TPHS data sets. Later, Coşkun (2002) was applied the synthetic cohort method in his master thesis for the first time. So, this thesis will be the second application of synthetic cohort method from the survey data in Turkey.

CHAPTER III
GENERAL OVERVIEW ON LIFE INSURANCE

A. REQUIREMENTS OF INSURANCE

Individuals face some kinds of risks in their daily lives, for instance; their houses may catch fire, they may be involved in an accident, their possessions may be stolen, they may get sick or they may die. Just like individuals, institutions may also encounter similar dangers, their buildings may burn, lose profit, their assets may be stolen, their employees may get sick or the employees may experience a work accident. These kinds of incidents cause income loss or great amount of expenditure. Hence precaution against such incidents should be taken in advance. Unless precaution is taken, both individuals and institutions may face serious economical crises at the moment of the danger, however; it is impossible for the individuals to take precaution against such dangers every time and furthermore, they may not afford this. On the other hand, if the companies use their funds which they will make use in their operations in order to insure themselves; they will face problems in producing the goods and services. Thus another economical power is needed in order to be prevented from possible harms of various risks. This need caused the emerging of the concept of "insurance" (Güvel and Güvel, 2002).

The term "insurance" comes from the word "sicurta" meaning "guarantee". Individuals will guarantee themselves as a result of the need for safety against risks (Güvel and Güvel, 2002). People's coalition against dangers and sharing the damages that they had to face alone forms the fundamental of insurance system. In this respect, insurance can be defined as follows: "it is the compensation of the loss of the people who encountered a danger, from the amount of money that has been saved by means of the payments of the people who are likely to face the similar danger". Hence a transfer of risk is maintained in which the loss of some people is compensated by many other people. (Nomer and Yunak, 2000).

In this respect the elements of insurance will vary. For instance, the subject of insurance may both be the goods that people own such as; buildings, houses or cars and it may be related with the life of a person. The insurance types made with this purpose are assessed in two groups. In the first one, the damages appeared due to the realization of the risks people face are compensated physically. That is, the damage is paid. In other words, in such insurances, the insurance firms are responsible for paying whatever the loss is. Hence, these sorts of insurances are called loss insurance. On the other hand, the insurer pays only the identified insurance amount even if the insurance are made for whole life. These kinds of insurances are called amount insurances. At this point, life insurances form the most important group of amount insurance.

B. HISTORICAL BACKGROUND OF LIFE INSURANCE

In the ancient worlds of Greece and Rome men came together in associations or funeral clubs to make contributions out of which burial costs would be met. But it was in 1583 that we have the first evidence of life insurance in Britain like as today. A policy was prepared on 18th June 1583 on the life of William Gibbons for the sum of £382. The contract was the twelve months. Gibbons gave £32 premium to 16 insurers and he died in one year. Insurers paid an indemnity £382 to Gibbons' family.

The first insurance company was established in England in 1705, which is "The Amicable Society". Later, in 1755, like Edmund Halley's mortality table, James Dodson has constructed the new mortality table who said that the calculated premium according to persons' age can be applied during the life insurance period. The equitable Life Assurance Society was established using by James Dodson's actuarial bases in 1762. After this period, Life Insurances have started to be gambling in England. Thus, The Life Assurance Act was prepared in 1774. The title explains

its purpose; “An act for regulating insurances upon lives and prohibiting all such insurances except in cases where person s insuring shall have an interest on the life or death of the person insured”. End of the 19th century, life insurances have started to use as investment tool and Life Assurance Act in 1870 was managed life insurance to gain constancy (Dicksen and Steele, 1984).

In Turkey, insurance has begun to develop after Beyoğlu fire in 1870 that caused the burning of nearly 3000 homes and several deaths. Thus, three foreign insurance companies opened their insurance agency in İstanbul with the permission of Sultan Abdulaziz, which were Sun, Northern and Northern British Companies. In 1890, the number of foreign insurance agency reached to 15 companies. In Ottoman Empire, the insurance policy should be prepared by the any foreign insurance company to be legitimate according to Şeyhülislam. Therefore, the insurance activities have started with the foreign insurance companies. In 1893, the first Turkish insurance company, Osmanlı Umum Sigorta, was established.

Insurance had great importance as development tool after the announcement of the Republic of Turkey. Anadolu Anonim Türk Insurance (1925), Milli Reassurance (1929), Güven Insurance (1935) was established. The first private capital insurance company, Doğan Insurance, was established in 1945. The number of life insurance companies shows an increase when coming to 1980’s. The number of insurance companies reached to 26 in 2004 (Association of the Insurance and Reinsurance Companies of Turkey Annual Report, 2004).

C. DEFINITION AND TYPES OF LIFE INSURANCE

Life insurance is a branch of insurance under the scope of amount insurances. No definition exists in the article 1321 of the Turkish Commerce Law where the adjustments of the life insurances are made and in the following articles. It is seen that there is a definition for the amount insurances in article 1263 of the Turkish Commerce Law; however the definition of the amount insurances is not enough to

explain the life insurance. Hence, it will be beneficial to include the definition in the doctrine (Ulaş, 1997). The reason of the life insurance to emerge is to provide a life that insured can have without having problems in his/her elder ages, and to ensure that his/her relatives are financially in a reasonable condition in case of his/her death.

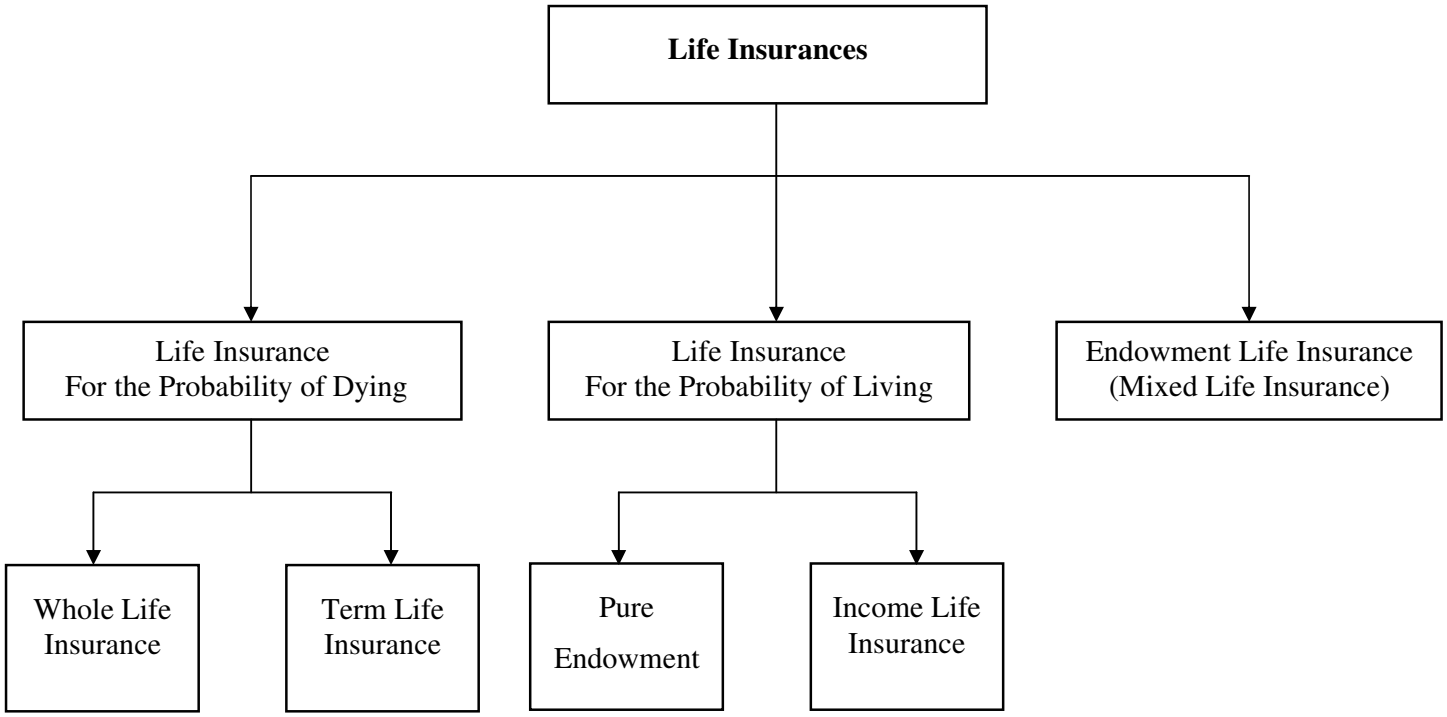
Both guaranteeing the insured person's elder ages and providing his/her relatives with an opportunity of carrying out the life without having financial problems, after his death may be considered a savings operation, but having a risk of death shows that there is a risk transfer from insured to the insurer. Therefore, it is not possible to mention merely a savings concept, because there seems to be a risk and only if this risk is realized, the insured will be paid compensation (Pekiner, 1974). As understood from this definition, the risk issue in the life insurance covers not only the state of death but also the probability of living.

Individuals cannot gain their economical independence until they reach their 20-25 years of age and particularly between the ages of 0-14 most of the income of the family is spent on their care and growth. After this first phase of economical dependency in the person's life, the income gets higher between the ages of 25 and 55 and ends at the retirement age that is 65. Then, the second dependency period starts. It may be seen that this dependency period in women may continue longer in women than men, depending on the social structure of the communities (Akmut, 1980). The factors causing the people to have life insurances are the desires of the individuals to guarantee both their own lives and their family's lives and the purposes of ensuring their children's growth as well as their economical independence. Threatening the life, the risks of unemployment, aging, being unable to work and death have got effects that cause a decrease in income or consume it totally. For example the health care and treatment expenditures of older age risk are greater than those of younger people. On the other hand, while causing the removal of income, death risk also increases the funeral expenditures. Therefore, life insurances have a great significance in terms of ensuring an economical support to the individual or his/her relatives.

Although life insurance has been defined in the article 1322 of Turkish Commerce Law, as “death and living insurances” in accordance to their risk types, this differentiating is not found sufficient today. It is for this reason that, with a more detailed approach in doctrine and insurance sector, some different types of this insurance have been generated in accordance with the necessities of the time. These insurances consist of state of death, living and mixed (Endowment) insurances and subparts of them, depending on their features. The insurer’s payment obligation may depend on the condition of the insurer’s death within the duration of the contract (Term Insurance). This duration may be a certain period of 5 or 10 years and may be arranged as lasting for lifelong (Whole Life Insurance). On condition that the insurer dies within the contract duration, payment is made to his/her inheritors considering the death probabilities and coefficient of accumulation indicated in the life table.

A policy may be prepared in order for the insured person to deserve payment providing he/she stays alive. Policy may be prepared for this third type of insurance in between death and living insurances (Endowment Life Insurances). These insurances can be defined as mixed insurances since the insured person requests payment to him/herself on condition that he/she is living at the end of the contract or payment to his/her inheritors on condition that he/she dies in a certain time. The responsibility of paying is inevitable for the insurance company (Akmut, 1980). This separation made briefly regarding the policy type of the life insurance is important. Therefore, it is necessary to explain these headings in detail.

Figure III.1 Types of Life Insurances



1. Life Insurance for the Probability of Dying

This type of insurance is known as the oldest and the most classical type of life insurance. In the insurances done against the probability of dying, the risk is the death of the insured person. That is, in such life insurances the insurer has the responsibility to pay the insurance amount in case of the death of the insured. Insurer doesn't make any payment if the insured is alive at the end of the period stated in the policy.

In the insurances done against death, neither money is saved through savings nor there are closes making it possible to change the insurance amount (Ünan, 1998). The insurance period may be in between certain years or may last for whole life in this insurance.

The insurance against death may be prepared considering the probability that his/her children may not complete their education in case of the death of the insured person or because of a need of guaranteeing a credit debt (Ünan, 1998). It is seen that there are two fundamental separations for this type of insurance (Pekiner, 1974; Ulaş, 1997; Nomer and Yunak, 2000; Temel, 2001).

a. Whole Life Insurance

Whole Life Insurance gives the insured person the insurance guarantee for all his/her life. In this insurance the insurer is responsible for paying the amount of insurance stated in the policy to the relatives of the insured person no matter when he/she dies. This insurance is generally made on the purpose that the economical power is maintained for the relatives of the dead person.

The premiums are constant for the payment period in whole life insurances in general. It can be stipulated that one article in the contract or future premiums be changed upon the request of the insured person (Temel, 2001). In whole life

insurances payment of the premiums may either last for life long or continue until a certain age or a certain time. In some whole life payments, the premium may be paid at once as a whole. The life insurances whose premium payments continue for life long is ideal for the ones who demand to have a life insurance for more than 15 years or make a saving by means of life insurance. Because premium payments and expenditure are low in the policy period. However; it is not as profitable for those who want to have the life insurance done for 15 years or more. Because the cost deductions taken in the beginning and at the end for short periods are higher. Therefore, the annual premiums taken from the whole life insurances whose premium payments are made within a certain time are higher than the annual premiums taken from the whole life insurances whose premiums last for life long (Temel, 2001). For the policies with premium payments for limited time, the period of premium payments should be shorter than the duration of the contract. Whole life insurances may be subject to inflation with a purpose of getting rid of the adverse effects of inflation (Ulaş, 1997).

Insurance companies should save some reserves for the expenditures of future deaths of all of the whole life insurances. The amount of such a reserve is based on the way of paying the premium as well as its duration. Due to this reserve all whole life insurances have got a policy value (Temel, 2001).

Most of the whole life insurances are profit participating policies. Thanks to profit participating policies, the allocated profit shares give an additional flexibility to the policy. Insurance companies always show the examples of the profit shares of the profit participating policies they had allocated before or are to allocate in the future, to their probable clients. These profit share examples are generally defined in accordance with the company's mortality rates and the statistics of cost and interests. The profit shares can not be guaranteed but for most of the policies the profit share paid in reality is higher than the profit share that was thought to be paid.

b. Term Life Insurance

In the term life insurance the insurer is bound to pay the certain amount indicated in the policy to the insured person's relatives only if that person dies within the time interval agreed on the policy. Unless death occurs within that period, insurance ends and the insurer doesn't have to pay the compensation any longer. The term life policies can be sold for at least a period of one year and may ensure a guarantee for the ages until 65 or even 70. They are usually preferred by the people who will have the right to retire in order to have an economical guarantee against the risk of death that can happen until that date. By this way they prevent the ones left behind to remain in poverty (Pekiner 1974).

There are some penalty articles in term insurance policies for early leaves. But the possibility to change their policies has been given to the insured people. Hence, leaving term life insurance is observed more than the other policies. The notifications such as "alterable" or "renewable" are put on the policy in such insurances, ensuring a possibility to make amendments or renewals.

In the "alterable term life insurance" the insured person is given the opportunity to change this term life insurance policy with another life insurance (endowment life insurance, whole life insurance or for probability of living) whenever he/she wants In the renewable term life insurance the insurer creates an opportunity for the policy to be renewed before the end of the period without a need of a new health examination.

In the term life insurance, since there is no cash payment or no allocation of profit shares, the calculations are done in accordance to the premium base. Therefore, compared with the other life insurances, the competition in the sales of the policy changes mostly according to the premium (Temel, 2001).

The premiums of the term life insurance policies can be paid in constant amounts as well as increasing amounts. While the policies made in constant amounts are made for the periods such as 10 years or 20 years, the policies in increasing amounts are the ones with a renewable character. Most of the annual renewable term life insurance policies made recently present low premiums, long renewing periods (until the age of 100 years), huge amounts of guarantee (such as $100.000, $250.000) and different categories of premiums. That's why they are more profitable than the constant amount policies (Temel, 2001).

2. Life Insurance for the Probability of Living

In the life insurance for the probability of living the responsibility of the insurer to pay compensation depends on the condition that the insured person is living within the period assigned in the insurance policy. In this case, the risk for the insurer is not the state of death but the continuation of the state of living. In the life insurance for the probability of living the insurer makes a total payment or an annuity payment to the insured person when the period in the policy ends. This type of insurance is divided into two as "pure endowment (capital)" and "income life insurance (annuity)".

a. Pure Endowment

In this type, in case of the insured person is living at the end of the period assigned in the policy; insurer has to pay the amount assigned in the policy to him/her at once. If the insured person dies within this period, the insurer needn't pay this amount.

b. Income Life Insurance (Annuity)

In this type the insurer appoints an income to the insured person to be paid in certain intervals. As a rule annuity payment is made for the whole life of the insured

person. There are two kinds of practices of income life insurance. The purpose in both insurances is the desire of the insured people to guarantee their older ages (Ulaş, 1997).

In the fist type of income life insurance, the insured person has got some money in total. However, he/she is not sure if this money is sufficient enough until his/her death. Hence, he/she gives it to the insurer, wanting to obtain an income to be paid to him/her in certain intervals until he/she dies. The insurer's paying the appointed annuity may either begin after insured's payments or begin after a date stated in the contract. If the insured person dies at a date between the beginning of the insurance and beginning of the annuity payment, the money paid by the insured person until that date is given back to him in certain amount. This kind of insurance is preferred mostly by people who have some amount of cumulative money but no opportunity to use it in any financial institution.

In a second type of income life insurance the insured person pays generally annual premiums at certain intervals and demands to be paid an income (annuity) starting from a defined date.

In income life insurance, if the insured person dies, the insurer stops making the payments. Nonetheless if a payment guarantee has been indicated in the contract while the policy is made, the insurer is obliged to pay the annuity within that period without checking whether the insured person is still alive. If there is an article in the insurance policy stipulating an annuity payment to the relatives in case of the death of the insured person, this payment should be made in the event of his/her death (Ünan, 1998).

With all its types, life insurance for the probability of living is an important type of life insurance for the people who have no one to look after and who want to guarantee his/her old age.

3. Endowment Life Insurance

The previously explained life insurance for the probability of dying and life insurance for the probability of living are the types of insurances guaranteeing the contradicting risks. In both insurance types some outcomes against the insured person may emerge. In order to remove these drawbacks, another insurance type, containing both the states of death and living, has been generated and called "endowment life insurance" (Ulaş, 1997).

In this type of insurance the insurance amount is paid to the insured person's relatives in case of his/her death before the date agreed on the contract. Meanwhile, in case of his/her being alive for some certain time the insurer is again obliged to pay the amount agreed on the contract to the insured person.

As seen, the probability of the realization of the risk in this type of life insurance is "certain" and the state of "uncertainty" that should be in the insurance doesn't exist here. Therefore, it is claimed that this insurance is in fact not an insurance but a savings operation. However; according to Bozer (1965) and Pekiner (1974), endowment life insurance is a sort of insurance with both risk and savings feature. In this sense, endowment life insurance can be explained as an insurance type in which savings and insurance elements are combined. The risk element in this type is the death of the insured person before a definite time. Besides, the savings element is his/her being alive at that age and on that date.

As there are probabilities of both death and living in the endowment life insurance the premiums of the insurance must be higher than the other life insurances. The premiums are generally paid annually but if demanded, they can also be paid as a net single premium.

CHAPTER IV
EXPLANATION OF FUNCTIONS OF MORTALITY TABLES

A. MORTALITY TABLES

Mortality tables, the other name is life tables, are descriptive tables that determined how many person will die and how many persons will live between two ages or age groups from the results of survival or death statistics of any population. (Turkish Life Insurance Regulation, 1996). Mortality tables are used by public health workers, actuaries, and demographers in studies of migration, fertility, population projections, orphanhood, widowhood, length of life, length of marriage, and length of working life. A mortality table is composed of several functions for each age or age group. Mortality tables are constructed from age specific death rates and the resulting values of these tables are used to measure mortality, survivorship, and life expectation (Shryock and Siegel, 1973). There are two types of mortality tables; the generation or cohort mortality table and period or current mortality table.

The first type of mortality table, the cohort mortality table, provides a "longitudinal" perspective in that it follows the mortality experience of particular cohort. The cohort mortality table reflects the mortality experience of an actual cohort from birth until no lives remain in the group (Arias, 2004). This type of table is useful for projections of mortality (Shryock and Siegel, 1973).

The second type of mortality table, the period mortality table, does not represent the mortality experience of an actual cohort. The period mortality table considers a hypothetical cohort and assumes that it is subject to age-specific death rates observed for actual population during a particular period such as a year, three year, or an intercensal period. (Arias, 2004). Generally, the death statistics are used for a period mortality table for one to three years. And the population data is represented with the middle of that period. Therefore, these tables represent a

combined mortality experience by age of population in a short period of time (Shryock and Siegel, 1973).

Mortality tables can be classified in two ways according to the length of the age interval in that data are presented. A complete mortality table (unabridged mortality tables) contains data for every single year of age. An abridged mortality table typically contains data by 5 or 10 year age intervals (Arias, 2004). In fact, in demography abridged mortality tables are used more common than complete mortality tables. Because the mortality data sometimes can not be sufficiently reliable or sometimes shorter mortality data can be preferred (Newell, 1994). On the other hand, in insurance sector, complete mortality tables are used more common than abridged mortality tables. Because the amount of premiums and reserves are determined on the single age of insured. Usually abridged mortality tables begin with age groups 0 to 1 and 1 to 5, then five year groups until the last, open-ended interval.

Mortality tables provide the most complete and exact way of comparing mortality of different populations or groups (Türkyılmaz, 1998). The commonly used functions in complete mortality tables can be defined the following notations;

x This column shows the age interval between the two exact ages indicated. For instance, for complete mortality tables, ‘‘20–21’’ means the 1-year interval between the 20th and 21st birthdays. Age interval can be more than one year (5, 10 or “n” year) in abridged mortality tables.

$\mathbf{l_x}$ This column shows the number of persons, who survive to the beginning of each age interval. l_0 value is called radix. Usually it would be numbered 1, 10,000 or 100,000.

$\mathbf{{}_np_x}$ This column shows the probability of living between ages x to x + n. It is showed by the following formula;

$_nP_x = l_{x+n} / l_x$

q_x This column shows the probability of dying between ages x to x + n. It is showed by the following formula;

$_nq_x = 1 - {}_nP_x$

$_nm_x$ The central death rate in the life table. It is showed by the following formula;

$_nm_x = {}_nd_x / {}_nL_x$

$_nd_x$ This column shows the number of deaths occurring between ages x and x+n. It is showed by the following formula;

$_nd_x = l_x - l_{x+n}$

$_na_x$ The average number of years lived in the interval between ages x and x+n by those who die in the interval. In such case the values of, a_x will be taken as 0.5n. This is normally reasonable except for very young and old ages. On the other hand, a_x values of used mortality table in insurance, which is complete mortality table, are used as a value of 0.5.

$_nL_x$ This column shows the total number of person-years lived in the interval between ages x and x+n. The number of people in this age group which would be found in a stationary population. If there are no migration and if the births are evenly distributed over the calendar year, the survivor of these births would constitute a stationary population. Because, the number of persons living in any given age group would never change. When individuals left the group, either by death or by growing older and entering the next higher age group, their

places would immediately be taken by persons entering from the next lower age groups. It is showed by the following formula;

$L_x = 0{,}5.(l_x + l_{x+1})$ for complete mortality tables,

${}_nL_x = (n \,.\, l_x) - ({}_nd_x \,.\, {}_na_x)$ for abridged mortality tables.

T_x This column shows the total number of person years lived of ages x and above. It is showed by the following formula;

$$T_x = \sum {}_nL_x$$

e_x This column shows the average remaining life time (also called life expectancy) for a person who survives to the beginning of that age interval. e_0 value is defined as life expectancy at birth. It is showed by the following formula;

$$e_x = T_x / l_x$$

${}_nS_x$ This column shows the survivorship ratio. It is showed by the following formula;

$${}_nS_x = L_{x+n} / L_x$$

B. MODEL LIFE TABLES

The life table provides the most complete description of mortality for any population. The basic data input needed for its construction are the age-specific death rates calculated from information on deaths by age and sex from vital registration and population by age and sex from census or surveys. In many developing countries, these basic data do not exist because of either lack of vital registration

systems, or unusable. This data can be incompleteness or there are some errors in reporting (Murray and others, 2000). Demographers make various efforts to devise alternative methodologies in order to fill the existing gaps. In cases of unusable or non-existent vital registration data, indirect techniques for obtaining mortality rates are employed. These techniques are used on the observed similarities in the age-patterns of mortality for different populations with similar socio-biological characteristics.

A model life table is a set of life tables, based on a theoretical framework, which includes a wide range of mortality rates. It presents a single pattern of fixed and determined mortality (Frias and Rodriguez, 1980). The basic objective for the creation of any model life table is to construct a system that gives schedules of mortality by sex and age, defined by a small number of parameters that capture the level as well as the age pattern of mortality. Thus, model life tables are essential demographic tools for populations lacking accurate demographic data (Murray and others, 2000).

The best known model life tables are (i) the UN Model Life Tables, (ii) The Coale-Demeny Model Life Tables, (iii) the UN Model Life Tables for Developing countries, (iv) the Ledermann System of Model Life Tables and (v) the Brass Logit System. But in this thesis, the West model of Coale and Demeny regional model life table will be based on to construct the mortality table of Turkey from both “infant mortality rates” and “orphanhood methods”. Thus, Coale and Demeny regional model life tables will be explain below.

The Coale and Demeny regional model life tables were first published in 1966. They were derived from a set of 192 life tables, by sex, from actual populations. This set included life tables from several time periods (39 from before 1900 and 69 from after the Second World War) and mostly from Western countries. Europe, North America, Australia and New Zealand contributed a total of 176 tables. Three were from Israel; 6 from Japan, 3 from Taiwan; and 4 from the white

population of South Africa. All of the 192 selected life tables were derived from registration data, and were subjected to very stringent standards of accuracy (United Nations, 1983).

A preparation analysis of the tables exhibited that four different mortality patterns could be distinguished among them. Those patterns were labeled “North”, “South”, “East”, and “West”. Each model had a characteristic pattern of child mortality. The East model comes mainly from the Eastern European countries, and is characterized by high mortality rates in infancy and at older ages (over age 50). The North model is based largely on the Nordic countries, and is characterized by comparatively low infant mortality, high child mortality and low old age mortality beyond age 50. The South model is based on life tables from the countries of Southern Europe (Spain, Portugal, and southern Italy), and has a mortality pattern characterized by high mortality under age 5, low mortality from about age 40 to age 60, and high mortality over age 65. The West model is based on the residual tables not used in the other regional sets (countries of Western Europe and most of the non-European populations) (United Nations, 1983). It is characterized by a pattern intermediate between North and the East patterns. Because this model is derived from the largest number and broadest variety of cases, it is believed to represent the most general mortality pattern (Murray and others, 2000). The West model is often recommended as a first choice to represent mortality in countries where lack of evidence prevents a more suitable choice of model (United Nations, 1983).

C. HISTORICAL BACKGROUND OF MORTALITY TABLES

The landmark study, which started it all, was by a London merchant named John Graunt. In 1662 he published a book entitled “Natural and Political observations made upon the Bills of Mortality”. The book was based on publications of the number of people dying each week in the big cities, classified by apparent cause of death. Graunt analyzed 20 years of deaths according to cause and identified the likely age associated with cause. Although some of his methods were speculative

because of absent data. Graunt was found that the probability of survival from 0-5 age interval to 6-15 age intervals was 64.0 percent.

In England Edmond Halley produced the first widely circulated work on the calculation of life annuities in his paper published in 1693 in "Philosophical Transactions of the Royal Society". This was based on data collected for years 1687 to 1691 by Caspar Neumann, a pastor in the German city of Breslaw. Halley was found that the probability of survival from 0-5 age interval to 6-15 age intervals was 71.0 percent.

The second mortality table which is prepared scientifically based on death data was constructed by Joshua Milne in 1815. This table was constructed from death information of two regions of Carlisle City in England between 1779 and 1787. Firstly in history, while these tables were constructed for the European countries, especially for Scandinavian countries, today, they are usable for many countries and continents.

On the other hand, in Turkey, mortality table studies started in 1950's. The first mortality table was constructed by Swiss statistician Wiesler who used death statistics of 63 provinces. Wiesler has constructed the tables for both genders separately in his study, "Première Table de Mortalité pour la Turquie". Wiesler has used death data for two years and he did not make any correction. Therefore, the probability of failure was high (Duransoy, 1993). Wiesler has calculated mortality rate between 0-10 age intervals, which was 117.4 per thousand for male, 100.5 per thousand for female.

The second mortality table was constructed by Gürtan (1966). Gürtan constituted the abridge mortality table by using 1955 and 1960 censuses. These tables were prepared according to five each age group for two genders. Later, Alpay (1969) constructed the mortality tables for 4 regions and 3 big provinces (İstanbul, Ankara, İzmir) by using the first year results of Turkey Population Survey. Three

different mortality tables were constructed for each region separately and these were total, urban and rural mortality tables. Moreover, these tables were constituted from the birth and death statistics, which was used firstly in Turkey. Later, Oral (1969), was calculated the age specific death rates for Ankara province which was taken from the death registration of Ankara. Oral has reached the q_x values from m_x values and then compared with Coale-Demeny South Model Life Table and Brass' African Standard Life Table by using logit methods of Brass.

In 1970, Özsoy prepared the new mortality table for Army Solidarity Association (Ordu Yardımlaşma Kurumu). In this table, it was used the data of T.C. Emekli Sandığı for the years 1950-1957. Another important study was applied by Muhterem Öcal. Öcal (1974) was used 9 province center (Adana, Ankara, Bursa, Eskişehir, Gaziantep, İstanbul, İzmir, Kayseri, Konya) of the results of 1960 census and SIS death statistics.

In 1987, Demirci selected appropriate pattern according to Shorter and Macura's model life table that was taken Turkish Demographic Survey in 1966-1967 and constructed Turkey mortality tables by using Coale and Demeny model life table (west and east) and United Nations model life table (general).

In 1991, Hancıoğlu estimated infant and under-5 mortality rates and expectations of life at age 20 for Turkey using abridged life tables in his doctoral dissertation. He constructed the abridged life tables for male and females separately for the years 1970-1975, 1975-1980, and 1980-1985.

In 1992, Hoşgör estimated mortality level for Turkey by using intercensal growth rates between censuses. Later, in 1997, he has estimated life expectancy at age 10 (e10) for all provinces and 7 geographical regions by using Preston and Bannet (1983) method in his doctoral dissertation. This dissertation was the first study in point of all provinces of Turkey and seven geographical regions and he used 1985 and 1990 censuses.

In 1993, Duransoy constructed the new mortality table by using SIS death statistics. These tables were constructed for 1971-1981 and 1980-1990 periods. He constructed three mortality tables, which are total, male and female mortality tables for 1971-1981 and 1980-1990.

In 2000, Toros constructed life tables for each year between the period of 1990 and 2000 for both genders separately. Toros used to Myers blended index that is used to show the level of age heaping for three census results. These are estimated for 1970, 1990 censuses and 1997 population count. Toros corrected age distribution of 1990 census and 1997 population count and used infant and child mortality rates from the TDHS-1993 and 1998 data.

In 2001, Demirbüken constructed Ankara mortality table from the burial records of Ankara city cemeteries which was the first mortality table from the burial records. Later, Coşkun (2002) used to synthetic orphanhood method and he consisted the tables for two genders separately by using 1993 and 1998 Turkish Demographic and Health Survey in his master thesis in 2002. These tables refer to the year of 1996.

Finally the last mortality table has been constructed for the year of 2000 for Turkey by The Ministry of Health Refik Saydam Hygiene Center Presidency School of Public Health. They corrected the number of adult deaths using Bennett-Horiuchi (1981) and Generalized Growth Balance Method and they used 1990 and 2000 censuses and death statistics of SIS.

On the other hand, SIS has prepared mortality tables in 1966-1967. These tables were constituted for both genders and some province such as Ankara, İstanbul, and İzmir. While preparing these tables, United Nations' correction factor has been used to smooth age misreporting. Later in 1989, SIS was constructed abridged mortality table for both genders by using death data of Turkey Population Survey.

D. USAGE OF MORTALITY TABLES IN LIFE INSURANCE

Math and statistic have been used in the administration of insurance companies and the conduction of the insurance activities for almost 400 years. The idea of making insurance emerged from the assumption that the probable value of the risk can be found out almost closer to the reality. In order for this assumption to be valid, according to "Law of Large Numbers", it is necessary to gather several people facing the same threat and these people should be the customers of the same insurance company, but this is not always possible. There being a great number of insurance companies and the competition among them as well as the people's being insufficient in economical terms, hinder the number of insured people to increase. In this case, the insurance companies should define the probable value of risk in view of the information acquired with the previous observations (Akmut, 1980).

On the other hand, it is not easy to calculate the costs of the payments or the guarantees to the insured people in the life insurances as it is in calculating the costs of other goods; because, it is not known whether the risk that is the subject of the insurance may be realized or not; and it is not known when it will happen. In other words, the cost estimates of the insurance company depend on the probabilities of the occurrence of some biometrical events such as death or disablement (Özsoy, 1970). Therefore, the insurance companies feel a need to use the tables prepared from the previous observations and records in order to fulfill this request.

By using these tables, the insurance companies don't make predictions about who will die but they predict approximately how many people may die within the policy period. Moreover, they calculate the premiums that they are going to take from the insured and the compensation to be paid in accordance to these tables.

The insurer takes a premium from the insured person in return to his making the insurance. That is, the premium constitutes the equivalent of the risk. The insurer or the insured person's not facing a loss is only possible by a correct calculation of

the premiums. Hence, it is very important to know the probabilities of death or disablement. In life insurances, the premiums that will be paid by the insured people are calculated according to the death or living probabilities on the mortality tables prepared in advance. For this reason that the mortality tables are the most significant element that enables to collect the correct calculated premiums which must be taken by the insurer in order to fulfill its responsibilities to its insured people (Özsoy, 1970).

The mortality tables' functions for the life insurance companies can be listed as follows:

- Identifying the uncertain risk (death) as certain by gathering a great number of people and pointing out the probabilities of death.

- Identifying the amount of income that the insurer provided from premiums and so, showing the insurer the funds that he will be able to make investment.

- Ensuring the insurer some information about the total compensation to be paid in the future. Thus, it helps him to make long term plans

- Helping the planning of the management and selling costs of the insurance organization

- Enabling the calculation of reserves and profit shares

E. MORTALITY TABLES USING IN TURKEY

The death rates of any country should represent the population characteristics of that country to use mortality table for the calculation of premium and reserves in

insurance sector. Although, mortality table has gained an importance for insurance sector, there is no any constructed mortality table from Turkish data. Moreover, this deficiency has been tried to complete with foreign mortality tables. In Turkey, sixteen different mortality tables have been used until 1978 (Duransoy, 1993). These tables were;

1. American CSO 1953-1958
2. English H^m
3. English O^m
4. French AF
5. French PF 1952-1956
6. French PM
7. French PMF 1931
8. French RF
9. German Abel
10. German General ADST
11. Swiss SM 1901-1910
12. Swiss SM 1921-1930
13. Swiss SM 1941-1950
14. Swiss SM 1948-1953
15. Swiss SM 1958-1963
16. Swiss TG 1960

But the surplus of those tables has caused the blocking of standardization to use in life insurance sector. Therefore, a lot of researches have been applied to decrease these tables. Insurance Inspection Committee (Sigorta Murakabe Kurulu) of Turkish Treasury Undersecretaryship has reduced mortality tables from sixteen mortality tables to three mortality tables with the clause 28^{th} of law no. 7397 in 5^{th} May 1978 and 14(950.1/7) 12665 numbered article (Duransoy, 1993). These tables;

1. Swiss Male (SM) Mortality Table (1948-1953)
2. Allgemeine Deutsche Sterbetafel Tabelle (ADST) General German Mortality Table (1949-1951)
3. Commissioners Standard Ordinary (CSO) Mortality Table (1953-1958)

Later, American Commissioners Standard Ordinary (CSO) 1980 mortality table has been added for female and male with B.02.1HM.O.SGM.0.2.1.2 /Gen/99/62885 numbered article in 31st July 2001 by the Undersecretariat of Turkish Treasury (Ataman, 2002).

The Undersecretariat of Turkish Treasury has undertaken the control and inspection of mortality tables for life insurance companies in Turkey. The mortality tables, which are used to determine the risk premium, have chosen with great careful. The Undersecretariat of Turkish Treasury can determine the mortality and the morbidity tables according to the results of the portfolio of life insurance companies or the data of State Institute of Statistics. The Undersecretaryship can want to table and the results of the portfolio, which are constructed by the Association of Insurance and Reinsurance Companies of Turkey, from the insurance companies at the end of the year. Association of the Insurance and Reinsurance Companies of Turkey has consolidated these tables and then they have sent to The Undersecretariat of Turkish Treasury and insurance companies (Turkish Life Insurance Regulation, 1996).

If insurance companies have ten years and over mortality experience, these companies can construct their own mortality tables or they can change current mortality tables with own mortality experience. But these companies have to send the new constructed mortality tables to the Undersecretariat of Turkish Treasury with related formulas, methods of calculation, assumptions in order to confirmation by the Undersecretariat of Turkish Treasury (Turkish Life Insurance Regulation, 1996).

Although the insurance companies can construct their own mortality tables, no insurance company has used own mortality table yet. All insurance companies have used four mortality tables accepted by The Undersecretariat of Turkish Treasury. But these four different mortality tables do not use with same frequency. Insurance companies use these mortality tables for different payment of different life insurance policies.

In Turkey, there are four different mortality tables. But three of them had constructed from death rates of 1950s. These are Swiss Male Mortality Table (1948-1953), ADST German General Mortality Table (1949-1951), and CSO Mortality Table (1953-1958). It can be identified as an old date mortality tables. Except these

three mortality tables, on the other hand, 1980 CSO Mortality Table is the newest mortality table for Turkey. The life insurance companies have used 1980 CSO mortality tables more than the tables of 1950s because of being contemporary. Because 1980 CSO mortality table have a more close value according to today and it is important not lose their contemporary of insurance policies.

On the other hand, when investigating the profitability, old date mortality tables are more profitable for whole life insurance policies and term life insurance policies for insurance companies. Because, old date mortality tables had higher death rates and therefore, risk premium for death, which is taken from insured, will be higher equally. But insurance companies can not use easily high death rate mortality tables. Because competition of life insurance companies has prevented the usage of these tables easily. One company can have more insured by using mortality table, which has lower death rates.

1. Swiss Male (SM) Mortality Table (1948-1953)

Until 1978, six mortality tables (1901-1910, 1921-1930, 1941-1950, 1948-1953, 1958-1963, 1960) from sixteen used mortality tables were Swiss Male Mortality Table in Turkey. In 1978, Insurance Inspection Committee of Turkish Treasury Undersecretaryship has reduced the number of tables from sixteen to three (Duransoy, 1993). One of three mortality tables was Swiss Male 1948-1953 Mortality Table.

When investigating the mortality table of Switzerland, it can be seen that eleven mortality tables have been used in Switzerland. These tables have been computed for Switzerland since 1876. They cover the periods 1876-1880, 1881-1888, 1889-1900, 1910-1911, 1920-1921, 1929-1932, 1939-1944, 1948-1953, 1953-1963, 1968-1973, 1978-1983 and 1988-1993. The first three tables were closed at earlier ages but since 1910-1911 they have been closed at age 100, except the 1988-

1993 table which was closed at age 108. The latest complete life table covers the period of 1998-2003 years (Robin, Cheung and Paccaud, 2003).

The classification of diseases has been registered since 1876 in Switzerland. And after 1969, vital statistics have been computerized in Switzerland and the statistical bureau provided deaths between 1969 and 2002 by sex and age at death and by year and month of death with statistics of all the recorded (Robin, Cheung and Paccaud, 2003). Therefore, Swiss Male Mortality Table (1948-1953) has been constructed from the death registration of Switzerland.

2. Allgemeine Deutsche Sterbetafel Tabelle (ADST) General German Mortality Table (1949-1951)

After population census at 13th September 1950 in Germany, the government planed to construct new mortality table to see present condition of population and also make a projection for future. In order to construct this table, the government constitute a committee from statistic institute of provinces, some actuaries and social security experts which is called "Mortality Table and Population Projection Committee" (Sterbetafel und Bevölkerungsvorausberechnung) (Statistic Der Bundesrepublic Deutschland, 1953).

The main objective of construction of this table could make an estimation not only for specific period but also for future. The committee used both traditional and new methods to construct this table. Three methods had been used to construct mortality tables until 1949 in Germany. The first method is birth-year method, the second is death-year method and the third is Boeckhsche method. The committee investigated between 1946-1952 periods but, death rates of Germany is very high between 1946-1948 periods. So, the period 1949-1951 was selected to construct this table owing to fact that the death rates turned to constant values after 1949 (Statistic Der Bundesrepublic Deutschland, 1953).

The migration movements happened especially during the World War II, continued even after the end of the war. A dense migration occurred from the Soviet lands occupied by the Germans to Germany. Moreover the prisoners of war may also be included in this migration. Generally, while preparing the life tables, the migration movements are not included but as there was a dense immigration, the committee had included this factor in the table as well. And the modified q(x) values are formed (Statistic Der Bundesrepublic Deutschland, 1953).

As the infant death between 0 - 1 of ages are examined according to months in order to show diversity. Since there isn't any information about birth, the death-year method has been used. A great amount of fluctuation is observed above the ages of 90. Hence ages above 90 aren't used and instead of that method, it is though that the extrapolation method is used. However the actuaries defend that a more precise calculation be made for the ages above 90. Therefore, it is found suitable to use the interpolation method to be used while calculating the ages above 90.

3. Commissioners Standard Ordinary (CSO) Mortality Table (1953-1958)

At the request of the National Association of Insurance Commissioners (NAIC) and the Society of Actuaries (SOA) have worked together to produce a proposal for a Commissioners Standard Ordinary (CSO) mortality table for use in the current valuation system in 1958. This table was constructed from the combined ultimate mortality experience of 15 large insurance companies. Three different exposure periods, 1946-1950, 1950-1954, and 1946-1954 were originally considered, but the period between 1950 and 1954 was selected as the most appropriate because it provided a sufficiently large amount of homogenous data. And also this table was the most representative of the recent mortality experience (Society of Actuaries, 1981).

The mortality data firstly, was submitted in quinquennial age group for policy years 1-15. The experience for policy years 16 and over was submitted on an

individual single age. The data used to develop the table excluded the first five policy years of mortality experience. This was done to reduce the effect on the mortality rates of differences in intercompany underwriting rules, eliminating adverse selection of insured, and suicide. For policy years 6-15, the mortality data were taken from the death data which were based on medical experience. On the other hand, for policy years 16 and over included non-medical experience, which was only a relative small proportion of the experience. All war deaths were excluded except for some cases in early ages (Society of Actuaries, 1981).

Later, the mortality data secondly, was separated for single age by using interpolation formula. For ages under 20, the mortality rates were based on the experience of four large insurance companies. A special study was made of population mortality data and the experience of one large company to calculate an infant mortality rate. Further adjustments were then made at old ages, and the mortality rate at age 99 set equal to 1.000. On the other hand 1958 CSO mortality table represented male mortality. A small component of the experience was on female lives. A three year age setback was assumed as the most practical and reasonable way to reflect the lower level female mortality. (Society of Actuaries, 1981).

4. Commissioners Standard Ordinary (CSO) Mortality Table (1980)

During more than twenty years (exposure period of the 1958 CSO Mortality Table), there have been substantial reductions in the mortality rates for insured lives. Real death rates and used death rates of 1958 CSO Mortality Tables have created differences. Besides, as a result of the use of the 1958 CSO Mortality Table for life insurance reserves has created problems in several areas. It produced higher life insurance reserves. Thus, companies have to set up their deficiency reserves much greater than required reserves. On the other hand 1958 CSO mortality table represented male mortality. A small component of the experience was on female lives. After considerable discussion by the Committee members and an extensive

survey of other actuaries, particularly consultants and those employed by smaller companies, the Committee decided to develop and recommend sex distinct tables (Society of Actuaries, 1981).

At the request of the National Association of Insurance Commissioners (NAIC) and the Society of Actuaries (SOA) have worked together to produce a proposal for a Commissioners Standard Ordinary (CSO) mortality table for use in the current valuation system in 1980.

The Committee decided that the exposure period for the data should be from 1970-1975 life insurance policies. This period was selected because it was the most recent period of experience available, and there were no epidemics or other unusual events that would have affected mortality. All war deaths were excluded. A five year exposure periods (1970-1975) was used instead of four years used for the 1958 CSO Mortality Table in order to provide more data, especially for the female mortality table. Non-medical and medical data were included at all durations. It was considered appropriate to include non medical data in 1980 CSO Mortality Table because of the industry trend, since the development of the 1958 CSO Mortality Table. The non medical experience was also needed to provide sufficient data for the female mortality table. Non medical experience for durations 6-15 constituted about 37 percent of male select experience and about 55 percent of the female select experience (Society of Actuaries, 1981).

The first five policy years of mortality experience were also excluded for the tables. Experience of policy years 6 and over were used in these tables. The total exposures for ages 20-94 for the 1980 CSO Male Mortality Table are about four times than 1958 CSO Mortality Table, and the actual deaths are over twice level. Since the experience data for age 0 were scarce, and since the experience rates were extremely low. Therefore, it was decided to developed appropriate age 0 rates by relating them to the age 1 rates. Ratios were determined from the 1958 CSO Mortality Table of the age 0 rates to age 1 rate (Society of Actuaries, 1981).

On the other hand, the Committee decided to end both the male and female tables at age 100, the same approach as was used for the 1958 CSO Mortality Table. Intercompany mortality data were not available above age 99, and age 90 and over were not enough and considered to be unreliable. Therefore, mortality rates were extended using two different methods. The first method used was to fit a cubic polynomial to three consecutive points (age 88, 89, and 90) and requiring $q_w = 1$. This method was founded by Miller in his "Elements of Graduation" in 1946. The second method used to extend the tables to increase geometrically starting at age 88 (Society of Actuaries, 1981).

The 1980 CSO Mortality Table is prepared from the deaths of insured American Lives. These tables do not reflect accurately the life expectations of whole United States population because the observations were restricted to only that portion of population owning life insurance (Dorfman, 2001).

CHAPTER V
CONSTRUCTION OF MORTALITY TABLES FOR TURKEY

One of the most important objectives of this thesis is to construct mortality table from totally Turkish mortality data. The mortality tables can be constructed either with direct or indirect calculations. But in Turkey, several problems of censuses, vital registration system and other sources obstruct the calculation with direct methods. Turkish censuses have problems because of the age reporting errors. The basic reason for the age reporting is age heaping (Shorter and Macura, 1982; Toros, 2000). Moreover, overcounting and undercounting problem consist depending on the general socio-political atmosphere (Hancıoğlu, 1997). Because, the number of politicians in the Grand National Assembly of Turkey and the amount of money that are taken from municipalities are determined directly with the population size. On the other hand, vital registration systems and SIS death statistics have also several problems to construct mortality table. Therefore, indirect techniques have become an important to construct mortality tables for Turkey.

In this study, it is aimed to construct the mortality table with two different methods to compare among each other and to test the reliable and representative mortality table for Turkey. The first mortality table will construct from infant mortality rates to base on Coale and Demeny West Model Life Table with the formula of linear interpolation. After that, the second mortality table will construct with synthetic orphanhood method. Both tables give a reference for year of February 2001.

Firstly, it will be useful to exhibit current mortality condition of Turkey to determine which model life table of Coale and Demeny can represent Turkey. General mortality structure constitutes with three parts; child mortality, adult mortality and overall mortality. Overall mortality is combination of child and adult mortality. The previous studies (1966-1967 and 1989 SIS mortality tables) related to relationship of child and adult mortality showed that the child mortality was higher

according to adult mortality (SIS, 1993). But these differences have decreased in time. According to SIS, it was accepted that adult and child mortalities will be come closer between 1995 and 2000 period. East model life table had represented the relationship between adult and child mortality in the past. Owing to increasing expected life level and decreasing differences between child and adult mortality, it can say that East model life table has come close to West model life table (SIS, 1993).

The previous studies indicate that the adult mortality pattern of the West level is expected to be closer than other models for Turkey. According to Toros (2000), least variations are observed in the East family of model life tables for females and in West for males. Moreover Demirci (1987) indicated that in adult mortality according to the khi-square test and survivor rates which had been got from population census's data, appropriate pattern was found West model life table. In parallel, Coşkun (2002) was used in master thesis West model life table in order to be closer than other models for Turkey. On the other hand, Hancıoğlu (1991) and Türkyılmaz (1998) indicated that East model life table was the most appropriate model for Turkey which gave the best fits for Turkish early age mortality pattern.

Owing to fact that constructed mortality tables in this thesis from East model life table gives similar results with West model life tables, West model life table is preferred to construct the mortality table of Turkey from both "infant mortality rates" and "orphanhood methods".

A. CONSTRUCTION OF MORTALITY TABLES FROM THE INFANT MORTALITY RATES

Interpolation is a method of constructing new data points from a discrete set of known data points. Interpolation allows predicting an unknown value if any two particular values are known and assumed while the rate of change is constant. This calculation is described below.

The line is defined by the points (x_1, y_1) and (x_2, y_2). A third point (x, y) would exist the line if the following relation holds:

$$(y_2 - y_1) / (x_2 - x_1) = (y - y_1) / (x - x_1),$$

Linear interpolation can become with two simple steps. First, calculation of the value of Θ, the interpolation factor is defined by the following formula;

$$\Theta = (x - x_1) / (x_2 - x_1)$$

Then second, calculation of desired interpolated ordinate is defined by the following formula;

$$y = \Theta \, . \, y_2 + (1.0 - \Theta) \, . \, y_1$$

In this study, interpolation formula assists the construction of Turkey mortality tables for both genders from infant mortality rates ($_1q_0$). These mortality rates represent 5 years preceding the 2003 TDHS which give a reference for the year 2001.2. Infant mortality rate is estimated 28.8 ‰ for females, 30.1 ‰ for males. Moreover, in the same period, child mortality is estimated 7.5 ‰ for females and 9.5 ‰ for males.

Figure V.1 Interpolated q(x) Values Based on West Model Life Table

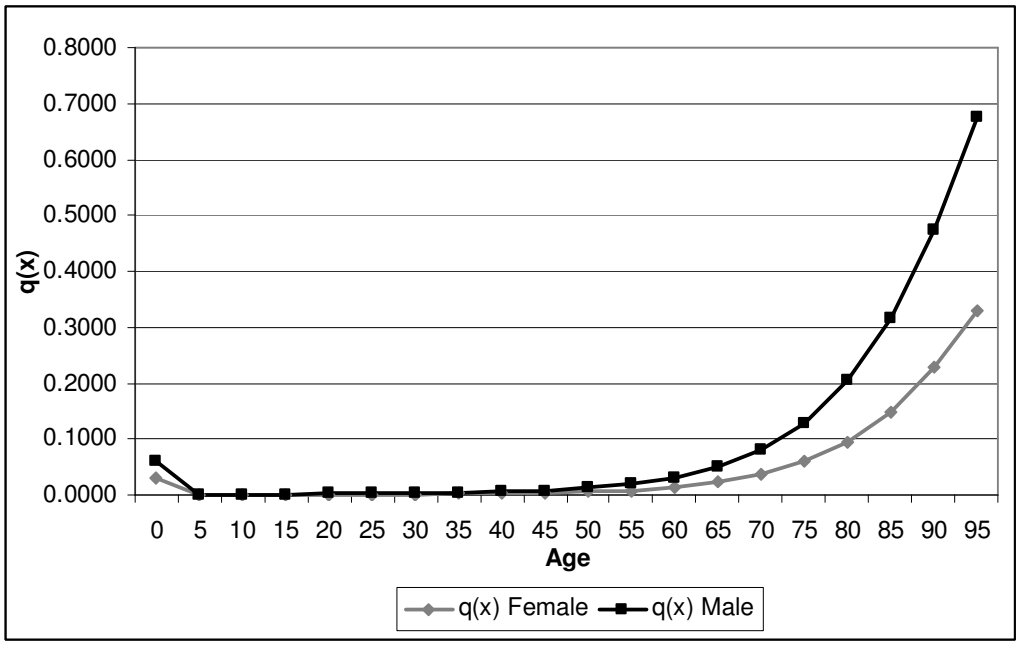


Figure V.1 shows that the interpolated q(x) values for both genders using West Model Life Table which are 5 year age interval. In the first forty year of life, q(x) values shows a similarity for males and females. Death rates of males are higher than females in all age groups except only between age 30 and 40. In this age interval females death rates show an increasing according to males. After age 55, male death rates show an increasing more than females which are 65.1 ‰ for males and 48.6 ‰ for females.

Interpolated q(x) values have assisted the construction of single-year q(x) values. These q(x) values have constructed using with UNABR applications of MORTPAK (United Nations, 1988).

The basic purpose of UNABR application of MORTPAK is to produce a smooth set of q(x) values and to estimate single-year probabilities of dying and survivors. The mortality probabilities in five-year age groups are graduated by use of an eight-parameter formula of Heligman and Pollard (1980). These parameters are

estimated by least squares criteria, minimizing the sum of squares of the proportional differences of the fitted from the observed mortality probabilities, after regrouping into five-year age groups. The least squares fitting criterion produces a smoothed set of q(x) values and single-year q(x) values (United Nations, 1988). After that, these values assist to calculate the other columns of Turkey Mortality Tables.

Table V.1 Turkey Female Mortality Table (2001) (From The Infant Mortality Rate)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
0	100,000	2,880	0.02880	0.97120	0.02922	0.98370	98,560	7,074,291	70.74
1	97,120	333	0.00343	0.99657	0.00343	0.99734	96,954	6,975,731	71.83
2	96,787	182	0.00188	0.99812	0.00188	0.99842	96,696	6,878,778	71.07
3	96,605	124	0.00128	0.99872	0.00128	0.99887	96,543	6,782,082	70.20
4	96,481	94	0.00097	0.99903	0.00097	0.99912	96,434	6,685,539	69.29
5	96,387	75	0.00078	0.99922	0.00078	0.99928	96,350	6,589,105	68.36
6	96,312	63	0.00065	0.99935	0.00065	0.99939	96,281	6,492,755	67.41
7	96,249	55	0.00057	0.99943	0.00057	0.99946	96,222	6,396,475	66.46
8	96,194	49	0.00051	0.99949	0.00051	0.99950	96,170	6,300,253	65.50
9	96,145	47	0.00049	0.99951	0.00049	0.99952	96,122	6,204,084	64.53
10	96,098	46	0.00048	0.99952	0.00048	0.99952	96,075	6,107,962	63.56
11	96,052	46	0.00048	0.99952	0.00048	0.99951	96,029	6,011,887	62.59
12	96,006	49	0.00051	0.99949	0.00051	0.99947	95,982	5,915,858	61.62
13	95,957	52	0.00054	0.99946	0.00054	0.99943	95,931	5,819,877	60.65
14	95,905	57	0.00059	0.99941	0.00059	0.99938	95,877	5,723,946	59.68
15	95,848	62	0.00065	0.99935	0.00065	0.99933	95,817	5,628,069	58.72
16	95,786	67	0.00070	0.99930	0.00070	0.99926	95,753	5,532,252	57.76
17	95,719	74	0.00077	0.99923	0.00077	0.99920	95,682	5,436,500	56.80
18	95,645	80	0.00084	0.99916	0.00084	0.99913	95,605	5,340,818	55.84
19	95,565	87	0.00091	0.99909	0.00091	0.99905	95,522	5,245,213	54.89
20	95,478	94	0.00098	0.99902	0.00099	0.99898	95,431	5,149,691	53.94
21	95,384	100	0.00105	0.99895	0.00105	0.99892	95,334	5,054,260	52.99
22	95,284	106	0.00111	0.99889	0.00111	0.99885	95,231	4,958,926	52.04
23	95,178	113	0.00119	0.99881	0.00119	0.99878	95,122	4,863,695	51.10
24	95,065	119	0.00125	0.99875	0.00125	0.99872	95,006	4,768,574	50.16
25	94,946	124	0.00131	0.99869	0.00131	0.99866	94,884	4,673,568	49.22
26	94,822	130	0.00137	0.99863	0.00137	0.99860	94,757	4,578,684	48.29
27	94,692	135	0.00143	0.99857	0.00143	0.99854	94,625	4,483,927	47.35
28	94,557	142	0.00150	0.99850	0.00150	0.99848	94,486	4,389,303	46.42

Table V.1 Turkey Female Mortality Table (2001) (From The Infant Mortality Rate) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
29	94,415	146	0.00155	0.99845	0.00155	0.99842	94,342	4,294,817	45.49
30	94,269	152	0.00161	0.99839	0.00161	0.99835	94,193	4,200,475	44.56
31	94,117	159	0.00169	0.99831	0.00169	0.99828	94,038	4,106,282	43.63
32	93,958	164	0.00175	0.99825	0.00175	0.99822	93,876	4,012,244	42.70
33	93,794	170	0.00181	0.99819	0.00181	0.99814	93,709	3,918,368	41.78
34	93,624	178	0.00190	0.99810	0.00190	0.99806	93,535	3,824,659	40.85
35	93,446	185	0.00198	0.99802	0.00198	0.99797	93,354	3,731,124	39.93
36	93,261	194	0.00208	0.99792	0.00208	0.99787	93,164	3,637,771	39.01
37	93,067	202	0.00217	0.99783	0.00217	0.99777	92,966	3,544,607	38.09
38	92,865	213	0.00229	0.99771	0.00230	0.99764	92,759	3,451,641	37.17
39	92,652	224	0.00242	0.99758	0.00242	0.99751	92,540	3,358,882	36.25
40	92,428	236	0.00255	0.99745	0.00256	0.99737	92,310	3,266,342	35.34
41	92,192	250	0.00271	0.99729	0.00272	0.99720	92,067	3,174,032	34.43
42	91,942	266	0.00289	0.99711	0.00290	0.99700	91,809	3,081,965	33.52
43	91,676	284	0.00310	0.99690	0.00310	0.99679	91,534	2,990,156	32.62
44	91,392	303	0.00332	0.99668	0.00332	0.99656	91,241	2,898,622	31.72
45	91,089	324	0.00356	0.99644	0.00356	0.99630	90,927	2,807,382	30.82
46	90,765	348	0.00383	0.99617	0.00384	0.99601	90,591	2,716,455	29.93
47	90,417	375	0.00415	0.99585	0.00416	0.99568	90,230	2,625,864	29.04
48	90,042	405	0.00450	0.99550	0.00451	0.99531	89,840	2,535,634	28.16
49	89,637	438	0.00489	0.99511	0.00490	0.99490	89,418	2,445,795	27.29
50	89,199	474	0.00531	0.99469	0.00533	0.99445	88,962	2,356,377	26.42
51	88,725	514	0.00579	0.99421	0.00581	0.99394	88,468	2,267,415	25.56
52	88,211	559	0.00634	0.99366	0.00636	0.99336	87,932	2,178,947	24.70
53	87,652	608	0.00694	0.99306	0.00696	0.99274	87,348	2,091,015	23.86
54	87,044	661	0.00759	0.99241	0.00762	0.99204	86,714	2,003,667	23.02
55	86,383	720	0.00833	0.99167	0.00837	0.99125	86,023	1,916,954	22.19
56	85,663	785	0.00916	0.99084	0.00921	0.99038	85,271	1,830,931	21.37
57	84,878	855	0.01007	0.98993	0.01012	0.98943	84,451	1,745,660	20.57

Table V.1 Turkey Female Mortality Table (2001) (From The Infant Mortality Rate) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
58	84,023	931	0.01108	0.98892	0.01114	0.98836	83,558	1,661,210	19.77
59	83,092	1,015	0.01222	0.98778	0.01229	0.98717	82,585	1,577,652	18.99
60	82,077	1,104	0.01345	0.98655	0.01354	0.98586	81,525	1,495,068	18.22
61	80,973	1,201	0.01483	0.98517	0.01494	0.98440	80,373	1,413,543	17.46
62	79,772	1,306	0.01637	0.98363	0.01651	0.98279	79,119	1,333,170	16.71
63	78,466	1,417	0.01806	0.98194	0.01822	0.98101	77,758	1,254,051	15.98
64	77,049	1,536	0.01994	0.98006	0.02014	0.97904	76,281	1,176,294	15.27
65	75,513	1,662	0.02201	0.97799	0.02225	0.97686	74,682	1,100,013	14.57
66	73,851	1,795	0.02431	0.97569	0.02460	0.97445	72,954	1,025,331	13.88
67	72,056	1,933	0.02683	0.97317	0.02719	0.97180	71,090	952,377	13.22
68	70,123	2,077	0.02962	0.97038	0.03006	0.96886	69,085	881,288	12.57
69	68,046	2,225	0.03270	0.96730	0.03324	0.96563	66,934	812,203	11.94
70	65,821	2,376	0.03610	0.96390	0.03676	0.96206	64,633	745,270	11.32
71	63,445	2,528	0.03985	0.96015	0.04066	0.95815	62,181	680,637	10.73
72	60,917	2,677	0.04395	0.95605	0.04493	0.95383	59,579	618,456	10.15
73	58,240	2,824	0.04849	0.95151	0.04969	0.94909	56,828	558,877	9.60
74	55,416	2,962	0.05345	0.94655	0.05492	0.94390	53,935	502,049	9.06
75	52,454	3,090	0.05891	0.94109	0.06070	0.93819	50,909	448,114	8.54
76	49,364	3,203	0.06489	0.93511	0.06706	0.93195	47,763	397,205	8.05
77	46,161	3,297	0.07142	0.92858	0.07407	0.92513	44,513	349,443	7.57
78	42,864	3,368	0.07857	0.92143	0.08179	0.91768	41,180	304,930	7.11
79	39,496	3,412	0.08639	0.91361	0.09029	0.90955	37,790	263,750	6.68
80	36,084	3,424	0.09489	0.90511	0.09962	0.90072	34,372	225,960	6.26
81	32,660	3,401	0.10413	0.89587	0.10985	0.89112	30,960	191,588	5.87
82	29,259	3,341	0.11419	0.88581	0.12110	0.88069	27,589	160,629	5.49
83	25,918	3,242	0.12509	0.87491	0.13343	0.86945	24,297	133,040	5.13
84	22,676	3,102	0.13680	0.86320	0.14684	0.85733	21,125	108,743	4.80
85	19,574	2,926	0.14948	0.85052	0.16156	0.84424	18,111	87,618	4.48
86	16,648	2,716	0.16314	0.83686	0.17763	0.83018	15,290	69,507	4.18

Table V.1 Turkey Female Mortality Table (2001) (From The Infant Mortality Rate) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
87	13,932	2,477	0.17779	0.82221	0.19514	0.81518	12,694	54,217	3.89
88	11,455	2,215	0.19337	0.80663	0.21406	0.79918	10,348	41,524	3.62
89	9,240	1,941	0.21006	0.78994	0.23472	0.78215	8,270	31,176	3.37
90	7,299	1,662	0.22770	0.77230	0.25696	0.76415	6,468	22,907	3.14
91	5,637	1,389	0.24641	0.75359	0.28103	0.74517	4,943	16,439	2.92
92	4,248	1,130	0.26601	0.73399	0.30682	0.72509	3,683	11,496	2.71
93	3,118	895	0.28704	0.71296	0.33514	0.70399	2,671	7,813	2.51
94	2,223	686	0.30859	0.69141	0.36489	0.68245	1,880	5,143	2.31
95	1,537	508	0.33051	0.66949	0.39595	0.65978	1,283	3,263	2.12
96	1,029	365	0.35471	0.64529	0.43119	0.63615	847	1,980	1.92
97	664	251	0.37801	0.62199	0.46611	0.61281	539	1,133	1.71
98	413	166	0.40194	0.59806	0.50303	0.58788	330	595	1.44
99	247	106	0.42915	0.57085	0.54639	0.36340	194	265	1.07
100	141	141	1.00000	0.00000	2.00000	0.00000	71	71	0.50

Table V.2 Turkey Male Mortality Table (2001) (From The Infant Mortality Rate)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
0	100,000	3,014	0.03014	0.96986	0.03060	0.98248	98,493	6,860,473	68.60
1	96,986	437	0.00451	0.99549	0.00452	0.99656	96,767	6,761,980	69.72
2	96,549	228	0.00236	0.99764	0.00236	0.99804	96,435	6,665,213	69.03
3	96,321	150	0.00156	0.99844	0.00156	0.99864	96,246	6,568,778	68.20
4	96,170	111	0.00115	0.99885	0.00115	0.99897	96,115	6,472,533	67.30
5	96,060	86	0.00090	0.99910	0.00090	0.99918	96,017	6,376,417	66.38
6	95,973	71	0.00074	0.99926	0.00074	0.99931	95,938	6,280,401	65.44
7	95,902	60	0.00063	0.99937	0.00063	0.99940	95,872	6,184,463	64.49
8	95,842	54	0.00056	0.99944	0.00056	0.99946	95,815	6,088,591	63.53
9	95,788	49	0.00051	0.99949	0.00051	0.99950	95,764	5,992,775	62.56
10	95,739	47	0.00049	0.99951	0.00049	0.99951	95,716	5,897,012	61.59
11	95,693	47	0.00049	0.99951	0.00049	0.99950	95,669	5,801,296	60.62
12	95,646	50	0.00052	0.99948	0.00052	0.99945	95,621	5,705,626	59.65
13	95,596	56	0.00059	0.99941	0.00059	0.99937	95,568	5,610,006	58.68
14	95,540	65	0.00068	0.99932	0.00068	0.99927	95,507	5,514,438	57.72
15	95,475	75	0.00079	0.99921	0.00079	0.99915	95,437	5,418,931	56.76
16	95,399	87	0.00091	0.99909	0.00091	0.99903	95,356	5,323,494	55.80
17	95,312	99	0.00104	0.99896	0.00104	0.99891	95,263	5,228,138	54.85
18	95,213	109	0.00115	0.99885	0.00115	0.99880	95,158	5,132,875	53.91
19	95,104	119	0.00125	0.99875	0.00125	0.99871	95,044	5,037,717	52.97
20	94,985	127	0.00134	0.99866	0.00134	0.99864	94,921	4,942,673	52.04
21	94,858	132	0.00139	0.99861	0.00139	0.99859	94,792	4,847,752	51.11
22	94,726	135	0.00143	0.99857	0.00143	0.99856	94,658	4,752,960	50.18
23	94,590	138	0.00146	0.99854	0.00146	0.99854	94,521	4,658,302	49.25
24	94,452	139	0.00147	0.99853	0.00147	0.99853	94,383	4,563,781	48.32
25	94,313	139	0.00147	0.99853	0.00147	0.99853	94,244	4,469,398	47.39
26	94,175	137	0.00146	0.99854	0.00146	0.99854	94,106	4,375,154	46.46
27	94,037	137	0.00146	0.99854	0.00146	0.99854	93,969	4,281,048	45.53
28	93,900	138	0.00147	0.99853	0.00147	0.99853	93,831	4,187,080	44.59

Table V.2 Turkey Male Mortality Table (2001) (From The Infant Mortality Rate) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
29	93,762	139	0.00148	0.99852	0.00148	0.99851	93,692	4,093,249	43.66
30	93,623	140	0.00150	0.99850	0.00150	0.99849	93,553	3,999,556	42.72
31	93,483	143	0.00153	0.99847	0.00153	0.99845	93,411	3,906,004	41.78
32	93,340	147	0.00158	0.99842	0.00158	0.99839	93,266	3,812,593	40.85
33	93,192	153	0.00164	0.99836	0.00164	0.99832	93,116	3,719,327	39.91
34	93,039	160	0.00172	0.99828	0.00172	0.99823	92,959	3,626,211	38.98
35	92,879	169	0.00182	0.99818	0.00182	0.99812	92,795	3,533,252	38.04
36	92,710	181	0.00195	0.99805	0.00195	0.99798	92,620	3,440,457	37.11
37	92,529	193	0.00209	0.99791	0.00209	0.99783	92,433	3,347,837	36.18
38	92,336	208	0.00225	0.99775	0.00225	0.99766	92,232	3,255,404	35.26
39	92,128	225	0.00244	0.99756	0.00244	0.99746	92,016	3,163,172	34.33
40	91,903	244	0.00265	0.99735	0.00265	0.99723	91,782	3,071,156	33.42
41	91,660	265	0.00289	0.99711	0.00289	0.99698	91,528	2,979,375	32.50
42	91,395	288	0.00315	0.99685	0.00315	0.99670	91,251	2,887,847	31.60
43	91,107	314	0.00345	0.99655	0.00346	0.99639	90,950	2,796,596	30.70
44	90,793	343	0.00378	0.99622	0.00379	0.99604	90,621	2,705,646	29.80
45	90,450	375	0.00415	0.99585	0.00416	0.99565	90,262	2,615,025	28.91
46	90,074	411	0.00456	0.99544	0.00457	0.99522	89,869	2,524,763	28.03
47	89,664	449	0.00501	0.99499	0.00502	0.99475	89,439	2,434,894	27.16
48	89,214	491	0.00550	0.99450	0.00552	0.99423	88,969	2,345,455	26.29
49	88,724	537	0.00605	0.99395	0.00607	0.99365	88,455	2,256,486	25.43
50	88,187	587	0.00666	0.99334	0.00668	0.99301	87,893	2,168,031	24.58
51	87,600	642	0.00733	0.99267	0.00736	0.99231	87,278	2,080,138	23.75
52	86,957	701	0.00806	0.99194	0.00809	0.99154	86,607	1,992,859	22.92
53	86,257	765	0.00887	0.99113	0.00891	0.99069	85,874	1,906,252	22.10
54	85,491	834	0.00976	0.99024	0.00981	0.98975	85,074	1,820,378	21.29
55	84,657	910	0.01075	0.98925	0.01081	0.98871	84,202	1,735,304	20.50
56	83,747	991	0.01183	0.98817	0.01190	0.98758	83,252	1,651,102	19.72
57	82,756	1,077	0.01301	0.98699	0.01310	0.98634	82,218	1,567,850	18.95

Table V.2 Turkey Male Mortality Table (2001) (From The Infant Mortality Rate) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
58	81,680	1,170	0.01432	0.98568	0.01442	0.98497	81,095	1,485,632	18.19
59	80,510	1,269	0.01576	0.98424	0.01589	0.98346	79,876	1,404,537	17.45
60	79,241	1,373	0.01733	0.98267	0.01748	0.98181	78,555	1,324,662	16.72
61	77,868	1,485	0.01907	0.98093	0.01925	0.97999	77,125	1,246,107	16.00
62	76,383	1,602	0.02097	0.97903	0.02119	0.97800	75,582	1,168,982	15.30
63	74,781	1,724	0.02306	0.97694	0.02333	0.97581	73,919	1,093,400	14.62
64	73,057	1,852	0.02535	0.97465	0.02568	0.97341	72,131	1,019,481	13.95
65	71,205	1,984	0.02787	0.97213	0.02826	0.97077	70,213	947,350	13.30
66	69,220	2,120	0.03062	0.96938	0.03110	0.96789	68,161	877,138	12.67
67	67,101	2,257	0.03364	0.96636	0.03422	0.96473	65,972	808,977	12.06
68	64,843	2,396	0.03695	0.96305	0.03765	0.96127	63,645	743,005	11.46
69	62,448	2,533	0.04057	0.95943	0.04141	0.95750	61,181	679,360	10.88
70	59,914	2,667	0.04452	0.95548	0.04553	0.95336	58,580	618,179	10.32
71	57,247	2,796	0.04885	0.95115	0.05007	0.94885	55,848	559,598	9.78
72	54,450	2,916	0.05356	0.94644	0.05503	0.94394	52,992	503,750	9.25
73	51,534	3,026	0.05871	0.94129	0.06049	0.93857	50,021	450,758	8.75
74	48,508	3,120	0.06432	0.93568	0.06646	0.93273	46,948	400,737	8.26
75	45,388	3,196	0.07042	0.92958	0.07299	0.92638	43,790	353,789	7.79
76	42,192	3,251	0.07706	0.92294	0.08015	0.91948	40,566	309,999	7.35
77	38,941	3,281	0.08426	0.91574	0.08797	0.91201	37,300	269,432	6.92
78	35,660	3,283	0.09207	0.90793	0.09651	0.90390	34,018	232,132	6.51
79	32,376	3,255	0.10053	0.89947	0.10585	0.89515	30,749	198,114	6.12
80	29,122	3,193	0.10966	0.89034	0.11602	0.88570	27,525	167,366	5.75
81	25,928	3,099	0.11952	0.88048	0.12712	0.87551	24,379	139,841	5.39
82	22,829	2,971	0.13014	0.86986	0.13920	0.86456	21,344	115,462	5.06
83	19,858	2,811	0.14154	0.85846	0.15232	0.85281	18,453	94,118	4.74
84	17,047	2,621	0.15377	0.84623	0.16658	0.84023	15,737	75,666	4.44
85	14,426	2,407	0.16685	0.83315	0.18204	0.82681	13,223	59,929	4.15
86	12,019	2,173	0.18081	0.81919	0.19878	0.81251	10,932	46,706	3.89

Table V.2 Turkey Male Mortality Table (2001) (From The Infant Mortality Rate) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
87	9,846	1,926	0.19565	0.80435	0.21686	0.79732	8,883	35,774	3.63
88	7,920	1,674	0.21141	0.78859	0.23640	0.78124	7,082	26,891	3.40
89	6,245	1,424	0.22807	0.77193	0.25743	0.76428	5,533	19,809	3.17
90	4,821	1,184	0.24563	0.75437	0.28002	0.74643	4,229	14,276	2.96
91	3,637	960	0.26409	0.73591	0.30427	0.72772	3,157	10,047	2.76
92	2,676	758	0.28341	0.71659	0.33020	0.70818	2,297	6,890	2.57
93	1,918	582	0.30356	0.69644	0.35788	0.68784	1,627	4,593	2.39
94	1,336	433	0.32450	0.67550	0.38735	0.66677	1,119	2,966	2.22
95	902	312	0.34616	0.65384	0.41861	0.64502	746	1,848	2.05
96	590	217	0.36848	0.63152	0.45170	0.62266	481	1,101	1.87
97	373	146	0.39138	0.60862	0.48660	0.59977	300	620	1.66
98	227	94	0.41477	0.58523	0.52329	0.57645	180	321	1.41
99	133	58	0.43855	0.56145	0.56172	0.35957	104	141	1.06
100	75	75	1.00000	0.00000	2.00000	0.00000	37	37	0.50

B. CONSTRUCTION OF MORTALITY TABLES FROM ORPHANHOOD METHOD

The second method is synthetic orphanhood method to construct Turkey mortality tables. In this thesis 1998 and 2003 TDHS results were used to adult mortality. In two surveys, the question about the survival status of the parents is asked in the household questionnaire. The question about the survival status of mothers is asked at question number 10 and the question about the survival status of fathers is asked at question number 12 in household questionnaire. These questions are;

- Is ……’s natural mother alive? (Question 10)

- Is ……’s natural father alive? (Question 12)

In these questions “natural” word is used to avoid the adoption effect. If this word is not used in questionnaires, it can affect the results of orphanhood method negatively. According to these questions, the respondents give an answer as “yes”, “no” or “don’t know” and these answers assist to calculate proportions of alive mother and proportions of alive father.

Table V.3 Proportion of Persons Whose Mother/Father Alive in 1998 and 2003 TDHS

	Proportion of Alive Mother		Proportion of Alive Father	
age	1998 TDHS	2003 TDHS	1998 TDHS	2003 TDHS
0 - 4	0.9972	0.9978	0.9942	0.9959
5 - 9	0.9923	0.9944	0.9824	0.9858
10 - 14	0.9823	0.9891	0.9589	0.9658
15 - 19	0.9753	0.9750	0.9203	0.9377
20 - 24	0.9547	0.9585	0.8863	0.8936
25 - 29	0.9228	0.9377	0.7937	0.8276
30 - 34	0.8650	0.8804	0.7083	0.7069
35 - 39	0.8035	0.8061	0.5959	0.5914
40 - 44	0.7190	0.6938	0.4606	0.4653
45 - 49	0.5863	0.6230	0.3247	0.3586
50 - 54	0.3761	0.4577	0.1650	0.2185
55 - 59	0.2113	0.2534	0.0704	0.0976
60 - 64	0.0894	0.1008	0.0266	0.0332
65 - 69	0.0517	0.0463	0.0179	0.0178
70 - 74	0.0233	0.0151	0.0033	0.0043
75+	0.0255	0.0132	0.0153	0.0095

In Table V.3, Figure V.2 and Figure V.3 show that the proportion of persons whose mother/father alive in 1998 and 2003 TDHS. The synthetic orphanhood method assumes that proportion of respondents' age (n) of the first survey will decrease when they pass the next age group (n+5) in the second survey. Because persons are under the risk of dying in that five years.

Figure V.2 1998-2003 Proportion of Alive Mother

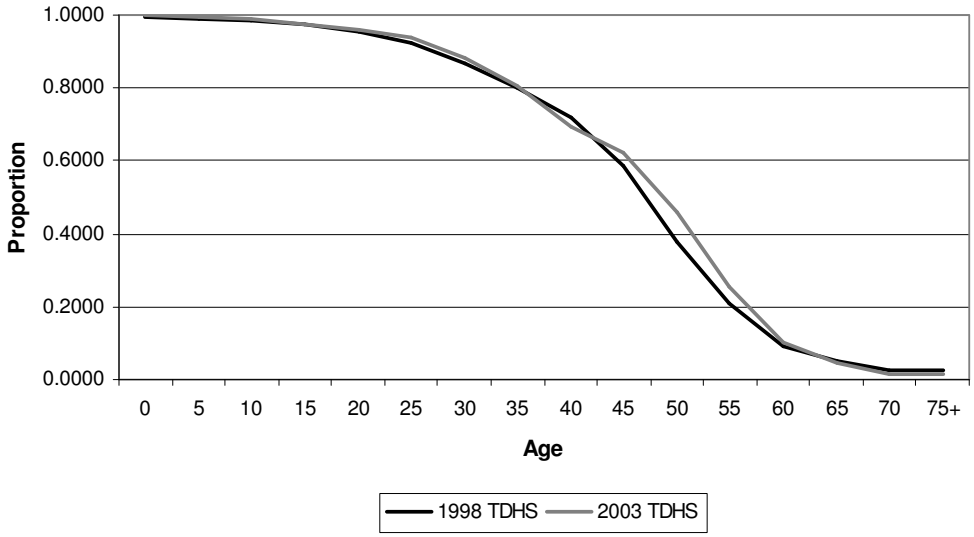
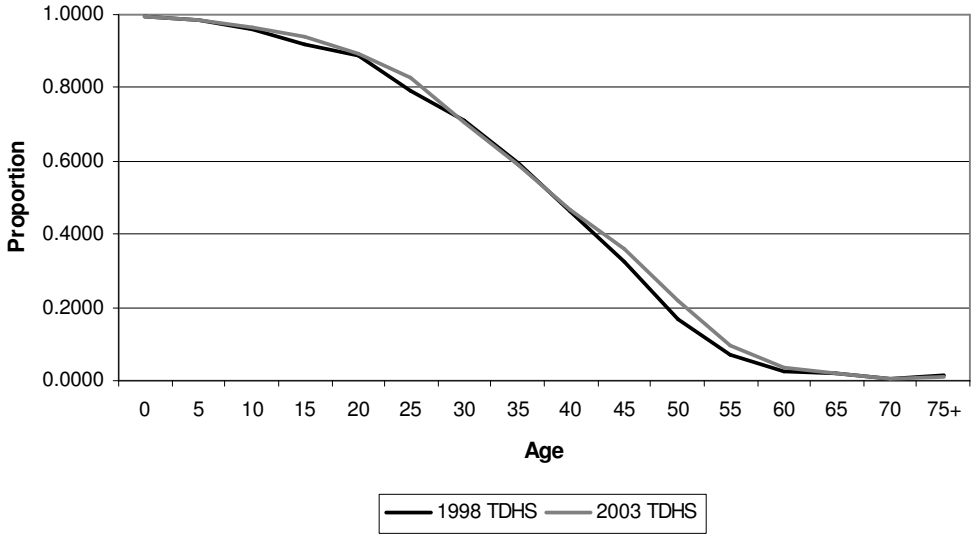


Figure V.3 1998-2003 Proportion of Alive Father



But for synthetic orphanhood method, intersurvey cohort of respondents should be calculated. Table V.4 shows that 1998 and 2003 intersurvey proportion of alive father and mother.

Table V.4 1998 and 2003 intersurvey proportion of alive father and mother.

	1998-2003 intersurvey proportion of alive mother	1998-2003 intersurvey proportion of alive father
0-4	0.9978	0.9959
5-9	0.9950	0.9874
10-14	0.9918	0.9708
15-19	0.9845	0.9494
20-24	0.9675	0.9219
25-29	0.9503	0.8609
30-34	0.9066	0.7667
35-39	0.8449	0.6401
40-44	0.7296	0.4999
45-49	0.6322	0.3892
50-54	0.4936	0.2619
55-59	0.3327	0.1549
60-64	0.1587	0.0730
65-69	0.0822	0.0489
70-74	0.0239	0.0117
75+	0.0136	0.0334

Brass established an equation relating to the female probability of surviving; Hill and Blacker established an equation relating to the male probability of surviving from age 25 to 25+n. These equations have the form:

$$l_{(25+n)} / l_{(25)} = W_{(n)} \cdot S_{(n-5)} + (1-W_{(n)}) \cdot S_{(n)} \qquad \text{for females}$$

$$l_{(35+n)} / l_{(32,5)} = W_{(n)} \cdot S_{(n-5)} + (1-W_{(n)}) \cdot S_{(n)} \qquad \text{for males}$$

Where, S(n) is the proportion of respondents aged from n to n+4 of alive mother or father. W(n) is a weighting factor which is calculated according to mean age at maternity and paternity using interpolation formula. Mean age at maternity can be calculated directly by using TDSH-1998 and 2003 Individual Questionnaire. But it is not possible for the mean age of paternity which can not be calculated directly from data. Therefore, first age of marriage of males subtract from the first age of marriage of females. And than it added to mean age at maternity and later, nine moths pregnancy periods is subtracted from this number. Because males are under the risk of dying in this pregnancy period.

In this thesis, it is used only the last one year data preceding the 1998 and 2003 surveys. So, the average mean age of childbearing can be calculated for 2001.2 as a reference time. Table V.5 shows that the mean age at maternity and paternity for 1998 and 2003. Table V.6 and Table V.7 indicate female and male adult survivorship probabilities which are calculated by Brass formula.

Table V.5 Mean Age of Childbearing for Females and Males

	Mean Age of Childbearing	
	Females	Males
1998	27,09	30,52
2003	26,79	30,73
Average	26,94	30,62

Table V.6 Female Adult Survivorship Probability l(25+n)/l(25)

Age (n)	Weighting factor W(n)	Proportion with mother surviving S(n-5)	Complement of weighing factor (1-W(n))	Proportion with mother surviving S(n)	Female adult survivorship probability l(25+n)/l(25)
20	0.8334	0.9845	0.1666	0.9675	0.9817
25	0.9072	0.9675	0.0928	0.9503	0.9659
30	0.9502	0.9503	0.0498	0.9066	0.9481
35	0.9781	0.9066	0.0219	0.8449	0.9053
40	0.9412	0.8449	0.0588	0.7296	0.8381
45	0.8742	0.7296	0.1258	0.6322	0.7174
50	0.6887	0.6322	0.3113	0.4936	0.5891

Table V.7 Male Adult Survivorship Probability l(35+n)/l(35)

Age (n)	Weighting factor W(n)	Proportion with father surviving S(n-5)	Complement of weighing factor (1-W(n))	Proportion with father surviving S(n)	Male adult survivorship probability l(35+n)/l(35)
20	0.3610	0.9494	0.6390	0.9219	0.9318
25	0.2817	0.9219	0.7183	0.8609	0.8781
30	0.1011	0.8609	0.8989	0.7667	0.7762
35	-0.1090	0.7667	1.1090	0.6401	0.6263
40	-0.4452	0.6401	1.4452	0.4999	0.4375
45	-0.7096	0.4999	1.7096	0.3892	0.3106

Female and male adult survivorship probabilities assist to determine suitable mortality level and than e_{20} values from the west model life table between 1998-2003. So, orphanhood method is important to estimate adult mortality. Because e_{20} value gives already crucial information about adult mortality.

Table V.8 Mean West Level and e_{20} values for 1998-2003 Intersurvey Cohort

	Mean West Level	e_{20}
Female	22,62	55,99
Male	22,17	52,14

COMBIN application of MORTPAK is used to construct abridged life tables which joins the infant and the child mortality rate and estimated e_{20} values by using west model life table. This application produces mortality tables; however these mortality tables are constructed as an abridged mortality table. Thus, UNABR application of MORTPAK is used to transform abridged mortality tables to unabridged mortality tables.

Table V.9 Turkey Female Mortality Table (2001) (From Orphanhood Method)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
0	100,000	2,886	0.02886	0.97114	0.02928	0.98331	98,557	7,285,398	72.85
1	97,114	403	0.00415	0.99585	0.00416	0.99706	96,912	7,186,841	74.00
2	96,711	166	0.00172	0.99828	0.00172	0.99867	96,628	7,089,928	73.31
3	96,545	90	0.00093	0.99907	0.00093	0.99924	96,500	6,993,301	72.44
4	96,455	56	0.00058	0.99942	0.00058	0.99951	96,427	6,896,801	71.50
5	96,399	38	0.00039	0.99961	0.00039	0.99966	96,380	6,800,374	70.54
6	96,361	27	0.00028	0.99972	0.00028	0.99975	96,348	6,703,994	69.57
7	96,334	21	0.00022	0.99978	0.00022	0.99980	96,324	6,607,646	68.59
8	96,313	16	0.00017	0.99983	0.00017	0.99984	96,305	6,511,322	67.61
9	96,297	14	0.00015	0.99985	0.00015	0.99985	96,290	6,415,017	66.62
10	96,282	13	0.00014	0.99986	0.00014	0.99986	96,276	6,318,728	65.63
11	96,269	13	0.00014	0.99986	0.00014	0.99986	96,262	6,222,452	64.64
12	96,255	14	0.00015	0.99985	0.00015	0.99984	96,248	6,126,190	63.65
13	96,241	17	0.00018	0.99982	0.00018	0.99980	96,232	6,029,942	62.65
14	96,224	21	0.00022	0.99978	0.00022	0.99976	96,213	5,933,710	61.67
15	96,202	25	0.00026	0.99974	0.00026	0.99972	96,190	5,837,497	60.68
16	96,177	29	0.00030	0.99970	0.00030	0.99968	96,163	5,741,307	59.69
17	96,149	33	0.00034	0.99966	0.00034	0.99964	96,132	5,645,144	58.71
18	96,116	37	0.00038	0.99962	0.00038	0.99960	96,098	5,549,012	57.73
19	96,079	40	0.00042	0.99958	0.00042	0.99957	96,059	5,452,914	56.75
20	96,039	43	0.00045	0.99955	0.00045	0.99954	96,017	5,356,855	55.78
21	95,996	45	0.00047	0.99953	0.00047	0.99953	95,973	5,260,837	54.80
22	95,951	46	0.00048	0.99952	0.00048	0.99952	95,928	5,164,864	53.83
23	95,905	47	0.00049	0.99951	0.00049	0.99951	95,881	5,068,937	52.85
24	95,858	48	0.00050	0.99950	0.00050	0.99950	95,834	4,973,055	51.88
25	95,810	48	0.00050	0.99950	0.00050	0.99950	95,786	4,877,222	50.91
26	95,762	49	0.00051	0.99949	0.00051	0.99949	95,737	4,781,436	49.93
27	95,713	49	0.00051	0.99949	0.00051	0.99949	95,689	4,685,699	48.96
28	95,664	50	0.00052	0.99948	0.00052	0.99948	95,639	4,590,010	47.98

Table V.9 Turkey Female Mortality Table (2001) (From Orphanhood Method) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
29	95,614	51	0.00053	0.99947	0.00053	0.99947	95,589	4,494,371	47.01
30	95,564	52	0.00054	0.99946	0.00054	0.99945	95,538	4,398,782	46.03
31	95,512	53	0.00056	0.99944	0.00056	0.99943	95,485	4,303,244	45.05
32	95,459	56	0.00059	0.99941	0.00059	0.99940	95,430	4,207,759	44.08
33	95,402	59	0.00062	0.99938	0.00062	0.99936	95,373	4,112,328	43.11
34	95,343	63	0.00066	0.99934	0.00066	0.99932	95,312	4,016,956	42.13
35	95,280	68	0.00071	0.99929	0.00071	0.99926	95,246	3,921,644	41.16
36	95,213	73	0.00077	0.99923	0.00077	0.99920	95,176	3,826,397	40.19
37	95,139	80	0.00084	0.99916	0.00084	0.99912	95,099	3,731,222	39.22
38	95,059	87	0.00092	0.99908	0.00092	0.99904	95,016	3,636,122	38.25
39	94,972	96	0.00101	0.99899	0.00101	0.99894	94,924	3,541,107	37.29
40	94,876	106	0.00112	0.99888	0.00112	0.99882	94,823	3,446,183	36.32
41	94,770	118	0.00125	0.99875	0.00125	0.99868	94,710	3,351,360	35.36
42	94,651	132	0.00139	0.99861	0.00139	0.99853	94,585	3,256,649	34.41
43	94,520	147	0.00155	0.99845	0.00155	0.99836	94,446	3,162,064	33.45
44	94,373	163	0.00173	0.99827	0.00173	0.99817	94,292	3,067,618	32.51
45	94,210	183	0.00194	0.99806	0.00194	0.99795	94,119	2,973,326	31.56
46	94,027	204	0.00217	0.99783	0.00217	0.99770	93,925	2,879,208	30.62
47	93,823	229	0.00244	0.99756	0.00244	0.99742	93,709	2,785,282	29.69
48	93,594	256	0.00273	0.99727	0.00273	0.99710	93,466	2,691,574	28.76
49	93,339	287	0.00307	0.99693	0.00307	0.99675	93,195	2,598,107	27.84
50	93,052	320	0.00344	0.99656	0.00345	0.99635	92,892	2,504,912	26.92
51	92,732	359	0.00387	0.99613	0.00388	0.99590	92,553	2,412,020	26.01
52	92,373	401	0.00434	0.99566	0.00435	0.99540	92,173	2,319,467	25.11
53	91,972	448	0.00487	0.99513	0.00488	0.99483	91,748	2,227,295	24.22
54	91,524	501	0.00547	0.99453	0.00549	0.99419	91,274	2,135,546	23.33
55	91,024	560	0.00615	0.99385	0.00617	0.99348	90,744	2,044,272	22.46
56	90,464	624	0.00690	0.99310	0.00692	0.99268	90,152	1,953,529	21.59
57	89,840	696	0.00775	0.99225	0.00778	0.99177	89,492	1,863,377	20.74

Table V.9 Turkey Female Mortality Table (2001) (From Orphanhood Method) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
58	89,143	776	0.00871	0.99129	0.00875	0.99076	88,755	1,773,885	19.90
59	88,367	864	0.00978	0.99022	0.00983	0.98962	87,935	1,685,130	19.07
60	87,503	961	0.01098	0.98902	0.01104	0.98835	87,022	1,597,195	18.25
61	86,542	1,066	0.01232	0.98768	0.01240	0.98693	86,009	1,510,173	17.45
62	85,476	1,182	0.01383	0.98617	0.01393	0.98533	84,885	1,424,164	16.66
63	84,294	1,308	0.01552	0.98448	0.01564	0.98354	83,640	1,339,279	15.89
64	82,985	1,445	0.01741	0.98259	0.01756	0.98154	82,263	1,255,640	15.13
65	81,541	1,592	0.01953	0.98047	0.01972	0.97930	80,744	1,173,377	14.39
66	79,948	1,751	0.02190	0.97810	0.02214	0.97679	79,073	1,092,632	13.67
67	78,197	1,920	0.02455	0.97545	0.02486	0.97398	77,237	1,013,559	12.96
68	76,278	2,099	0.02752	0.97248	0.02790	0.97085	75,228	936,322	12.28
69	74,178	2,287	0.03083	0.96917	0.03131	0.96735	73,035	861,094	11.61
70	71,891	2,482	0.03452	0.96548	0.03513	0.96346	70,651	788,059	10.96
71	69,410	2,682	0.03864	0.96136	0.03940	0.95911	68,069	717,409	10.34
72	66,728	2,885	0.04323	0.95677	0.04419	0.95427	65,285	649,340	9.73
73	63,843	3,086	0.04834	0.95166	0.04954	0.94889	62,300	584,054	9.15
74	60,757	3,282	0.05402	0.94598	0.05552	0.94292	59,116	521,754	8.59
75	57,475	3,467	0.06032	0.93968	0.06220	0.93630	55,741	462,638	8.05
76	54,008	3,635	0.06730	0.93270	0.06964	0.92897	52,191	406,897	7.53
77	50,373	3,780	0.07503	0.92497	0.07795	0.92087	48,483	354,706	7.04
78	46,594	3,893	0.08356	0.91644	0.08720	0.91194	44,647	306,223	6.57
79	42,700	3,970	0.09297	0.90703	0.09750	0.90211	40,715	261,576	6.13
80	38,731	4,002	0.10332	0.89668	0.10895	0.89131	36,730	220,860	5.70
81	34,729	3,983	0.11468	0.88532	0.12166	0.87949	32,738	184,131	5.30
82	30,746	3,908	0.12710	0.87290	0.13573	0.86658	28,792	151,393	4.92
83	26,838	3,775	0.14066	0.85934	0.15130	0.85252	24,951	122,601	4.57
84	23,063	3,584	0.15541	0.84459	0.16850	0.83727	21,271	97,650	4.23
85	19,479	3,339	0.17140	0.82860	0.18747	0.82078	17,810	76,379	3.92
86	16,140	3,045	0.18866	0.81134	0.20831	0.80302	14,618	58,569	3.63

Table V.9 Turkey Female Mortality Table (2001) (From Orphanhood Method) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
87	13,095	2,714	0.20723	0.79277	0.23118	0.78398	11,738	43,951	3.36
88	10,382	2,358	0.22711	0.77289	0.25620	0.76365	9,203	32,213	3.10
89	8,024	1,992	0.24830	0.75170	0.28350	0.74205	7,028	23,010	2.87
90	6,031	1,633	0.27078	0.72922	0.31318	0.71922	5,215	15,983	2.65
91	4,398	1,295	0.29450	0.70550	0.34535	0.69521	3,751	10,768	2.45
92	3,103	991	0.31938	0.68062	0.38007	0.67011	2,607	7,017	2.26
93	2,112	729	0.34534	0.65466	0.41742	0.64401	1,747	4,410	2.09
94	1,383	515	0.37225	0.62775	0.45738	0.61706	1,125	2,663	1.93
95	868	347	0.39997	0.60003	0.49995	0.58938	694	1,537	1.77
96	521	223	0.42836	0.57164	0.54511	0.56114	409	843	1.62
97	298	136	0.45722	0.54278	0.59272	0.53252	230	434	1.46
98	162	79	0.48637	0.51363	0.64265	0.50370	122	204	1.26
99	83	43	0.51562	0.48438	0.69473	0.32632	62	82	0.98
100	40	40	1.00000	0.00000	2.00000	0.00000	20	20	0.50

Table V.10 Turkey Male Mortality Table (2001) (From Orphanhood Method)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
0	100,000	3,010	0.03010	0.96990	0.03056	0.98253	98,495	6,865,775	68.66
1	96,990	432	0.00445	0.99555	0.00446	0.99660	96,774	6,767,280	69.77
2	96,558	227	0.00235	0.99765	0.00235	0.99804	96,445	6,670,506	69.08
3	96,331	150	0.00156	0.99844	0.00156	0.99864	96,256	6,574,061	68.24
4	96,181	111	0.00115	0.99885	0.00115	0.99897	96,126	6,477,804	67.35
5	96,071	87	0.00091	0.99909	0.00091	0.99917	96,027	6,381,679	66.43
6	95,983	72	0.00075	0.99925	0.00075	0.99930	95,947	6,285,652	65.49
7	95,911	61	0.00064	0.99936	0.00064	0.99939	95,880	6,189,705	64.54
8	95,850	55	0.00057	0.99943	0.00057	0.99945	95,822	6,093,824	63.58
9	95,795	50	0.00052	0.99948	0.00052	0.99949	95,770	5,998,002	62.61
10	95,745	47	0.00049	0.99951	0.00049	0.99951	95,722	5,902,231	61.65
11	95,698	47	0.00049	0.99951	0.00049	0.99950	95,675	5,806,509	60.68
12	95,652	49	0.00051	0.99949	0.00051	0.99946	95,627	5,710,834	59.70
13	95,603	54	0.00057	0.99943	0.00057	0.99939	95,576	5,615,207	58.73
14	95,548	62	0.00065	0.99935	0.00065	0.99930	95,517	5,519,632	57.77
15	95,486	72	0.00075	0.99925	0.00075	0.99919	95,450	5,424,114	56.81
16	95,415	83	0.00087	0.99913	0.00087	0.99907	95,373	5,328,664	55.85
17	95,332	95	0.00100	0.99900	0.00100	0.99894	95,284	5,233,291	54.90
18	95,236	107	0.00112	0.99888	0.00112	0.99883	95,183	5,138,007	53.95
19	95,130	116	0.00122	0.99878	0.00122	0.99874	95,072	5,042,824	53.01
20	95,013	124	0.00131	0.99869	0.00131	0.99866	94,951	4,947,753	52.07
21	94,889	130	0.00137	0.99863	0.00137	0.99861	94,824	4,852,802	51.14
22	94,759	134	0.00141	0.99859	0.00141	0.99858	94,692	4,757,978	50.21
23	94,625	136	0.00144	0.99856	0.00144	0.99856	94,557	4,663,285	49.28
24	94,489	137	0.00145	0.99855	0.00145	0.99855	94,421	4,568,728	48.35
25	94,352	138	0.00146	0.99854	0.00146	0.99854	94,283	4,474,307	47.42
26	94,214	138	0.00146	0.99854	0.00146	0.99854	94,146	4,380,024	46.49
27	94,077	137	0.00146	0.99854	0.00146	0.99854	94,008	4,285,879	45.56
28	93,939	137	0.00146	0.99854	0.00146	0.99854	93,871	4,191,870	44.62

Table V.10 Turkey Male Mortality Table (2001) (From Orphanhood Method) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
29	93,802	138	0.00147	0.99853	0.00147	0.99852	93,733	4,097,999	43.69
30	93,664	140	0.00149	0.99851	0.00149	0.99850	93,595	4,004,266	42.75
31	93,525	142	0.00152	0.99848	0.00152	0.99846	93,454	3,910,671	41.81
32	93,383	147	0.00157	0.99843	0.00157	0.99840	93,309	3,817,218	40.88
33	93,236	152	0.00163	0.99837	0.00163	0.99833	93,160	3,723,908	39.94
34	93,084	160	0.00172	0.99828	0.00172	0.99824	93,004	3,630,748	39.01
35	92,924	168	0.00181	0.99819	0.00181	0.99813	92,840	3,537,744	38.07
36	92,756	179	0.00193	0.99807	0.00193	0.99800	92,666	3,444,904	37.14
37	92,577	193	0.00208	0.99792	0.00208	0.99784	92,481	3,352,238	36.21
38	92,384	207	0.00224	0.99776	0.00224	0.99767	92,281	3,259,757	35.28
39	92,177	223	0.00242	0.99758	0.00242	0.99748	92,066	3,167,476	34.36
40	91,954	242	0.00263	0.99737	0.00263	0.99725	91,833	3,075,411	33.45
41	91,712	263	0.00287	0.99713	0.00287	0.99700	91,581	2,983,577	32.53
42	91,449	287	0.00314	0.99686	0.00314	0.99672	91,306	2,891,997	31.62
43	91,162	313	0.00343	0.99657	0.00344	0.99640	91,006	2,800,691	30.72
44	90,849	343	0.00377	0.99623	0.00378	0.99605	90,678	2,709,685	29.83
45	90,507	374	0.00413	0.99587	0.00414	0.99567	90,320	2,619,007	28.94
46	90,133	409	0.00454	0.99546	0.00455	0.99524	89,928	2,528,687	28.06
47	89,724	448	0.00499	0.99501	0.00500	0.99477	89,500	2,438,759	27.18
48	89,276	489	0.00548	0.99452	0.00550	0.99425	89,032	2,349,259	26.31
49	88,787	535	0.00603	0.99397	0.00605	0.99367	88,519	2,260,227	25.46
50	88,252	585	0.00663	0.99337	0.00665	0.99304	87,959	2,171,708	24.61
51	87,666	640	0.00730	0.99270	0.00733	0.99234	87,346	2,083,749	23.77
52	87,026	699	0.00803	0.99197	0.00806	0.99157	86,677	1,996,403	22.94
53	86,328	763	0.00884	0.99116	0.00888	0.99072	85,946	1,909,726	22.12
54	85,564	833	0.00973	0.99027	0.00978	0.98978	85,148	1,823,779	21.31
55	84,732	907	0.01071	0.98929	0.01077	0.98875	84,278	1,738,631	20.52
56	83,824	988	0.01179	0.98821	0.01186	0.98762	83,330	1,654,353	19.74
57	82,836	1,074	0.01297	0.98703	0.01305	0.98638	82,299	1,571,023	18.97

Table V.10 Turkey Male Mortality Table (2001) (From Orphanhood Method) (Continued)

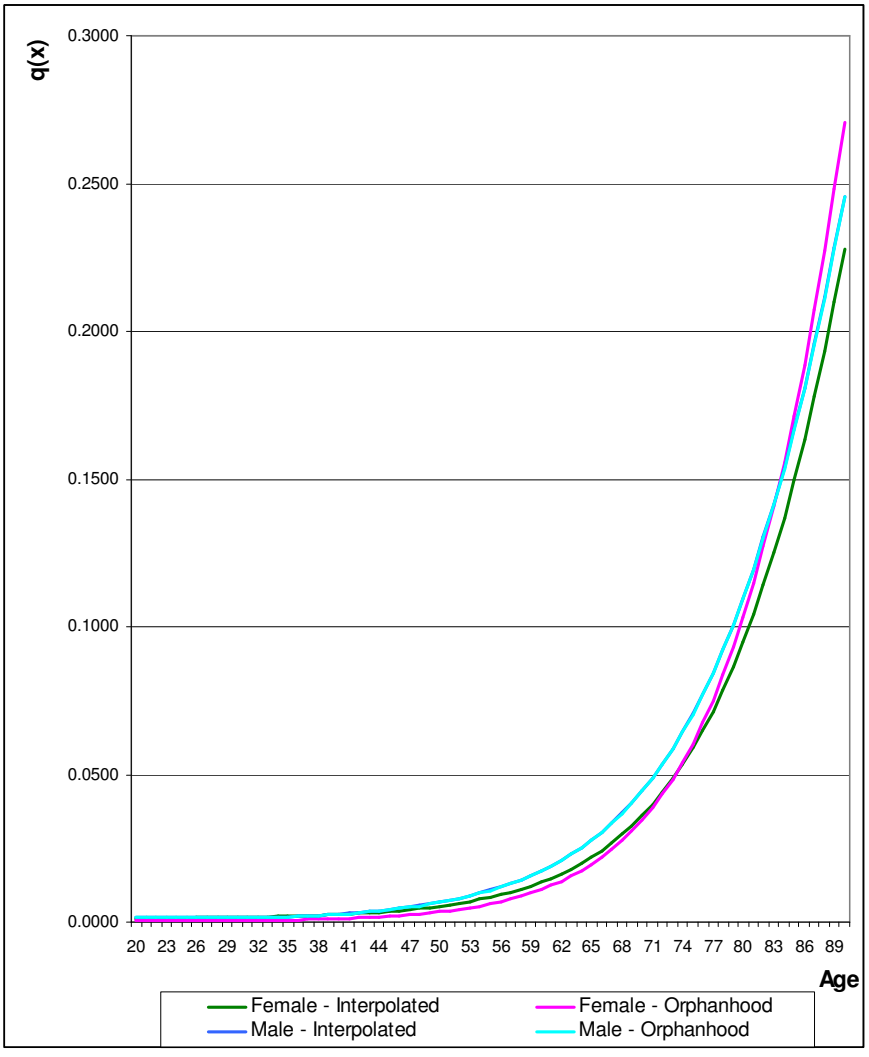
x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
58	81,762	1,167	0.01427	0.98573	0.01437	0.98502	81,178	1,488,724	18.21
59	80,595	1,266	0.01571	0.98429	0.01583	0.98351	79,962	1,407,545	17.46
60	79,329	1,371	0.01728	0.98272	0.01743	0.98186	78,644	1,327,583	16.74
61	77,958	1,482	0.01901	0.98099	0.01919	0.98005	77,217	1,248,940	16.02
62	76,476	1,599	0.02091	0.97909	0.02113	0.97806	75,677	1,171,723	15.32
63	74,877	1,721	0.02299	0.97701	0.02326	0.97588	74,016	1,096,046	14.64
64	73,156	1,849	0.02528	0.97472	0.02560	0.97348	72,231	1,022,030	13.97
65	71,306	1,982	0.02779	0.97221	0.02818	0.97085	70,315	949,799	13.32
66	69,325	2,117	0.03054	0.96946	0.03101	0.96798	68,266	879,484	12.69
67	67,207	2,255	0.03355	0.96645	0.03412	0.96483	66,080	811,218	12.07
68	64,953	2,394	0.03685	0.96315	0.03754	0.96138	63,756	745,138	11.47
69	62,559	2,531	0.04046	0.95954	0.04130	0.95761	61,294	681,382	10.89
70	60,028	2,666	0.04441	0.95559	0.04542	0.95348	58,695	620,088	10.33
71	57,362	2,795	0.04873	0.95127	0.04995	0.94897	55,965	561,393	9.79
72	54,567	2,916	0.05344	0.94656	0.05491	0.94406	53,109	505,429	9.26
73	51,651	3,026	0.05858	0.94142	0.06035	0.93870	50,138	452,320	8.76
74	48,625	3,121	0.06418	0.93582	0.06631	0.93288	47,065	402,182	8.27
75	45,504	3,198	0.07027	0.92973	0.07283	0.92654	43,906	355,117	7.80
76	42,307	3,253	0.07690	0.92310	0.07998	0.91965	40,680	311,211	7.36
77	39,053	3,284	0.08409	0.91591	0.08778	0.91218	37,411	270,531	6.93
78	35,769	3,287	0.09189	0.90811	0.09632	0.90409	34,126	233,120	6.52
79	32,483	3,259	0.10034	0.89966	0.10564	0.89534	30,853	198,994	6.13
80	29,223	3,199	0.10947	0.89053	0.11581	0.88589	27,624	168,141	5.75
81	26,024	3,105	0.11932	0.88068	0.12689	0.87572	24,472	140,517	5.40
82	22,919	2,978	0.12992	0.87008	0.13895	0.86478	21,430	116,046	5.06
83	19,941	2,818	0.14132	0.85868	0.15206	0.85303	18,532	94,616	4.74
84	17,123	2,629	0.15354	0.84646	0.16631	0.84047	15,809	76,083	4.44
85	14,494	2,415	0.16661	0.83339	0.18175	0.82705	13,287	60,275	4.16
86	12,079	2,181	0.18056	0.81944	0.19848	0.81276	10,989	46,988	3.89

Table V.10 Turkey Male Mortality Table (2001) (From Orphanhood Method) (Continued)

x	lx	dx	qx	px	mx	Sx	Lx	Tx	ex
87	9,898	1,934	0.19540	0.80460	0.21656	0.79758	8,931	35,999	3.64
88	7,964	1,682	0.21115	0.78885	0.23607	0.78150	7,123	27,068	3.40
89	6,282	1,431	0.22781	0.77219	0.25709	0.76454	5,567	19,945	3.17
90	4,851	1,190	0.24537	0.75463	0.27968	0.74669	4,256	14,378	2.96
91	3,661	966	0.26383	0.73617	0.30392	0.72798	3,178	10,122	2.76
92	2,695	763	0.28315	0.71685	0.32985	0.70844	2,314	6,944	2.58
93	1,932	586	0.30330	0.69670	0.35752	0.68810	1,639	4,630	2.40
94	1,346	436	0.32424	0.67576	0.38698	0.66702	1,128	2,991	2.22
95	910	315	0.34591	0.65409	0.41825	0.64526	752	1,864	2.05
96	595	219	0.36824	0.63176	0.45134	0.62289	485	1,111	1.87
97	376	147	0.39114	0.60886	0.48623	0.60000	302	626	1.67
98	229	95	0.41454	0.58546	0.52293	0.57668	181	324	1.41
99	134	59	0.43833	0.56167	0.56136	0.35966	105	142	1.06
100	75	75	1.00000	0.00000	2.00000	0.00000	38	38	0.50

The mortality tables are constructed with two different methods. When investigating these tables, q(x) values show similarities among two methods for both genders. Especially, under 75 mortality of both genders has a close values. Therefore in this thesis, Orphanhood method is selected as a representative method for Turkey. Moreover, constructed mortality tables from orphanhood are a representative mortality table for Turkey. Thus, other calculations which are net insurance premium payment or installment premium payment will be made from these tables. Figure V.4 shows that the q(x) values of constructed Turkey mortality tables.

Figure V.4 q(x) values of Turkey Mortality Tables



CHAPTER VI
CONSTRUCTION OF COMMUTATION TABLES FOR TURKEY

A. INTERNATIONAL ACTUARIAL NOTATIONS

The existing international actuarial notation was founded by George King that is explained in the Institute of Actuaries Text-Book, Part II, Life Contingencies. And later, it is symbolized unanimously by the Second International Actuarial Congress held in London in May 1898. Later, in the Third International Congress, Dr Sprague rearranged the symbols in different orders and grouped them on different principles but did not introduce any changes in the symbols themselves beyond two slight additions in June 1900 in Paris. This Committee met in Brussels in July 1938 and again in July 1939, and certain changes would have been proposed for adoption at Lucerne in 1940. After that American Institute and Faculty of Actuaries and Fourteenth International Actuary Congress smoothed the last shape in 1950 and 1954.

Each fundamental symbolic letter is attached signs and letters and each letters have different meanings with these signs. Basic principle of notations system is explained detail below;

The bottom-right of the letter indicates the age of the person.

The top-right of the letter indicates the frequency of payment. A lack of notation means payments are made annually.

The bottom-left of the letter indicates the deferred time period of payment or insurance duration.

i : effective interest rate.

V : present value of 1 YTL at the end of the year. (V= 1 / (1+i))

w : the last age of life table

a : present value of annuity

s : future value of the annuity

A : present value of the life insurance against death

E : present value of an endowment.

P : generally refers to annual premiums' payment.

The interest rates (i) used by insurance companies have determined by the Turkish Treasury Undersecretaryship. The interest rate; is used to calculate premiums, reserves, and the parts of guaranteed dividends.

The interest rates are chosen carefully according to condition of the tariff, type of currency or asset for that insurance policy, future expected revenue of assets, economical condition of the country, and the financial structure of the company. One year life insurance policies can have e different interest rates respect to more than one year life insurance policies. The Turkish Treasury Undersecretaryship can be determined minimum or maximum limits of the interest rates if it is needed (Turkish Life Insurance Regulation, 1996).

The interest rates of the year 2006 are 9 percent for the New Turkish Liras policies and 2.5 percent for the foreign currency policies which is determined by The Turkish Treasury Undersecretaryship. If the insurance companies want to use another interest rate, they must declare and get authorization from The Turkish Treasury Undersecretaryship.

B. DEFINITION OF COMMUTATION TABLE

The Commutation tables are a computational table that shows net premiums for life annuities, endowments, and insurances from the same life table with the same

interest rate, for lives of different ages and for policies of different durations (Slud, 2001).

The values or columns of life tables are not enough to make several calculations related with the types of life insurance. Because in life insurance, there is guarantee for living or dying, and also there is a profit increase because of the used interest rate of life insurance. Therefore, insurance premiums which are paid by insured in a period of time are directed to investment with the interest rate. In addition, commutation table is the basic component to calculate life insurance premiums which are equivalent of the life insurance guarantee.

In addition, the commutation tables help to determine insurance reserves which are allocated by insurance companies. The reserve is the present value of liabilities at the time of balance sheet against the insured.

Commutation tables constitute six different notations. While, three of these notations are used to calculate life insurance for the probability of living, the other three notations are used to calculate life insurance for the probability of dying. These notations;

Life Insurance for Probability of Living;

D_x : Present value of 1 YTL taken from number of survive l_x person. It is showed by the following formula;

$$D_x = l_x.V^x$$

N_x : Total value of D_x values. It is showed by the following formula;

$$N_x = \sum_{t=0}^{\infty} D_{x+t}$$

S_x : Total value of N_x values. It is showed by the following formula;

$$S_x = \sum_{t=0}^{\infty} N_{x+t}$$

Life Insurance for Probability of Dying;

C_x : Present value of 1 YTL given to number of dead d_x person. It is showed by the following formula;

$$C_x = d_x.V^{x+1}$$

M_x : Total values of C_x values. It is showed by the following formula;

$$M_x = \sum_{t=0}^{\infty} C_{x+t}$$

R_x : Total values of M_x values. It is showed by the following formula;

$$R_x = \sum_{t=0}^{\infty} M_{x+t}$$

These formulas assist to construct Turkey commutation tables for females and males. Table VI.1, Table VI.2 (from the infant mortality rate) and Table VI.3, Table VI.4 (from orphanhood method) are prepared with help of commutation formulas which is calculated from dying and surviving probabilities of Turkey mortality tables. These tables has constructed as a Turkish Liras so, used interest rate is 9 percent.

Table VI.1 Turkey Female Commutation Table (2001) (From Orphanhood Method and 9% Interest Rate)

x	Dx	Nx	Sx	Cx	Mx	Rx
0	100,000.00	1,167,176.11	13,877,688.98	2,647.71	3,627.66	21,311.88
1	89,095.41	1,067,176.11	12,710,512.88	339.22	979.95	17,684.22
2	81,399.69	978,080.69	11,643,336.77	128.45	640.74	16,704.26
3	74,550.17	896,681.00	10,665,256.08	63.61	512.29	16,063.52
4	68,331.05	822,130.83	9,768,575.08	36.36	448.68	15,551.23
5	62,652.67	753,799.78	8,946,444.25	22.42	412.32	15,102.55
6	57,457.10	691,147.11	8,192,644.47	14.76	389.91	14,690.23
7	52,698.18	633,690.01	7,501,497.36	10.64	375.15	14,300.32
8	48,336.31	580,991.83	6,867,807.35	7.54	364.51	13,925.17
9	44,337.70	532,655.52	6,286,815.52	6.10	356.97	13,560.66
10	40,670.69	488,317.82	5,754,160.00	5.22	350.87	13,203.69
11	37,307.34	447,647.13	5,265,842.18	4.79	345.65	12,852.82
12	34,222.12	410,339.79	4,818,195.06	4.71	340.86	12,507.17
13	31,391.73	376,117.67	4,407,855.27	5.18	336.15	12,166.31
14	28,794.57	344,725.93	4,031,737.60	5.81	330.96	11,830.17
15	26,411.23	315,931.36	3,687,011.67	6.30	325.15	11,499.21
16	24,224.18	289,520.14	3,371,080.31	6.67	318.85	11,174.06
17	22,217.35	265,295.95	3,081,560.17	6.93	312.18	10,855.21
18	20,375.96	243,078.60	2,816,264.22	7.10	305.25	10,543.02
19	18,686.44	222,702.64	2,573,185.62	7.20	298.15	10,237.77
20	17,136.32	204,016.20	2,350,482.98	7.07	290.95	9,939.62
21	15,714.32	186,879.87	2,146,466.78	6.78	283.87	9,648.67
22	14,410.03	171,165.55	1,959,586.91	6.35	277.10	9,364.80
23	13,213.87	156,755.52	1,788,421.36	5.94	270.75	9,087.70
24	12,116.88	143,541.65	1,631,665.84	5.56	264.81	8,816.94
25	11,110.84	131,424.77	1,488,124.20	5.10	259.25	8,552.13
26	10,188.34	120,313.93	1,356,699.42	4.77	254.16	8,292.88
27	9,342.33	110,125.60	1,236,385.49	4.37	249.39	8,038.72
28	8,566.57	100,783.27	1,126,259.90	4.09	245.02	7,789.33

Table VI.1 Turkey Female Commutation Table (2001) (From Orphanhood Method and 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
29	7,855.16	92,216.69	1,025,476.63	3.82	240.93	7,544.31
30	7,202.74	84,361.54	933,259.94	3.57	237.11	7,303.38
31	6,604.45	77,158.79	848,898.40	3.39	233.54	7,066.26
32	6,055.74	70,554.34	771,739.61	3.28	230.15	6,832.72
33	5,552.45	64,498.60	701,185.27	3.16	226.87	6,602.57
34	5,090.83	58,946.15	636,686.68	3.08	223.72	6,375.69
35	4,667.40	53,855.32	577,740.52	3.04	220.63	6,151.98
36	4,278.98	49,187.92	523,885.20	3.02	217.59	5,931.34
37	3,922.65	44,908.94	474,697.28	3.02	214.57	5,713.75
38	3,595.74	40,986.29	429,788.34	3.03	211.55	5,499.18
39	3,295.81	37,390.55	388,802.05	3.05	208.51	5,287.63
40	3,020.62	34,094.75	351,411.50	3.10	205.46	5,079.12
41	2,768.11	31,074.13	317,316.75	3.17	202.35	4,873.66
42	2,536.37	28,306.02	286,242.62	3.23	199.18	4,671.31
43	2,323.71	25,769.64	257,936.60	3.30	195.95	4,472.13
44	2,128.54	23,445.93	232,166.96	3.38	192.64	4,276.18
45	1,949.41	21,317.39	208,721.03	3.47	189.26	4,083.54
46	1,784.98	19,367.97	187,403.64	3.55	185.79	3,894.28
47	1,634.05	17,582.99	168,035.67	3.66	182.24	3,708.48
48	1,495.47	15,948.94	150,452.68	3.75	178.58	3,526.24
49	1,368.24	14,453.48	134,503.74	3.85	174.84	3,347.66
50	1,251.41	13,085.23	120,050.26	3.95	170.98	3,172.83
51	1,144.14	11,833.82	106,965.03	4.06	167.03	3,001.84
52	1,045.61	10,689.68	95,131.21	4.16	162.97	2,834.81
53	955.11	9,644.07	84,441.53	4.27	158.81	2,671.84
54	871.98	8,688.97	74,797.46	4.38	154.54	2,513.03
55	795.60	7,816.99	66,108.49	4.49	150.16	2,358.49
56	725.42	7,021.38	58,291.50	4.59	145.68	2,208.32
57	660.93	6,295.96	51,270.12	4.70	141.08	2,062.65

Table VI.1 Turkey Female Commutation Table (2001) (From Orphanhood Method and 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
58	601.66	5,635.03	44,974.15	4.81	136.38	1,921.57
59	547.18	5,033.37	39,339.13	4.91	131.58	1,785.18
60	497.09	4,486.19	34,305.76	5.01	126.67	1,653.60
61	451.04	3,989.10	29,819.57	5.10	121.66	1,526.94
62	408.70	3,538.07	25,830.47	5.19	116.56	1,405.28
63	369.76	3,129.37	22,292.40	5.26	111.38	1,288.72
64	333.97	2,759.61	19,163.02	5.33	106.11	1,177.34
65	301.06	2,425.64	16,403.42	5.39	100.78	1,071.23
66	270.81	2,124.58	13,977.78	5.44	95.38	970.45
67	243.01	1,853.77	11,853.20	5.47	89.94	875.07
68	217.47	1,610.77	9,999.42	5.49	84.47	785.13
69	194.02	1,393.30	8,388.66	5.49	78.98	700.66
70	172.51	1,199.28	6,995.36	5.46	73.49	621.68
71	152.81	1,026.77	5,796.08	5.42	68.03	548.19
72	134.77	873.96	4,769.31	5.35	62.61	480.16
73	118.30	739.19	3,895.35	5.25	57.26	417.55
74	103.28	620.89	3,156.16	5.12	52.02	360.29
75	89.64	517.60	2,535.27	4.96	46.90	308.27
76	77.28	427.97	2,017.67	4.77	41.94	261.37
77	66.12	350.69	1,589.70	4.55	37.17	219.43
78	56.11	284.57	1,239.01	4.30	32.62	182.26
79	47.18	228.45	954.44	4.02	28.31	149.65
80	39.26	181.28	725.99	3.72	24.29	121.33
81	32.30	142.02	544.71	3.40	20.57	97.04
82	26.23	109.72	402.69	3.06	17.17	76.47
83	21.01	83.49	292.97	2.71	14.11	59.30
84	16.56	62.48	209.48	2.36	11.40	45.19
85	12.83	45.92	146.99	2.02	9.04	33.79
86	9.76	33.09	101.07	1.69	7.02	24.75

Table VI.1 Turkey Female Commutation Table (2001) (From Orphanhood Method and 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
87	7.26	23.34	67.98	1.38	5.33	17.72
88	5.28	16.07	44.64	1.10	3.95	12.39
89	3.74	10.79	28.57	0.85	2.85	8.43
90	2.58	7.05	17.78	0.64	2.00	5.58
91	1.73	4.47	10.73	0.47	1.36	3.58
92	1.12	2.74	6.26	0.33	0.89	2.22
93	0.70	1.62	3.52	0.22	0.56	1.33
94	0.42	0.92	1.90	0.14	0.34	0.76
95	0.24	0.50	0.98	0.09	0.20	0.42
96	0.13	0.26	0.48	0.05	0.11	0.22
97	0.07	0.13	0.22	0.03	0.06	0.11
98	0.03	0.06	0.09	0.02	0.03	0.05
99	0.02	0.02	0.03	0.01	0.01	0.02
100	0.01	0.01	0.01	0.01	0.01	0.01

Table VI.2 Turkey Male Commutation Table (2001) (From Orphanhood Method and 9% Interest Rate)

x	Dx	Nx	Sx	Cx	Mx	Rx
0	100,000.00	1,158,566.41	13,640,713.93	2,761.47	4,338.55	32,268.93
1	88,981.65	1,058,566.41	12,482,147.51	363.27	1,577.09	27,930.38
2	81,271.27	969,584.76	11,423,581.10	175.22	1,213.81	26,353.30
3	74,385.58	888,313.49	10,453,996.34	106.46	1,038.59	25,139.48
4	68,137.19	813,927.91	9,565,682.84	71.89	932.13	24,100.89
5	62,439.30	745,790.72	8,751,754.93	52.13	860.25	23,168.76
6	57,231.63	683,351.43	8,005,964.21	39.38	808.12	22,308.51
7	52,466.70	626,119.80	7,322,612.78	30.81	768.74	21,500.39
8	48,103.78	573,653.10	6,696,492.98	25.16	737.93	20,731.66
9	44,106.76	525,549.31	6,122,839.89	21.04	712.78	19,993.72
10	40,443.87	481,442.56	5,597,290.57	18.18	691.73	19,280.95
11	37,086.29	440,998.68	5,115,848.02	16.67	673.55	18,589.21
12	34,007.45	403,912.39	4,674,849.34	15.91	656.88	17,915.66
13	31,183.58	369,904.95	4,270,936.94	16.31	640.97	17,258.78
14	28,592.48	338,721.37	3,901,031.99	17.05	624.66	16,617.81
15	26,214.58	310,128.89	3,562,310.63	18.04	607.61	15,993.15
16	24,032.04	283,914.30	3,252,181.74	19.18	589.57	15,385.53
17	22,028.56	259,882.26	2,968,267.44	20.21	570.39	14,795.96
18	20,189.48	237,853.70	2,708,385.18	20.75	550.18	14,225.57
19	18,501.71	217,664.22	2,470,531.48	20.71	529.44	13,675.38
20	16,953.34	199,162.51	2,252,867.26	20.38	508.73	13,145.94
21	15,533.15	182,209.17	2,053,704.75	19.52	488.35	12,637.21
22	14,231.07	166,676.02	1,871,495.59	18.41	468.83	12,148.86
23	13,037.62	152,444.95	1,704,819.57	17.22	450.42	11,680.03
24	11,943.90	139,407.33	1,552,374.63	15.89	433.20	11,229.60
25	10,941.81	127,463.43	1,412,967.30	14.66	417.31	10,796.41
26	10,023.70	116,521.62	1,285,503.87	13.43	402.65	10,379.10
27	9,182.63	106,497.91	1,168,982.25	12.30	389.23	9,976.44
28	8,412.13	97,315.28	1,062,484.34	11.27	376.93	9,587.21

Table VI.2 Turkey Male Commutation Table (2001) (From Orphanhood Method and 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
29	7,706.29	88,903.14	965,169.06	10.39	365.66	9,210.29
30	7,059.60	81,196.86	876,265.92	9.65	355.27	8,844.62
31	6,467.04	74,137.26	795,069.06	9.02	345.62	8,489.36
32	5,924.05	67,670.22	720,931.80	8.53	336.60	8,143.74
33	5,426.37	61,746.17	653,261.58	8.11	328.07	7,807.14
34	4,970.21	56,319.80	591,515.41	7.84	319.95	7,479.07
35	4,551.98	51,349.59	535,195.61	7.56	312.11	7,159.12
36	4,168.57	46,797.60	483,846.03	7.38	304.55	6,847.01
37	3,817.00	42,629.03	437,048.42	7.28	297.17	6,542.46
38	3,494.55	38,812.03	394,419.39	7.18	289.88	6,245.30
39	3,198.83	35,317.49	355,607.36	7.10	282.70	5,955.41
40	2,927.60	32,118.66	320,289.87	7.06	275.60	5,672.71
41	2,678.81	29,191.06	288,171.21	7.05	268.54	5,397.11
42	2,450.57	26,512.25	258,980.15	7.06	261.48	5,128.57
43	2,241.17	24,061.68	232,467.90	7.05	254.42	4,867.08
44	2,049.07	21,820.51	208,406.22	7.09	247.37	4,612.66
45	1,872.79	19,771.45	186,585.71	7.10	240.29	4,365.29
46	1,711.06	17,898.66	166,814.26	7.13	233.19	4,125.00
47	1,562.65	16,187.60	148,915.60	7.15	226.06	3,891.81
48	1,426.47	14,624.94	132,728.01	7.17	218.91	3,665.75
49	1,301.52	13,198.47	118,103.06	7.20	211.74	3,446.84
50	1,186.85	11,896.95	104,904.59	7.22	204.54	3,235.10
51	1,081.64	10,710.10	93,007.64	7.24	197.32	3,030.57
52	985.08	9,628.46	82,297.55	7.26	190.07	2,833.25
53	896.49	8,643.38	72,669.09	7.27	182.82	2,643.18
54	815.20	7,746.89	64,025.71	7.28	175.55	2,460.36
55	740.61	6,931.69	56,278.82	7.28	168.27	2,284.81
56	672.18	6,191.08	49,347.14	7.27	160.99	2,116.54
57	609.41	5,518.90	43,156.06	7.25	153.72	1,955.55

Table VI.2 Turkey Male Commutation Table (2001) (From Orphanhood Method and 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
58	551.84	4,909.49	37,637.16	7.22	146.47	1,801.83
59	499.05	4,357.65	32,727.68	7.19	139.25	1,655.36
60	450.65	3,858.59	28,370.03	7.14	132.05	1,516.11
61	406.30	3,407.94	24,511.44	7.09	124.91	1,384.06
62	365.66	3,001.64	21,103.50	7.01	117.82	1,259.15
63	328.46	2,635.98	18,101.85	6.93	110.81	1,141.33
64	294.41	2,307.52	15,465.87	6.83	103.88	1,030.52
65	263.27	2,013.11	13,158.35	6.71	97.05	926.64
66	234.82	1,749.84	11,145.24	6.58	90.34	829.59
67	208.85	1,515.02	9,395.40	6.43	83.76	739.25
68	185.18	1,306.16	7,880.38	6.26	77.33	655.49
69	163.63	1,120.98	6,574.21	6.07	71.07	578.16
70	144.05	957.35	5,453.23	5.87	65.00	507.09
71	126.28	813.31	4,495.87	5.65	59.13	442.09
72	110.21	687.03	3,682.57	5.40	53.48	382.96
73	95.71	576.82	2,995.54	5.14	48.08	329.48
74	82.66	481.11	2,418.72	4.87	42.94	281.40
75	70.97	398.45	1,937.61	4.58	38.07	238.46
76	60.53	327.48	1,539.16	4.27	33.49	200.39
77	51.26	266.95	1,211.68	3.95	29.22	166.90
78	43.08	215.68	944.73	3.63	25.27	137.68
79	35.89	172.61	729.05	3.30	21.64	112.41
80	29.62	136.72	556.45	2.97	18.33	90.77
81	24.20	107.10	419.73	2.65	15.36	72.44
82	19.55	82.89	312.63	2.33	12.71	57.08
83	15.61	63.34	229.74	2.02	10.38	44.37
84	12.30	47.73	166.40	1.73	8.35	33.99
85	9.55	35.44	118.67	1.46	6.62	25.64
86	7.30	25.89	83.23	1.21	5.16	19.02

Table VI.2 Turkey Male Commutation Table (2001) (From Orphanhood Method and 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
87	5.49	18.59	57.34	0.98	3.95	13.85
88	4.05	13.10	38.75	0.78	2.97	9.90
89	2.93	9.05	25.65	0.61	2.18	6.93
90	2.08	6.12	16.61	0.47	1.57	4.74
91	1.44	4.04	10.49	0.35	1.10	3.17
92	0.97	2.60	6.45	0.25	0.76	2.07
93	0.64	1.63	3.85	0.18	0.50	1.31
94	0.41	0.99	2.22	0.12	0.33	0.81
95	0.25	0.58	1.23	0.08	0.21	0.48
96	0.15	0.33	0.65	0.05	0.12	0.28
97	0.09	0.18	0.32	0.03	0.07	0.15
98	0.05	0.09	0.14	0.02	0.04	0.08
99	0.03	0.04	0.05	0.01	0.02	0.04
100	0.01	0.01	0.01	0.01	0.01	0.01

C. LIFE ANNUITIES

A life annuity, or annuity, is a series of payments made at equal intervals during the term or whole life time (Neill, 1992). The most important determinants of the life annuities are present value of payments and probability of living. The present value of life annuities are identified as a net single premium which is paid by insured to insurer (Moralı, 1997).

Life annuities have calculated for whole life period or term life period which the payments can be made at the end of the year or at the beginning of the year. In addition it can be also possible to calculate life annuities for deferred time period, but the calculation of deferred life annuities can not explain in this thesis. Because it is not used frequently in practice especially in life insurance sector.

1. Whole Life Annuities

Whole life annuities are series of payments made at equal intervals at the end of the year during the lifetime of person who is x years old. The present value of these payments is shown with a_x value. The present value of these 1 YTL payments which is paid by companies should be equal to net single payments of number of l_x persons who are x years old.

$$l_x.a_x = V^1.l_{x+1} + V^2.l_{x+2} + ...$$

If the numerator and denominator of equation multiply with V^x;

$$a_x = \frac{V^{x+1}.l_{x+1}}{l_x.V_x} + \frac{V^{x+2}.l_{x+2}}{l_x.V_x} + ... = \frac{D_{x+1}}{D_x} + \frac{D_{x+2}}{D_x} + ...$$

$$a_x = \frac{N_{x+1}}{D_x} \text{ . 1 YTL}$$

If the payments are made at the beginning of the year during the lifetime of person who is x years old, the present value of these payments is shown with $\ddot{a}_x$. So;

$$\ddot{a}_x = 1 + a_x$$

$$\ddot{a}_x = 1 + \frac{V.l_{x+1}}{lx} + \frac{V^2.l_{x+2}}{lx} + \text{.....}$$

If the numerator and denominator of equation multiply with V^x;

$$\ddot{a}_x = 1 + \frac{V^{x+1}.l_{x+1}}{l_x.V_x} + \frac{V^{x+2}.l_{x+2}}{l_x.V_x} + \text{.....} = 1 + \frac{D_{x+1}}{D_x} + \frac{D_{x+2}}{D_x} + \text{.....}$$

$$\ddot{a}_x = 1 + \frac{N_{x+1}}{D_x} = \frac{D_x + N_{x+1}}{D_x} = \frac{D_x}{D_x} + \frac{D_{x+1}}{D_x} + \frac{D_{x+2}}{D_x} + \text{.....}$$

$$\ddot{a}_x = \frac{N_x}{D_x} \text{ . 1 YTL}$$

2. Term Life Annuities

The present value of annuity payments which is paid to x years old person at the end of the year during n years is shown with $a_{x:\overline{n}|}$.

$$a_{x:\overline{n}|} = \frac{V^{x+1}.l_{x+1}}{l_x.V_x} + \frac{V^{x+2}.l_{x+2}}{l_x.V_x} + \ldots\ldots + \frac{V^{x+n}.l_{x+n}}{l_x.V_x}$$

$$a_{x:\overline{n}|} = \frac{D_{x+1}}{D_x} + \frac{D_{x+2}}{D_x} + \ldots\ldots\ldots + \frac{D_{x+n}}{D_x}$$

$$a_{x:\overline{n}|} = \frac{N_{x+1} - N_{x+n+1}}{D_x}$$

If the payments are made at the beginning of the year during n years who is x years old, the present value of these payments is shown with $\ddot{a}_{x:\overline{n}|}$. So;

$$\ddot{a}_{x:\overline{n}|} = 1 + a_{x:\overline{n}|}$$

$$\ddot{a}_x = 1 + \frac{V^{x+1}.l_{x+1}}{l_x.V_x} + \frac{V^{x+2}.l_{x+2}}{l_x.V_x} + \ldots\ldots + \frac{V^{x+n}.l_{x+n}}{l_x.V_x}$$

$$\ddot{a}_x = 1 + \frac{D_{x+1}}{D_x} + \frac{D_{x+2}}{D_x} + \ldots\ldots\ldots + \frac{D_{x+n-1}}{D_x}$$

$$\ddot{a}_x = \frac{N_x - N_{x+n}}{D_x}$$

D. CALCULATION OF NET PREMIUMS IN LIFE INSURANCES

The main mission of the insured person in life insurances is to pay the premium to the insurer. The insurance premium calculated thanks to the commutation tables are defined as net premium or risk premium. Like all organizations, the insurance companies have also some expenditures. Therefore, the

manufacturing and administrative costs of the company should be added to the net premium. Furthermore, the reserved amounts put aside for the unexpected losses should be added to the net premium as well. All these additions are called loading and by adding the loading to the net premium gross premium is found out.

Gross premium = Net premium + Loading (The expenditures of the insurer + the commission of the insurer)

The net premium, which is in the gross premium, is based on the fundamental of equality in the responsibilities of insurer and insured person (Moralı, 1997). That is, the net premiums calculated from the commutation tables according to the types of life insurances are thought to be equal to the present value of the life insurance guarantee that is taken by insurer.

The present value of the net premiums = the present value of the insurer's responsibility.

The insured people can make their premium payments both in cash and in installments. For both payment styles the insurers have to make different calculations. The premium payments are calculated differently according to the life insurance types.

In this thesis study, it is assumed that the premium payments are made at the moment of policy starting for net single premium payments and at the beginning of the term for installment payments.

1. Net Single Premium Payments of Insured

a. Pure Endowment

The net single premium which must pay from the insured is defined as ${}_nE_x$. On the other hand, (x) is age of insured, (n) is number of insurance year. (R) is also defined as the payment which is paid from the insurer at the end of the policy. Insurers who take premium (${}_nE_x$) from the number of l_x people must pay R amount of money to number of l_{x+n} people who survive at age (x+n).

$$ {}_nE_x \,.\, l_x = \; l_{x+n} \,.\, V^n \; = \; \frac{V^n . l_{x+n}}{l_x} $$

If the numerator and denominator of equation multiply with V^x;

$$ {}_nE_x \; = \; \frac{V^{x+n} . l_{x+n}}{V^x . l_x} \; = \; \frac{D_{x+n}}{D_x} \cdot \; R $$

b. Income Life Insurance

In Income Life Insurance, it was explained before, the insured pays a net single premium and depending on this payment, insurer has to pay annuity payments at the end or beginning of the year during the life time of insured. Therefore these payments can be also defined as whole life annuity payment. Depending on this, it is calculated with the same formula of whole life annuity. The insurer can make a payment at the end of the year or at the begging of the year. Both payments include different commutation formulas. So;

for payment at the end of the year which is named as “annuity-due”;

$$a_x = \frac{N_{x+1}}{D_x} \text{ . 1 YTL}$$

for payment at the beginning of the year which is named as “annuity-immediate”

$$\ddot{a}_x = \frac{N_x}{D_x} \text{ . 1 YTL}$$

c. Term Life Insurance

In term life insurance, the net single premium which must pay from the insured is shown with $A^{1}_{x:\overline{n}|}$. (x) is age of insured, (n) is number of insurance year. (R) is also defined as the payment which is paid from the insurer at the end of the policy. (1) shows that the payment of insurer can be made if insured dies during the (n) years.

Each of l_x people pays $A^{1}_{x:\overline{n}|}$ amount of premium. And total collected $l_x . A^{1}_{x:\overline{n}|}$ amount of premium provide 1 YTL to pay number of d_x people’s relatives. The payments are shown below;

1 year later : 1 YTL payment for each of d_x people,

2 year later : 1 YTL payment for each of d_{x+1} people,

3 year later : 1 YTL payment for each of d_{x+2} people,

. .

. .

. .

n year later : 1 YTL payment for each of d_{x+n-1} people.

And the present value of all these payments is;

$$A_{x:\overline{n}|}^{1} \,.\, l_x = V^1.d_x + V^2.d_{x+1} + ...+ V^n.d_{x+n-1}$$

$$A_{x:\overline{n}|}^{1} = v.\frac{d_x}{l_x} + v^2.\frac{d_{x+1}}{l_x} + ... + v^n.\frac{d_{x+n-1}}{l_x}$$

If the numerator and denominator of equation multiply with V^x;

$$A_{x:\overline{n}|}^{1} = \frac{C_x + C_{x+1} + ... + C_{x+n-1}}{l_x.V^x}$$

$$A_{x:\overline{n}|}^{1} = \frac{M_x - M_{x+n}}{D_x} \;.\; R$$

d. Whole Life Insurance

Net single premium taken from insured is shown A_x value. Each of l_x people pays A_x amount of premium. And total collected $l_x . A_x$ amount of premium provide 1 YTL to pay number of d_x people's relatives. So, the present value of all these payments is;

$$A_x . \ l_x = V^1.d_x + V^2.d_{x+1} + ... = v.\frac{d_x}{l_x} + v^2.\frac{d_{x+1}}{l_x} + v^3.\frac{d_{x+2}}{l_x} + ...$$

If the numerator and denominator of equation multiply with V^x;

$$A_x = \frac{V^{x+1}.d_x + V^{x+2}.d_{x+1} + ...}{l_x.V^x} = \frac{C_x + C_{x+1} + ...}{D_x}$$

$$A_x = \frac{M_x}{D_x} \cdot R$$

e. Endowment Life Insurance

In this condition, insurance company has to make a payment if insured dies or survives in (n) years. Net single premium which is paid by insured is shown with $A_{x:\overline{n}|}$ value. (R) is also defined as the payment which is paid from the insurer at the end of the policy.

$$A_{x:\overline{n}|} = A_{x:\overline{n}|}^{1} + {}_{n}E_{x}$$

$$A_{x:\overline{n}|} = \frac{M_x - M_{x+n}}{D_x} + \frac{D_{x+n}}{D_x} = \frac{M_x - M_{x+n} + D_{x+n}}{D_x} \cdot R$$

Table VI.3 Net Single Premium Formulas according to Life Insurances

Types of Life Insurance	Symbol	Explanation with Life Functions	Explanation with Commutation Formula
Whole Life Insurance	A_x	$\sum_{t=0}^{\infty} v^{t+1}\,{}_{t}q_x$	$\frac{M_x}{D_x}$
Term Life Insurance	$A_{x:\overline{n}|}^{1}$	$\sum_{t=0}^{n-1} v^{t+1}\,{}_{t}q_x$	$\frac{M_x - M_{x+n}}{D_x}$
Pure Endowment	${}_{n}E_x$	$v^n\,{}_{n}p_x$	$\frac{D_{x+n}}{D_x}$
Income Life Insurance (annuity-due)	a_x	$\sum_{t=1}^{\infty} v^{t}\,{}_{t}p_x$	$\frac{N_{x+1}}{D_x}$
Income Life Insurance (annuity-immediate)	a_x	$\sum_{t=0}^{\infty} v^{t}\,{}_{t}p_x$	$\frac{N_x}{D_x}$
Endowment Life Insurance	$A_{x:\overline{n}|}$	$\sum_{t=0}^{n-1} v^{t+1}\,{}_{t}q_x + v^n\,{}_{n}p_x$	$\frac{M_x - M_{x+n} + D_{x+n}}{D_x}$

2. Installment Payments of Insured

a. Pure Endowment

If insured survives at the end of the policy period, he/she will take compensation from the insurer. But this compensation payment can be made with not only net single payment but also installment payment. In pure endowment,

installment payment which is paid at the begging of the year equally is shown as ${}_tP({}_nE_x)$ value. (R) is also defined as the payment which is paid from the insurer at the end of the policy. Annually installments are paid in (t) years. So;

$$ {}_tP({}_nE_x) \cdot \ddot{a}_{x:\overline{t}|} = A_{x:\overline{n}|} $$

$$ {}_tP({}_nE_x) \cdot \frac{N_x - N_{x+t}}{D_x} = \frac{D_{x+n}}{D_x} $$

$$ {}_tP({}_nE_x) = \frac{D_{x+n}}{N_x - N_{x+t}} \cdot R $$

b. Term Life Insurance

In term life insurance, installment payment of insured which is paid at the begging of the year is shown as ${}_tP^{\overline{1}}_{x:\overline{n}|}$. Annually installments are paid in (t) years. So;

$$ {}_tP^{\overline{1}}_{x:\overline{n}|} \cdot \ddot{a}_{x:\overline{t}|} = A^{\overline{1}}_{x:\overline{n}|} $$

$$ {}_tP^{\overline{1}}_{x:\overline{n}|} \cdot \frac{N_x - N_{x+t}}{D_x} = \frac{M_x - M_{x+n}}{D_x} $$

$$ {}_tP^{\overline{1}}_{x:\overline{n}|} = \frac{M_x - M_{x+n}}{N_x - N_{x+t}} \cdot R $$

c. Whole Life Insurance

Insured wants to make a whole life insurance policy in order to give up money to his/her relatives when he/she dies and the payment of this policy can be made with installment payments. Installment payment which is paid at the begging of the year equally is shown as ${}_tP_x$ value. So;

$${}_tP_x \,.\, \ddot{a}_{x:\overline{t}|} = A_x$$

$${}_tP_x \,.\, \frac{N_x - N_{x+t}}{D_x} = \frac{M_x}{D_x}$$

$${}_tP_x = \frac{M_x}{N_x - N_{x+t}} \cdot R$$

d. Endowment Life Insurance

In this condition, insurance company has to make a payment if insured dies or survives in (n) years and the payment of this policy can be made with installment payments. So;

$${}_tP_{x:\overline{n}|} \,.\, \frac{N_x - N_{x+t}}{D_x} = \frac{M_x - M_{x+n} + D_{x+n}}{D_x} \cdot R$$

$${}_tP_{x:\overline{n}|} = \frac{M_x - M_{x+n} + D_{x+n}}{N_x - N_{x+t}} .. R$$

Table VI.4 Net Installment Premium Formulas during (t) Years according to Life Insurances

Types of Life Insurance	Symbol	Explanation with Commutation Formula
Whole Life Insurance	${}_tP_x$	$\frac{M_x}{N_x - N_{x+t}}$
Term Life Insurance	${}_tP_{x:\overline{n}\vert}^{1}$	$\frac{M_x - M_{x+n}}{N_x - N_{x+t}}$
Pure Endowment	${}_tP({}_nE_x)$	$\frac{D_{x+n}}{N_x - N_{x+t}}$
Endowment Life Insurance	${}_tP_{x:\overline{n}\vert}$	$\frac{M_x - M_{x+n} + D_{x+n}}{N_x - N_{x+t}}$

CHAPTER VII
RESULTS AND DISCUSSION

The other crucial objective of this thesis is to compare Turkey mortality tables which are constructed Turkish mortality data for both sexes and other four foreign mortality tables which are used in Turkey. The premium payments are important for both insurer and insured. Thanks to this comparison and analysis, the real insurance premium will be calculated for Turkey.

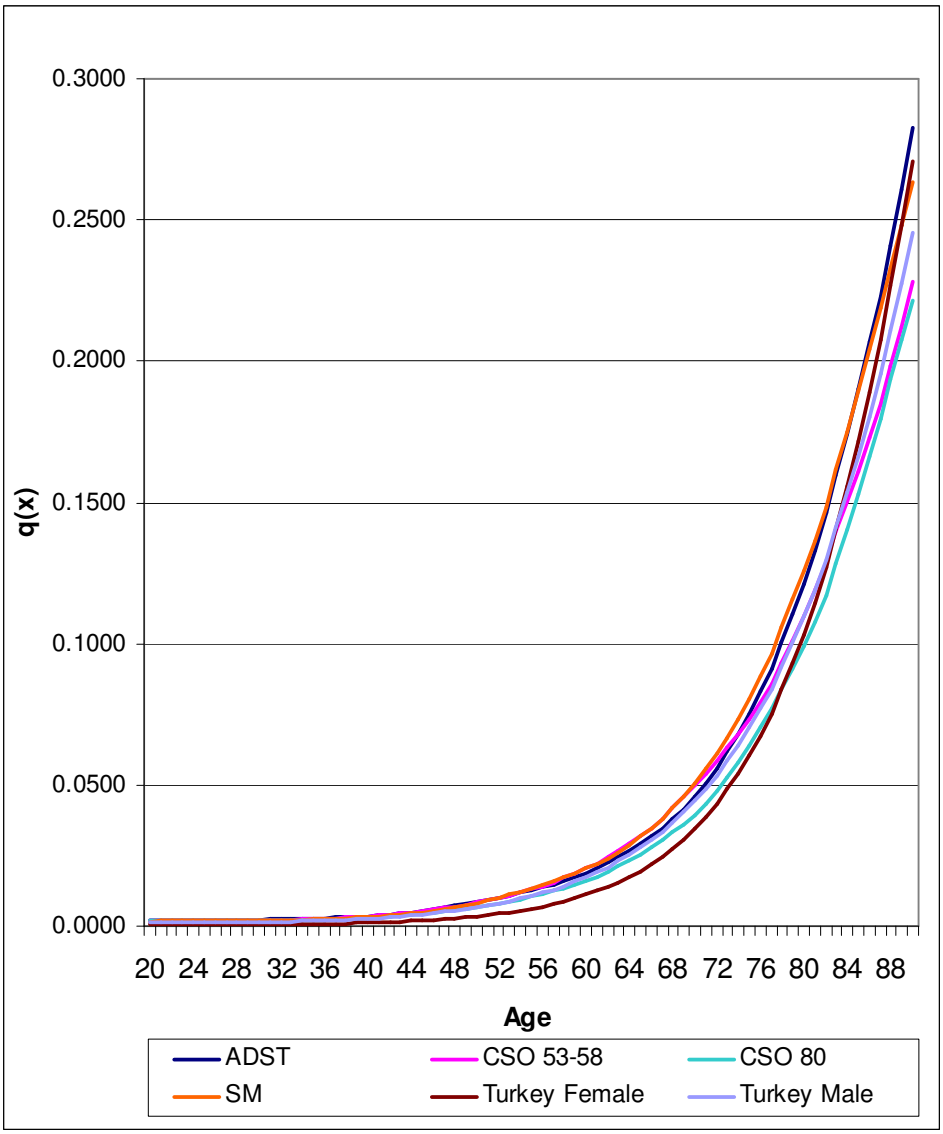
Insured can make a payment with two ways. First, as a net single premium, second, as an installment payment. In this part of thesis, only net single premium analysis will be made. Because, the results of two payment types give the same findings.

The other important point is that the analysis will investigate all insurance types separately. Therefore, the results can be evaluated according to probability of dying, living and both of them together.

A. ANALYSIS OF LIFE INSURANCE FOR PROBABILITY OF DYING

Probability of dying is the basic determinant to calculate insurance premiums. Because, premium payment plans are constructed by using probability of dying for both whole life insurance and term life insurance. Figure VII.1 shows that q(x) values of the four foreign mortality tables which are used by insurance companies in Turkey and Turkey mortality tables for both sexes which are constructed with orphanhood method. q(x) values give a general opinion related to insurance premium payments. Because if the probability of dying increases, insurers will want to take much more premium for the whole and term life insurance. The insurers want to ensure themselves when the death occurs.

Figure VII.1 q(x) Values of Used Mortality Tables in Turkey and Turkey Female and Male Mortality Tables.



According to Figure VII.1, q(x) values of Turkey female and male mortality tables have the lowest value between the age of 20 and 50. After age 50, q(x) values of Turkey male mortality table and after age 80 q(x) values of Turkey female mortality table show an increasing more than CSO 80 mortality table. Therefore, it can be seen that the CSO 80 mortality table has the closest values according to Turkey Female and Male mortality tables.

Accordingly, it will be useful to analyze insurance premiums for whole life insurance and term life insurance which are content of the probability of dying. Table VII.1 is prepared for net single premium payments of whole life insurance. This table shows that how much money insured has to pay; in order to his/her relatives can take 10,000 YTL compensation when he/she dies at anytime. In this table, 10,000 YTL is chosen as a fix amount of money which will also use for other insurance types.

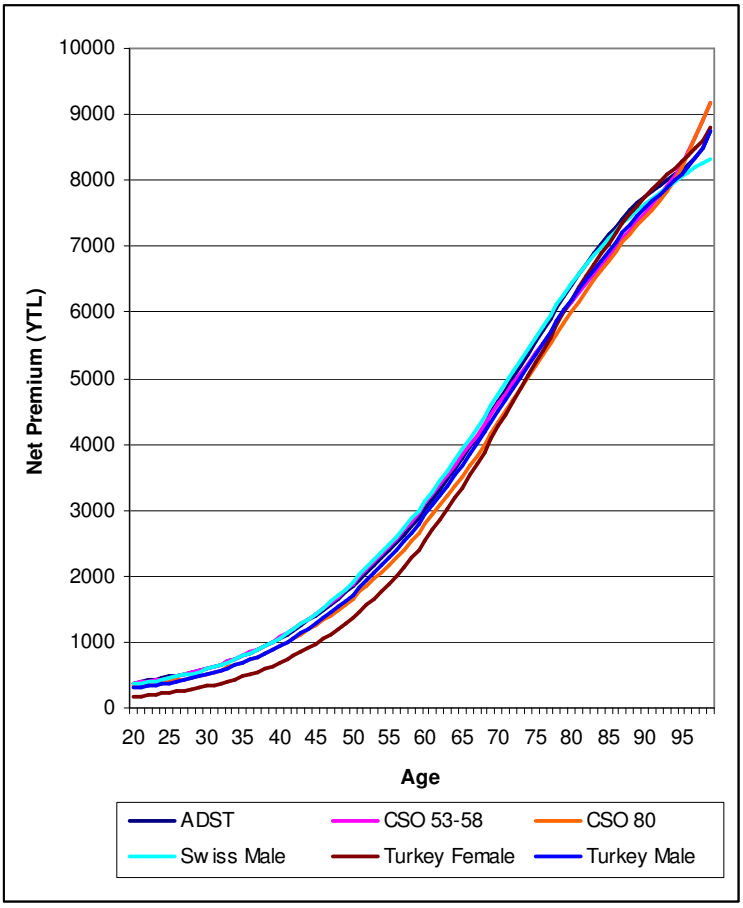
Table VII.1 Whole Life Insurance Net Single Premium Payments (YTL)

Age	ADST	CSO 53-58	Swiss Male	CSO 80	Turkey Female	Turkey Male
20	383	369	360	331	170	300
25	473	462	453	401	233	381
30	601	598	586	518	329	503
35	789	795	785	694	473	686
40	1,051	1,070	1,063	936	680	941
45	1,407	1,431	1,436	1,253	971	1,283
50	1,851	1,888	1,912	1,659	1,366	1,723
55	2,381	2,444	2,478	2,171	1,887	2,272
60	3,023	3,098	3,144	2,787	2,548	2,930
65	3,782	3,833	3,920	3,513	3,347	3,686
70	4,643	4,609	4,766	4,321	4,260	4,512
75	5,550	5,379	5,625	5,183	5,232	5,364
80	6,415	6,155	6,428	6,005	6,187	6,189
85	7,165	6,851	7,119	6,781	7,045	6,936
90	7,758	7,498	7,639	7,435	7,746	7,569
95	8,158	8,247	8,049	8,201	8,282	8,101
100	9,174				9,174	9,174

According to Table VII.1 and Figure VII.2, insured who is 20 years old have to pay the lowest premium (331 YTL) if insurer use CSO 80 mortality table among used four mortality tables in Turkey. But, if insurer use Turkey mortality tables, insured have to pay 170 YTL for females, 300 YTL for males which are the lowest payment among all mortality tables. But after age 40, CSO 80 mortality table includes lower premium payment than Turkey male mortality table and also higher premium payment than Turkey female mortality table. ADST mortality table has the

highest premium payment for whole life insurance between the age 20 and 40, but after age 40, SM mortality table also has the highest premium payment.

Figure VII.2 Whole Life Insurance Net Single Premium Payments (YTL)



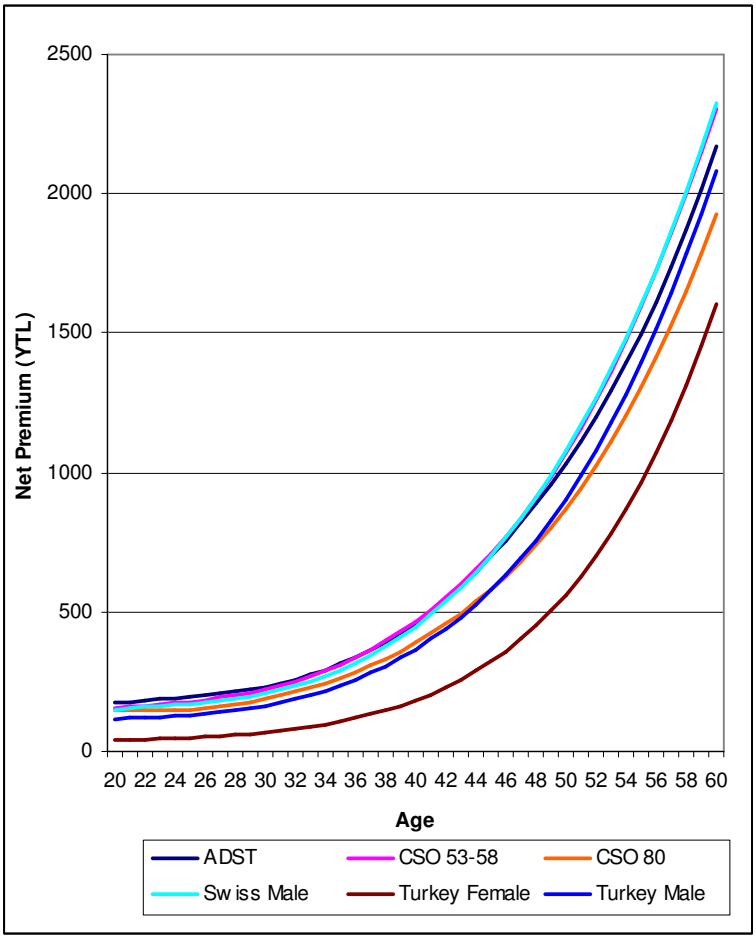
On the other hand, Table VII.2 and Figure VII.3 indicate that the term life insurance net single premium payments. For this table, policy period is determined as 15 years. And this table shows that how much money insured have to pay, in order to his/her relatives can take 10,000 YTL compensation when he/she dies in 15 years.

Table VII.2 Term Life Insurance Net Single Premium Payments for 15 Years (YTL)

Age	ADST	CSO 53-58	Swiss Male	CSO 80	Turkey Female	Turkey Male
20	174	158	151	146	41	116
25	195	178	171	151	48	130
30	232	223	209	187	66	163
35	314	310	292	264	106	236
40	461	466	448	389	183	367
45	698	707	702	581	321	578
50	1,034	1,071	1,077	870	561	906
55	1,499	1,594	1,601	1,307	964	1,394
60	2,172	2,306	2,328	1,925	1,605	2,086

According to Table VII.2 and Figure VII.3, insured who is 20 years old have to pay the lowest premium (140 YTL) if insurer use CSO 80 mortality table among used four mortality tables in Turkey. On the other hand, if insurer uses Turkey mortality tables, insured have to pay 41 YTL for females which is very low premium payment and 111 YTL for males. Both mortality tables have the lowest payment among all mortality tables. CSO 80 mortality table includes very close values with Turkey male mortality table after age 50. ADST mortality table has the highest premium payment for 15 years term life insurance between the age 20 and 45, but after age 45, it is observed that the SM mortality table has the highest premium payment.

Figure VII.3 Term Life Insurance Net Single Premium Payments for 15 Years (YTL)



Consequently, the net single premiums of whole and term life insurances have the lowest value at Turkey female and male mortality tables because of the low q(x) values. This conditions show that insurer has taken higher premiums from insured which may cause a loss for the insured.

B. ANALYSIS OF LIFE INSURANCE FOR PROBABILITY OF LIVING

The premiums of pure endowment and income life insurance can be calculated owing to probability of living. p(x) values of mortality tables are the basic factor to calculation of premiums of pure endowment and income life insurance.

Figure VII.4 p(x) Values of Used Mortality Tables in Turkey and Turkey Female and Male Mortality Tables.

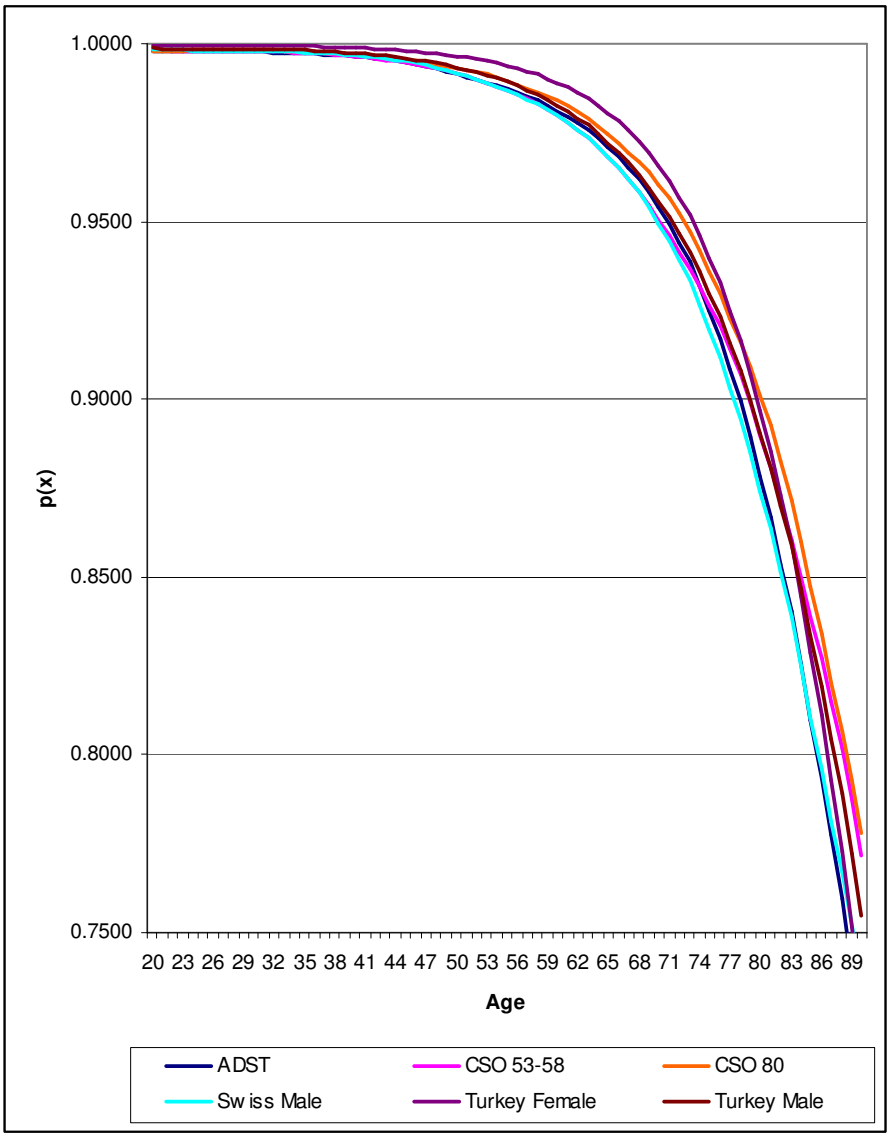


Figure VII.4 indicates that p(x) values of four used foreign mortality table in Turkey and Turkey mortality tables. p(x) and q(x) probabilities implement each other to "1". So p(x) values exhibit inverse results according to q(x) values. It can be acceptable for the premium calculation.

According to Figure VII.4, p(x) values of Turkey female and male mortality tables have the highest value between the age of 20 and 50. After age 50, p(x) values of Turkey male mortality table and after age 80 p(x) values of Turkey female mortality table show a decreasing more than CSO 80 mortality table. Therefore, it can be seen that the CSO 80 mortality table has the closest values according to Turkey Female and Male mortality tables.

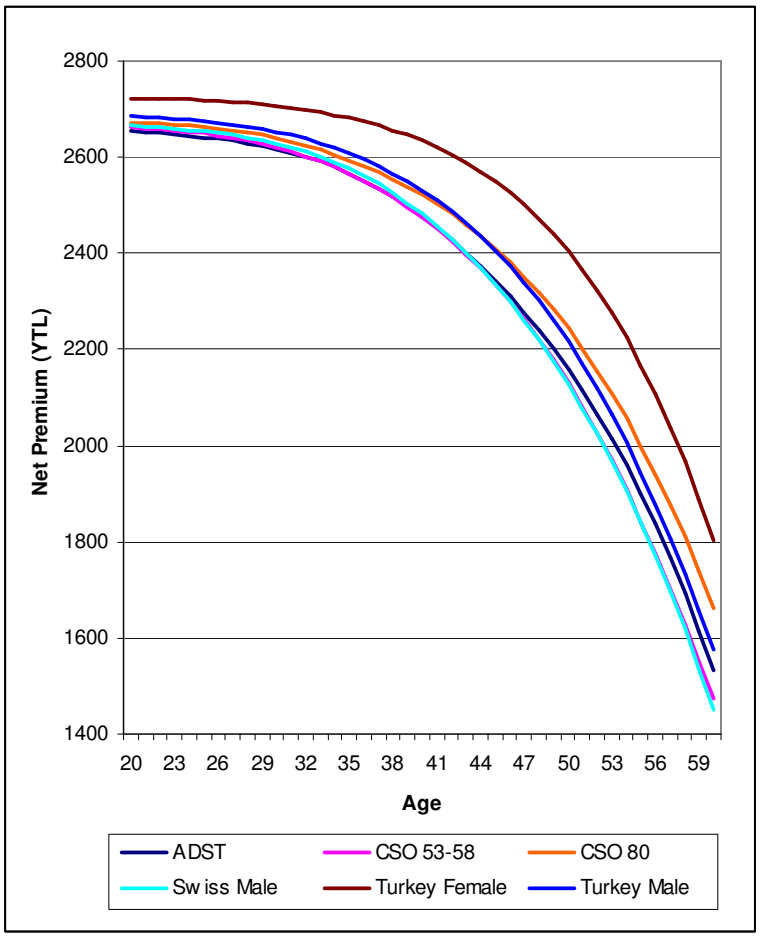
Additionally, it will be useful to analyze insurance premiums for pure endowment and income life insurance which are content of the probability of living.

Table VII.3 Pure Endowment Net Single Premium Payments for 15 Years (YTL)

Age	ADST	CSO 53-58	Swiss Male	CSO 80	Turkey Female	Turkey Male
20	2,654	2,663	2,666	2,672	2,724	2,685
25	2,641	2,650	2,654	2,664	2,719	2,676
30	2,617	2,620	2,629	2,639	2,706	2,653
35	2,566	2,566	2,576	2,594	2,681	2,607
40	2,476	2,475	2,481	2,521	2,634	2,530
45	2,344	2,336	2,335	2,410	2,550	2,406
50	2,159	2,131	2,129	2,244	2,406	2,218
55	1,901	1,843	1,840	2,000	2,168	1,945
60	1,534	1,473	1,452	1,664	1,803	1,575

Table VII.3 is prepared for net single premium payments of pure endowment. This table shows that how much money insured has to pay; in order to he/she can take 10,000 YTL compensation if he/she survives at the end of the 15 years. In this table, 10,000 YTL is also chosen as a fix amount of money too.

Figure VII 5 Pure Endowment Net Single Premium Payments for 15 Years (YTL)



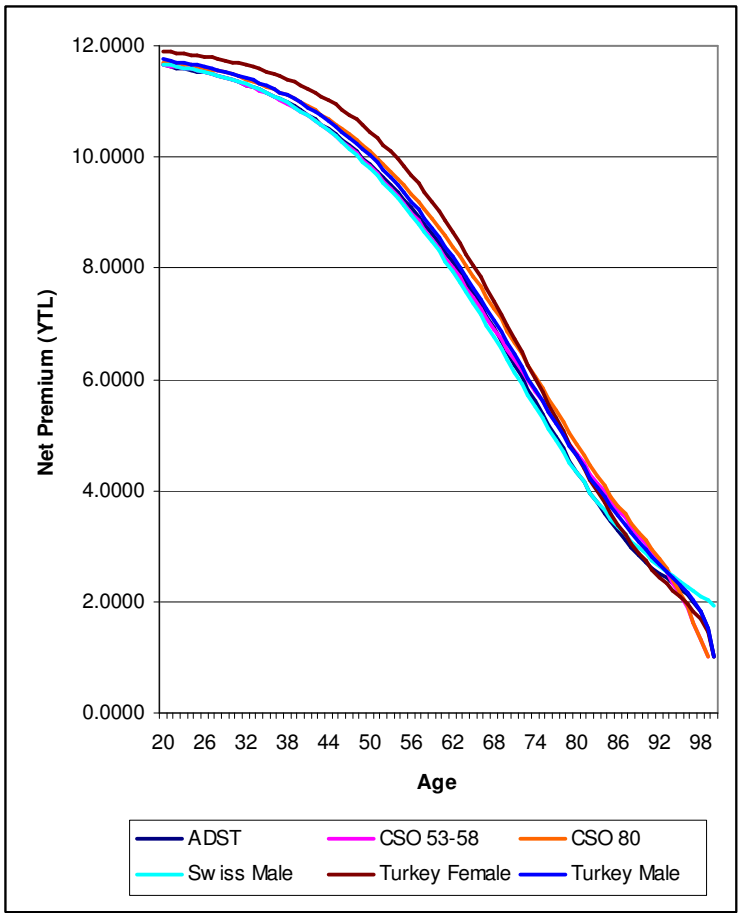
According to Table VII.3 and Figure VII.5, insured who is 20 years old have to pay the highest premium (2,672 YTL) if insurer use CSO 80 mortality table among used four mortality tables in Turkey. But, if insurer use Turkey mortality tables, insured have to pay 2,724 YTL for females, 2,685 YTL for males which are the highest payment among all mortality tables. But after age 45, CSO 80 mortality table includes higher premium payment than Turkey male mortality table and also lower premium payment than Turkey female mortality table. ADST, CSO 53-58 and SM mortality tables have very close premium payments.

On the other hand, Table VII.4 and Figure VII.6 indicate that the premiums of income life insurance for all mortality tables. This table shows that how much money insured has to pay in order to he/she can take 1 YTL from the insurers in every year until at the end of insured life.

Table VII.4 Income Life Insurance Net Single Premium Payments (YTL)

Age	ADST	CSO 53-58	Swiss Male	CSO 80	Turkey Female	Turkey Male
20	11.6469	11.6641	11.6749	11.7103	11.9055	11.7477
25	11.5383	11.5519	11.5623	11.6257	11.8285	11.6492
30	11.3838	11.3873	11.4008	11.4835	11.7124	11.5016
35	11.1559	11.1488	11.1607	11.2706	11.5386	11.2807
40	10.8381	10.8147	10.8243	10.9770	11.2873	10.9710
45	10.4076	10.3781	10.3720	10.5937	10.9353	10.5572
50	9.8693	9.8251	9.7956	10.1021	10.4564	10.0239
55	9.2272	9.1515	9.1099	9.4820	9.8252	9.3594
60	8.4501	8.3592	8.3033	8.7356	9.0250	8.5622
65	7.5302	7.4691	7.3634	7.8565	8.0570	7.6465
70	6.4883	6.5294	6.3392	6.8780	6.9518	6.6462
75	5.3898	5.5969	5.2986	5.8336	5.7744	5.6145
80	4.3423	4.6572	4.3257	4.8388	4.6175	4.6154
85	3.4332	3.8144	3.4898	3.8986	3.5787	3.7112
90	2.7158	3.0296	2.8595	3.1065	2.7294	2.9443
95	2.2307	2.1229	2.3634	2.1793	2.0808	2.3003

Figure VII.6 Income Life Insurance Net Single Premium Payments (YTL)



According to, Table VII.4 and Figure VII.6, insured who is 20 years old will pay 11.64 YTL as a minimum premium if insured uses ADST mortality table. And he/she take 1 YTL until he/she dies. Actually, premium payments have close values between age 20-45 for each mortality table. Turkey male and female mortality tables have the highest premium payments related to high p(x) values. But this high premium payment can not be identified as a loss for insured. Because, payments of all mortality tables show the similarities among each other. Another important point is that payments of CSO 80 mortality table show an increasing more than Turkey Male mortality table after age 40.

C. ANALYSIS OF ENDOWMENT LIFE INSURANCE

The results of the endowment life insurance have great importance. Because endowment life insurance is the most preferential type of life insurance policy by insurance companies in Turkey. Therefore, the results of this life insurance will exhibit the usability of Turkey mortality table more precisely. Because the other types of life insurances have a single probability factor such as dying or living. But endowment life insurance includes both probabilities.

Table VII.5 and Figure VII.7 show that how much money insured has to pay, in order to he/she can take 10,000 YTL compensation if he/she survives or dies at the end of the 15 years.

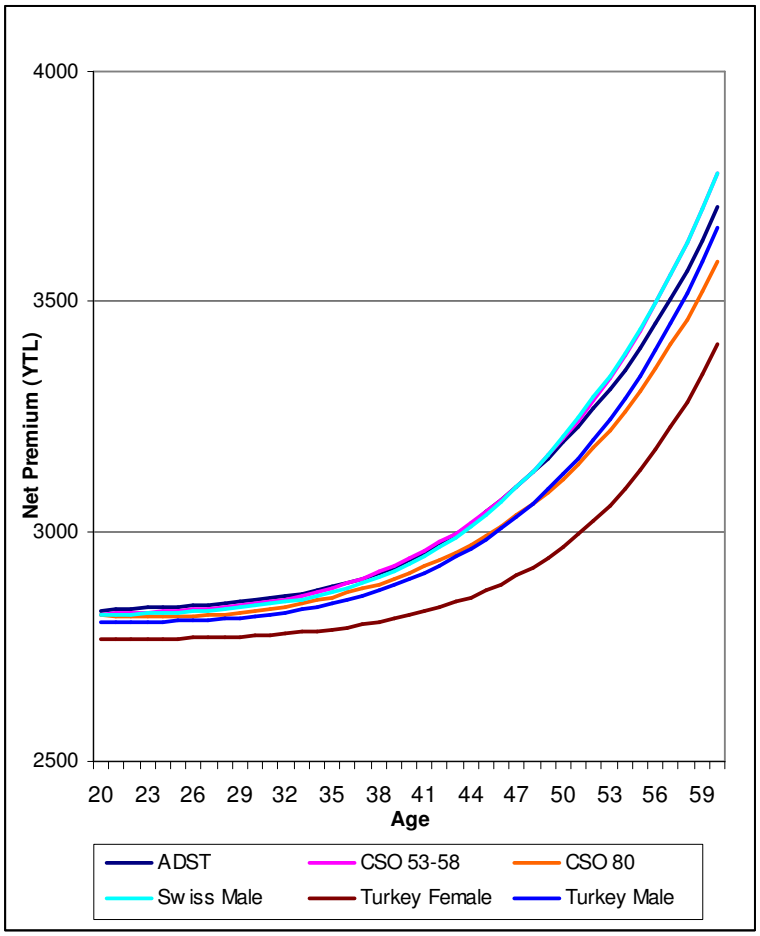
Table VII.5 Endowment Life Insurance Net Single Premium Payments for 15 Years (YTL)

Age	ADST	CSO 53-58	Swiss Male	CSO 80	Turkey Female	Turkey Male
20	2,828	2,820	2,817	2,817	2,765	2,801
25	2,837	2,828	2,825	2,816	2,767	2,805
30	2,850	2,843	2,838	2,827	2,773	2,816
35	2,880	2,876	2,869	2,857	2,788	2,844
40	2,938	2,941	2,929	2,910	2,817	2,896
45	3,042	3,043	3,037	2,991	2,871	2,984
50	3,193	3,202	3,206	3,115	2,967	3,124
55	3,400	3,437	3,441	3,307	3,132	3,339
60	3,705	3,778	3,779	3,588	3,408	3,660

According to Table VII.5 and Figure VII.7, Turkey female mortality table has minimum insurance premium and Turkey male mortality table follows that. But after age 45, it is seemed that CSO 80 mortality table has lower premiums than Turkey male mortality table. For example, any insured who is 50 years old has to pay 2,967

YTL for Turkey female mortality table, 3,115 YTL for CSO 80 mortality table, and 3,124 YTL for Turkey male mortality table in order to he/she can take 10,000 YTL compensation if he/she survives or dies at the end of the 15 years.

Figure VII.7 Endowment Life Insurance Net Single Premium Payments for 15 Years (YTL)



Consequently, it can be observed that the endowment life insurance whose premiums are calculated from Turkey female or male mortality table has the lowest premiums. This situation shows that insurance companies have taken higher premiums from insured. And it also causes loss for insured unjustly.

Similarly, insured has to pay lower insurance premiums for life insurance for the probability of dying (whole or term life insurance) in terms of q(x) values. This kind of insurances shows the similar results with endowment life insurance.

On the contrary, premiums of life insurance for the probability of living (pure endowment and income life insurance) give different results from the others. The main reason of this appears from the high survival probabilities of Turkey mortality tables. That income life insurance is generally preferred in long period of time reduces effects of high insurance premium.

When investigating three life insurance types, Turkey mortality tables have either closed premium values or lower premium values from the other foreign mortality tables. Three mortality tables which reflect the mortality pattern of 1950s give different results. But only CSO 80 mortality table gives similar results. In fact it is known that this table is already used by insurance companies in Turkey more frequently instead of other mortality tables (ADST, SM, CSO 53-58). Therefore Turkey mortality tables can be used comfortably in life insurance sector in Turkey.

CHAPTER VIII
CONCLUSION

The most significant application field for the mortality tables is the life insurances. The insurance premiums can only be calculated with this essential element; however, in our country, mortality tables which don't represent the reality in Turkey have been used both in insurance sector and in security institutions. Hence, it is evident that the insurance premiums calculated by the foreign tables be different. In order to eliminate this deficiency, it is needed to construct Turkey mortality tables from Turkish mortality data.

Therefore there are two main objectives of this thesis. The first objective is to construct mortality tables which represent the reality of Turkey and to construct commutation tables which assist the calculation of life insurance premiums. The second objective is also calculation of life insurance premiums according to types of life insurances by using these tables. Thanks to that four mortality tables which are used in life insurance sector in Turkey are compared with Turkey mortality table which is prepared from Turkish mortality data.

In this thesis, two different methods have been used to construct the tables. In the first method, according to the infant mortality rates of five – year period (1998 – 2003) calculated for both genders in TDHS-2003, mortality tables were established from Coale and Demeny's West Model Life Tables by using the interpolation formula. The death rates cover five years period preceding the 2003 survey and it refers the year of 2001.2. The second method was synthetic maternal and paternal orphanhood method devised by Zlotnik and Hill (1981) is used to estimate adult mortality for males and females. This technique is also applied to 1998 and 2003 TDHS data sets for both genders and it gave estimation to year of 2001.2. Both methods' mortality tables have been transformed from abridged mortality tables to complete mortality table by using UNABR application of MORTPAK.

However, the mortality tables are not accurate to calculate insurance premiums. Therefore, the commutation tables have been formed by adding a technical interest on the mortality tables. The life insurance premiums could be calculated with the help of this table. These tables have been constructed for two methods.

At the end of the thesis, the premium comparison has been made between Turkey commutation tables and other four foreign commutation tables which are used in Turkey. These comparisons have applied for all types of life insurance.

Life insurance premiums of three main types of life insurance (for probability of dying, probability of living and endowment life insurance) show different results. While premiums of life insurance for probability of dying and endowment life insurance show the similarity, premiums of life insurance for probability of living gives a different results from other types of life insurance. Therefore, the premium results of endowment life insurance, term life insurance and whole life insurance are different from pure endowment and income life insurance. The main reason of this originates from differentiation of probability of dying and surviving.

When investigating the dying and living probabilities, it is observed that used foreign mortality tables in Turkey shows differences from Turkey. Because, three of that tables reflect the death rates of 1950s and the mortality pattern and level show differences from Turkey mortality pattern and level. Especially, the demographic transition of Turkey has been changing since 1950s. While fertility rates was around 5 children per woman in the early 1970's, today's total fertility rate also decrease around 2.23 children per woman (HUIPS, 2004). Likewise, crude death rates have also declined from 30 per thousand in the 1940's to 7 per thousand in 1990's. Moreover, infant mortality rates have declined from 233 per thousand in 1955 to 29 per thousand in 2003 (Shorter and Macura, 1982; HUIPS, 2004). The decreasing of death rates is caused crucial differentiation to calculate the premiums of life insurances for death such as whole and term life insurances. This conditions show

that used foreign mortality tables stay behind of demographic structure of Turkey. The most significant result of this is taking unfair premiums from the insured related to dying and living probabilities.

The life insurance is divided three types. One of them is life insurance for the probability of dying (whole life insurance and term life insurance). The second type is life insurance for the probability of living (pure endowment and income life insurance) and the third type is also mixed type of life insurance (endowment life insurance). Owing to fact that the calculated premiums for these life insurances related to living and dying probabilities, different premium payments appear for insured people. When commutation tables for both sex produced in the study are compared with other commutation tables used in Turkey, insured has to pay fewer premiums for endowment life insurance, term life insurance and whole life insurance; on the other hand, they have to pay much premium for income life insurance or pure endowment. Owing to fact that the endowment life insurance is the most common type of life insurance, this results show that insured will make a loss unfairly if foreign mortality tables are used to calculate the premiums.

On the other hand, high insurance premium can be thought as a factor behind the demand shortage for life insurance due to high insurance premiums calculated from mortality tables that do not reflect the mortality patterns of Turkey. The number of people who have life insurance is given as 5,365,788 and 5,400,242 in 2004 and 2005 respectively, implying a slight increase between 2004 and 2005. Additionally, 42,306 insured people who have life insurance passed to the individual pension system (Emeklilik Gözetim Merkezi, 2005). Real and fair life insurance premium is important for the prevention of this passing and increasing the number of insured people. When economical condition of Turkey is considered, a decrease in life insurance premiums may be a trigger factor for the increase in the number of insured people.

The other important point is that life insurance companies can construct their own mortality table using own mortality data. Ten years mortality data is sufficient to prepare this table legally in Turkey. Most of life insurance companies in Turkey have done business over ten years. So, most of them have ten years mortality data today. Thus, it is not difficult to construct the mortality table using their own mortality data for life insurance companies which have large insured portfolio. Lack of early and old age mortality data may create problem to construct this table for those companies. Thus, this deficiency at early and old ages can be solved by using some mathematical calculation like CSO and ADST mortality tables.

When investigating the results of this thesis, it can not seem as a profitable for insurers. The premiums must be equal the present value of compensation. Turkey mortality tables are suitable demographic condition of Turkey. Thus, premium-compensation balance is provided with these tables. But, for other foreign mortality tables, insurance companies have taken high premium than the real premiums, especially life insurance for the probability of dying. For this reason, using foreign tables are seemed as a profitable for insurers. But actually, if Turkey mortality tables have been used in life insurance sector, more coherent estimations will be made to reflect current demographic condition of Turkey, premium-compensation balance will be provided, and this situation will increase demand of life insurance, it will decrease passing from life insurance to private pension system or leaving from life insurance, the dividend amount of insured will increase, the money which will direct to investment will increase, the share of life insurance in GDP will increase and this cause high confidence for insurance sector. Consequently, this thesis clearly shows that life insurance sector in Turkey need reliable mortality tables prepared on the basis of current mortality level and pattern of Turkey.

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APPENDIX

Table 1. CSO 1980 Mortality Table

x	lx	dx	qx	px	Lx	Tx	ex
0	100,000	418	0.0042	0.9958	99,791	7,083,377	70.83
1	99,582	107	0.0011	0.9989	99,529	6,983,586	70.13
2	99,475	98	0.0010	0.9990	99,426	6,884,057	69.20
3	99,377	97	0.0010	0.9990	99,328	6,784,631	68.27
4	99,280	94	0.0010	0.9990	99,232	6,685,303	67.34
5	99,185	89	0.0009	0.9991	99,141	6,586,070	66.40
6	99,096	85	0.0009	0.9991	99,053	6,486,930	65.46
7	99,011	109	0.0011	0.9989	98,956	6,387,876	64.52
8	98,902	45	0.0005	0.9995	98,879	6,288,920	63.59
9	98,856	73	0.0007	0.9993	98,820	6,190,041	62.62
10	98,783	72	0.0007	0.9993	98,747	6,091,221	61.66
11	98,711	76	0.0008	0.9992	98,673	5,992,474	60.71
12	98,635	84	0.0009	0.9991	98,593	5,893,801	59.75
13	98,551	98	0.0010	0.9990	98,502	5,795,208	58.80
14	98,454	113	0.0011	0.9989	98,397	5,696,705	57.86
15	98,340	131	0.0013	0.9987	98,275	5,598,308	56.93
16	98,210	148	0.0015	0.9985	98,136	5,500,033	56.00
17	98,061	164	0.0017	0.9983	97,980	5,401,898	55.09
18	97,898	174	0.0018	0.9982	97,810	5,303,918	54.18
19	97,723	182	0.0019	0.9981	97,632	5,206,108	53.27
20	97,542	185	0.0019	0.9981	97,449	5,108,475	52.37
21	97,356	186	0.0019	0.9981	97,263	5,011,026	51.47
22	97,170	184	0.0019	0.9981	97,078	4,913,763	50.57
23	96,987	180	0.0019	0.9981	96,896	4,816,684	49.66
24	96,806	176	0.0018	0.9982	96,718	4,719,788	48.75
25	96,630	171	0.0018	0.9982	96,545	4,623,070	47.84
26	96,459	167	0.0017	0.9983	96,376	4,526,525	46.93
27	96,292	165	0.0017	0.9983	96,210	4,430,150	46.01
28	96,128	163	0.0017	0.9983	96,046	4,333,940	45.09
29	95,964	164	0.0017	0.9983	95,882	4,237,894	44.16
30	95,800	166	0.0017	0.9983	95,717	4,142,012	43.24
31	95,634	170	0.0018	0.9982	95,549	4,046,295	42.31
32	95,464	175	0.0018	0.9982	95,377	3,950,746	41.38
33	95,289	182	0.0019	0.9981	95,198	3,855,369	40.46
34	95,107	190	0.0020	0.9980	95,012	3,760,171	39.54
35	94,917	200	0.0021	0.9979	94,817	3,665,158	38.61
36	94,717	212	0.0022	0.9978	94,611	3,570,341	37.69
37	94,505	227	0.0024	0.9976	94,391	3,475,731	36.78
38	94,278	243	0.0026	0.9974	94,156	3,381,339	35.87
39	94,035	262	0.0028	0.9972	93,903	3,287,183	34.96
40	93,772	283	0.0030	0.9970	93,631	3,193,280	34.05
41	93,489	308	0.0033	0.9967	93,335	3,099,649	33.16
42	93,182	332	0.0036	0.9964	93,016	3,006,314	32.26
43	92,850	359	0.0039	0.9961	92,670	2,913,298	31.38
44	92,490	388	0.0042	0.9958	92,297	2,820,628	30.50
45	92,103	419	0.0046	0.9954	91,893	2,728,331	29.62
46	91,684	451	0.0049	0.9951	91,458	2,636,438	28.76
47	91,233	485	0.0053	0.9947	90,990	2,544,980	27.90
48	90,747	521	0.0057	0.9943	90,487	2,453,989	27.04
49	90,227	560	0.0062	0.9938	89,946	2,363,503	26.20
50	89,666	602	0.0067	0.9933	89,365	2,273,556	25.36

Table 1. CSO 1980 Mortality Table (Continued)

x	lx	dx	qx	px	Lx	Tx	ex
51	89,065	650	0.0073	0.9927	88,739	2,184,191	24.52
52	88,414	704	0.0080	0.9920	88,062	2,095,451	23.70
53	87,711	764	0.0087	0.9913	87,329	2,007,389	22.89
54	86,947	831	0.0096	0.9904	86,531	1,920,060	22.08
55	86,115	902	0.0105	0.9895	85,665	1,833,529	21.29
56	85,214	977	0.0115	0.9885	84,726	1,747,865	20.51
57	84,237	1,052	0.0125	0.9875	83,711	1,663,139	19.74
58	83,185	1,130	0.0136	0.9864	82,620	1,579,428	18.99
59	82,055	1,212	0.0148	0.9852	81,449	1,496,808	18.24
60	80,843	1,300	0.0161	0.9839	80,193	1,415,359	17.51
61	79,543	1,395	0.0175	0.9825	78,845	1,335,167	16.79
62	78,148	1,500	0.0192	0.9808	77,398	1,256,321	16.08
63	76,648	1,614	0.0211	0.9789	75,841	1,178,924	15.38
64	75,034	1,736	0.0231	0.9769	74,166	1,103,083	14.70
65	73,297	1,863	0.0254	0.9746	72,366	1,028,917	14.04
66	71,434	1,989	0.0279	0.9721	70,439	956,551	13.39
67	69,445	2,114	0.0304	0.9696	68,388	886,112	12.76
68	67,331	2,235	0.0332	0.9668	66,214	817,724	12.14
69	65,096	2,355	0.0362	0.9638	63,919	751,511	11.54
70	62,742	2,479	0.0395	0.9605	61,502	687,592	10.96
71	60,263	2,609	0.0433	0.9567	58,958	626,090	10.39
72	57,653	2,747	0.0476	0.9524	56,280	567,132	9.84
73	54,906	2,890	0.0526	0.9474	53,461	510,852	9.30
74	52,016	3,027	0.0582	0.9418	50,502	457,391	8.79
75	48,989	3,145	0.0642	0.9358	47,417	406,888	8.31
76	45,844	3,233	0.0705	0.9295	44,228	359,472	7.84
77	42,611	3,286	0.0771	0.9229	40,968	315,244	7.40
78	39,325	3,299	0.0839	0.9161	37,675	274,276	6.97
79	36,026	3,280	0.0911	0.9089	34,385	236,601	6.57
80	32,745	3,237	0.0988	0.9012	31,127	202,215	6.18
81	29,509	3,172	0.1075	0.8925	27,923	171,088	5.80
82	26,337	3,088	0.1173	0.8827	24,793	143,165	5.44
83	23,249	2,982	0.1283	0.8717	21,758	118,372	5.09
84	20,267	2,842	0.1402	0.8598	18,846	96,614	4.77
85	17,425	2,665	0.1529	0.8471	16,092	77,768	4.46
86	14,760	2,451	0.1661	0.8339	13,534	61,675	4.18
87	12,308	2,210	0.1796	0.8204	11,203	48,141	3.91
88	10,098	1,952	0.1933	0.8067	9,122	36,938	3.66
89	8,147	1,689	0.2073	0.7927	7,302	27,816	3.41
90	6,458	1,432	0.2218	0.7782	5,742	20,513	3.18
91	5,026	1,191	0.2370	0.7630	4,430	14,772	2.94
92	3,835	972	0.2535	0.7465	3,349	10,341	2.70
93	2,863	779	0.2721	0.7279	2,473	6,993	2.44
94	2,084	617	0.2959	0.7041	1,776	4,519	2.17
95	1,467	484	0.3300	0.6700	1,225	2,744	1.87
96	983	378	0.3846	0.6154	794	1,519	1.54
97	605	291	0.4802	0.5198	460	725	1.20
98	315	207	0.6580	0.3420	211	265	0.84
99	108	108	1.0000	0.0000	54	54	0.50

Table 2. CSO 1953-1958 Mortality Table

x	lx	dx	qx	px	Lx	Tx	ex
0	100,000	708	0.0071	0.9929	99,646	6,829,669	68.30
1	99,292	175	0.0018	0.9982	99,205	6,730,023	67.78
2	99,117	151	0.0015	0.9985	99,042	6,630,818	66.90
3	98,967	144	0.0015	0.9985	98,894	6,531,776	66.00
4	98,822	138	0.0014	0.9986	98,753	6,432,882	65.10
5	98,684	133	0.0013	0.9987	98,617	6,334,129	64.19
6	98,551	128	0.0013	0.9987	98,486	6,235,512	63.27
7	98,422	124	0.0013	0.9987	98,360	6,137,025	62.35
8	98,298	121	0.0012	0.9988	98,238	6,038,665	61.43
9	98,177	119	0.0012	0.9988	98,118	5,940,427	60.51
10	98,059	119	0.0012	0.9988	97,999	5,842,309	59.58
11	97,940	120	0.0012	0.9988	97,880	5,744,309	58.65
12	97,820	123	0.0013	0.9987	97,758	5,646,430	57.72
13	97,696	129	0.0013	0.9987	97,632	5,548,672	56.80
14	97,567	136	0.0014	0.9986	97,500	5,451,040	55.87
15	97,432	142	0.0015	0.9985	97,361	5,353,540	54.95
16	97,290	150	0.0015	0.9985	97,215	5,256,180	54.03
17	97,140	157	0.0016	0.9984	97,061	5,158,965	53.11
18	96,982	164	0.0017	0.9983	96,900	5,061,904	52.19
19	96,818	168	0.0017	0.9983	96,734	4,965,004	51.28
20	96,650	173	0.0018	0.9982	96,563	4,868,270	50.37
21	96,477	177	0.0018	0.9982	96,389	4,771,706	49.46
22	96,300	179	0.0019	0.9981	96,211	4,675,317	48.55
23	96,121	182	0.0019	0.9981	96,030	4,579,107	47.64
24	95,940	183	0.0019	0.9981	95,848	4,483,076	46.73
25	95,756	185	0.0019	0.9981	95,664	4,387,228	45.82
26	95,572	187	0.0020	0.9980	95,478	4,291,564	44.90
27	95,384	190	0.0020	0.9980	95,289	4,196,086	43.99
28	95,194	193	0.0020	0.9980	95,098	4,100,797	43.08
29	95,001	198	0.0021	0.9979	94,902	4,005,699	42.16
30	94,804	202	0.0021	0.9979	94,703	3,910,797	41.25
31	94,602	207	0.0022	0.9978	94,498	3,816,094	40.34
32	94,394	212	0.0023	0.9977	94,288	3,721,596	39.43
33	94,182	219	0.0023	0.9977	94,073	3,627,308	38.51
34	93,964	226	0.0024	0.9976	93,851	3,533,235	37.60
35	93,738	235	0.0025	0.9975	93,620	3,439,384	36.69
36	93,503	247	0.0026	0.9974	93,379	3,345,764	35.78
37	93,256	261	0.0028	0.9972	93,125	3,252,384	34.88
38	92,995	280	0.0030	0.9970	92,855	3,159,259	33.97
39	92,715	301	0.0032	0.9968	92,564	3,066,404	33.07
40	92,414	326	0.0035	0.9965	92,250	2,973,840	32.18
41	92,087	354	0.0038	0.9962	91,911	2,881,589	31.29
42	91,734	383	0.0042	0.9958	91,542	2,789,679	30.41
43	91,351	414	0.0045	0.9955	91,144	2,698,136	29.54
44	90,937	447	0.0049	0.9951	90,714	2,606,992	28.67
45	90,490	484	0.0053	0.9947	90,248	2,516,278	27.81
46	90,006	525	0.0058	0.9942	89,744	2,426,030	26.95
47	89,481	569	0.0064	0.9936	89,197	2,336,287	26.11
48	88,912	618	0.0070	0.9930	88,603	2,247,090	25.27
49	88,294	671	0.0076	0.9924	87,959	2,158,487	24.45
50	87,623	729	0.0083	0.9917	87,259	2,070,529	23.63

Table 2. CSO 1953-1958 Mortality Table (Continued)

x	lx	dx	qx	px	Lx	Tx	ex
51	86,894	792	0.0091	0.9909	86,498	1,983,270	22.82
52	86,102	858	0.0100	0.9900	85,674	1,896,772	22.03
53	85,245	928	0.0109	0.9891	84,781	1,811,098	21.25
54	84,317	1,003	0.0119	0.9881	83,815	1,726,318	20.47
55	83,313	1,083	0.0130	0.9870	82,772	1,642,503	19.71
56	82,230	1,168	0.0142	0.9858	81,646	1,559,731	18.97
57	81,062	1,260	0.0155	0.9845	80,432	1,478,085	18.23
58	79,802	1,357	0.0170	0.9830	79,124	1,397,653	17.51
59	78,445	1,458	0.0186	0.9814	77,716	1,318,530	16.81
60	76,987	1,566	0.0203	0.9797	76,204	1,240,814	16.12
61	75,421	1,677	0.0222	0.9778	74,582	1,164,610	15.44
62	73,744	1,793	0.0243	0.9757	72,847	1,090,027	14.78
63	71,951	1,912	0.0266	0.9734	70,995	1,017,180	14.14
64	70,039	2,034	0.0290	0.9710	69,022	946,185	13.51
65	68,005	2,159	0.0318	0.9682	66,926	877,163	12.90
66	65,846	2,287	0.0347	0.9653	64,702	810,237	12.31
67	63,559	2,418	0.0380	0.9620	62,350	745,534	11.73
68	61,141	2,548	0.0417	0.9583	59,867	683,185	11.17
69	58,593	2,672	0.0456	0.9544	57,256	623,318	10.64
70	55,920	2,784	0.0498	0.9502	54,528	566,062	10.12
71	53,136	2,877	0.0542	0.9458	51,697	511,534	9.63
72	50,259	2,948	0.0586	0.9414	48,785	459,836	9.15
73	47,311	2,993	0.0633	0.9367	45,814	411,052	8.69
74	44,318	3,019	0.0681	0.9319	42,809	365,237	8.24
75	41,299	3,030	0.0734	0.9266	39,784	322,429	7.81
76	38,269	3,030	0.0792	0.9208	36,754	282,645	7.39
77	35,239	3,020	0.0857	0.9143	33,729	245,891	6.98
78	32,219	2,998	0.0931	0.9069	30,720	212,162	6.59
79	29,221	2,957	0.1012	0.8988	27,742	181,442	6.21
80	26,264	2,888	0.1100	0.8900	24,819	153,700	5.85
81	23,375	2,790	0.1193	0.8807	21,980	128,881	5.51
82	20,585	2,659	0.1292	0.8708	19,256	106,900	5.19
83	17,926	2,499	0.1394	0.8606	16,677	87,645	4.89
84	15,428	2,314	0.1500	0.8500	14,271	70,967	4.60
85	13,113	2,113	0.1611	0.8389	12,057	56,697	4.32
86	11,000	1,901	0.1728	0.8272	10,050	44,640	4.06
87	9,099	1,685	0.1851	0.8149	8,257	34,590	3.80
88	7,415	1,470	0.1982	0.8018	6,680	26,333	3.55
89	5,945	1,263	0.2125	0.7875	5,313	19,653	3.31
90	4,682	1,068	0.2281	0.7719	4,148	14,340	3.06
91	3,614	888	0.2458	0.7542	3,170	10,192	2.82
92	2,726	725	0.2659	0.7341	2,363	7,023	2.58
93	2,001	579	0.2893	0.7107	1,711	4,660	2.33
94	1,422	450	0.3167	0.6833	1,197	2,948	2.07
95	972	341	0.3512	0.6488	801	1,752	1.80
96	630	253	0.4006	0.5994	504	951	1.51
97	378	185	0.4884	0.5116	286	446	1.18
98	193	129	0.6681	0.3319	129	161	0.83
99	64	64	1.0000	0.0000	32	32	0.50

Table 3. ADST 1949-1951 Mortality Table

x	lx	dx	qx	px	Lx	Tx	ex
0	100,000	6,177	0.0618	0.9382	96,912	6,457,634	64.58
1	93,823	390	0.0042	0.9958	93,628	6,360,741	67.80
2	93,433	230	0.0025	0.9975	93,318	6,267,113	67.08
3	93,203	181	0.0019	0.9981	93,113	6,173,795	66.24
4	93,022	142	0.0015	0.9985	92,951	6,080,682	65.37
5	92,880	112	0.0012	0.9988	92,824	5,987,731	64.47
6	92,768	95	0.0010	0.9990	92,721	5,894,907	63.54
7	92,673	87	0.0009	0.9991	92,630	5,802,187	62.61
8	92,586	73	0.0008	0.9992	92,550	5,709,557	61.67
9	92,513	69	0.0007	0.9993	92,479	5,617,008	60.72
10	92,444	65	0.0007	0.9993	92,412	5,524,529	59.76
11	92,379	64	0.0007	0.9993	92,347	5,432,118	58.80
12	92,315	65	0.0007	0.9993	92,283	5,339,771	57.84
13	92,250	72	0.0008	0.9992	92,214	5,247,488	56.88
14	92,178	81	0.0009	0.9991	92,138	5,155,274	55.93
15	92,097	96	0.0010	0.9990	92,049	5,063,137	54.98
16	92,001	109	0.0012	0.9988	91,947	4,971,088	54.03
17	91,892	125	0.0014	0.9986	91,830	4,879,141	53.10
18	91,767	142	0.0015	0.9985	91,696	4,787,312	52.17
19	91,625	159	0.0017	0.9983	91,546	4,695,616	51.25
20	91,466	172	0.0019	0.9981	91,380	4,604,070	50.34
21	91,294	181	0.0020	0.9980	91,204	4,512,690	49.43
22	91,113	189	0.0021	0.9979	91,019	4,421,487	48.53
23	90,924	194	0.0021	0.9979	90,827	4,330,468	47.63
24	90,730	199	0.0022	0.9978	90,631	4,239,641	46.73
25	90,531	202	0.0022	0.9978	90,430	4,149,011	45.83
26	90,329	204	0.0023	0.9977	90,227	4,058,581	44.93
27	90,125	203	0.0023	0.9977	90,024	3,968,354	44.03
28	89,922	202	0.0022	0.9978	89,821	3,878,330	43.13
29	89,720	202	0.0023	0.9977	89,619	3,788,509	42.23
30	89,518	204	0.0023	0.9977	89,416	3,698,890	41.32
31	89,314	210	0.0024	0.9976	89,209	3,609,474	40.41
32	89,104	217	0.0024	0.9976	88,996	3,520,265	39.51
33	88,887	225	0.0025	0.9975	88,775	3,431,270	38.60
34	88,662	234	0.0026	0.9974	88,545	3,342,495	37.70
35	88,428	244	0.0028	0.9972	88,306	3,253,950	36.80
36	88,184	254	0.0029	0.9971	88,057	3,165,644	35.90
37	87,930	264	0.0030	0.9970	87,798	3,077,587	35.00
38	87,666	275	0.0031	0.9969	87,529	2,989,789	34.10
39	87,391	289	0.0033	0.9967	87,247	2,902,261	33.21
40	87,102	307	0.0035	0.9965	86,949	2,815,014	32.32
41	86,795	327	0.0038	0.9962	86,632	2,728,066	31.43
42	86,468	348	0.0040	0.9960	86,294	2,641,434	30.55
43	86,120	374	0.0043	0.9957	85,933	2,555,140	29.67
44	85,746	404	0.0047	0.9953	85,544	2,469,207	28.80
45	85,342	440	0.0052	0.9948	85,122	2,383,663	27.93
46	84,902	485	0.0057	0.9943	84,660	2,298,541	27.07
47	84,417	534	0.0063	0.9937	84,150	2,213,882	26.23
48	83,883	589	0.0070	0.9930	83,589	2,129,732	25.39
49	83,294	646	0.0078	0.9922	82,971	2,046,143	24.57
50	82,648	703	0.0085	0.9915	82,297	1,963,172	23.75

Table 3. ADST 1949-1951 Mortality Table (Continued)

x	lx	dx	qx	px	Lx	Tx	ex
51	81,945	759	0.0093	0.9907	81,566	1,880,876	22.95
52	81,186	815	0.0100	0.9900	80,779	1,799,310	22.16
53	80,371	874	0.0109	0.9891	79,934	1,718,532	21.38
54	79,497	935	0.0118	0.9882	79,030	1,638,598	20.61
55	78,562	1,002	0.0128	0.9872	78,061	1,559,568	19.85
56	77,560	1,070	0.0138	0.9862	77,025	1,481,507	19.10
57	76,490	1,138	0.0149	0.9851	75,921	1,404,482	18.36
58	75,352	1,211	0.0161	0.9839	74,747	1,328,561	17.63
59	74,141	1,289	0.0174	0.9826	73,497	1,253,815	16.91
60	72,852	1,378	0.0189	0.9811	72,163	1,180,318	16.20
61	71,474	1,471	0.0206	0.9794	70,739	1,108,155	15.50
62	70,003	1,566	0.0224	0.9776	69,220	1,037,417	14.82
63	68,437	1,665	0.0243	0.9757	67,605	968,197	14.15
64	66,772	1,773	0.0266	0.9734	65,886	900,592	13.49
65	64,999	1,889	0.0291	0.9709	64,055	834,707	12.84
66	63,110	2,006	0.0318	0.9682	62,107	770,652	12.21
67	61,104	2,119	0.0347	0.9653	60,045	708,545	11.60
68	58,985	2,234	0.0379	0.9621	57,868	648,501	10.99
69	56,751	2,357	0.0415	0.9585	55,573	590,633	10.41
70	54,394	2,491	0.0458	0.9542	53,149	535,060	9.84
71	51,903	2,625	0.0506	0.9494	50,591	481,912	9.28
72	49,278	2,749	0.0558	0.9442	47,904	431,321	8.75
73	46,529	2,863	0.0615	0.9385	45,098	383,418	8.24
74	43,666	2,966	0.0679	0.9321	42,183	338,320	7.75
75	40,700	3,056	0.0751	0.9249	39,172	296,137	7.28
76	37,644	3,120	0.0829	0.9171	36,084	256,965	6.83
77	34,524	3,152	0.0913	0.9087	32,948	220,881	6.40
78	31,372	3,150	0.1004	0.8996	29,797	187,933	5.99
79	28,222	3,116	0.1104	0.8896	26,664	158,136	5.60
80	25,106	3,047	0.1214	0.8786	23,583	131,472	5.24
81	22,059	2,941	0.1333	0.8667	20,589	107,890	4.89
82	19,118	2,794	0.1461	0.8539	17,721	87,301	4.57
83	16,324	2,609	0.1598	0.8402	15,020	69,580	4.26
84	13,715	2,394	0.1746	0.8254	12,518	54,561	3.98
85	11,321	2,153	0.1902	0.8098	10,245	42,043	3.71
86	9,168	1,894	0.2066	0.7934	8,221	31,798	3.47
87	7,274	1,619	0.2226	0.7774	6,465	23,577	3.24
88	5,655	1,361	0.2407	0.7593	4,975	17,113	3.03
89	4,294	1,119	0.2606	0.7394	3,735	12,138	2.83
90	3,175	897	0.2825	0.7175	2,727	8,404	2.65
91	2,278	689	0.3025	0.6975	1,934	5,677	2.49
92	1,589	507	0.3191	0.6809	1,336	3,744	2.36
93	1,082	363	0.3355	0.6645	901	2,408	2.23
94	719	253	0.3519	0.6481	593	1,508	2.10
95	466	172	0.3691	0.6309	380	915	1.96
96	294	113	0.3844	0.6156	238	535	1.82
97	181	73	0.4033	0.5967	145	298	1.64
98	108	45	0.4167	0.5833	86	153	1.42
99	63	27	0.4286	0.5714	50	68	1.07
100	36	36	1.0000	0.0000	18	18	0.50

Table 4. SM 1948-1953 Mortality Table

x	lx	dx	qx	px	Lx	Tx	ex
0	100,000	3,591	0.0359	0.9641	98,205	6,635,474	66.35
1	96,409	353	0.0037	0.9963	96,233	6,537,306	67.81
2	96,056	211	0.0022	0.9978	95,951	6,441,093	67.06
3	95,845	144	0.0015	0.9985	95,773	6,345,153	66.20
4	95,701	119	0.0012	0.9988	95,642	6,249,385	65.30
5	95,582	103	0.0011	0.9989	95,531	6,153,746	64.38
6	95,479	89	0.0009	0.9991	95,435	6,058,216	63.45
7	95,390	77	0.0008	0.9992	95,352	5,962,781	62.51
8	95,313	70	0.0007	0.9993	95,278	5,867,430	61.56
9	95,243	64	0.0007	0.9993	95,211	5,772,152	60.60
10	95,179	61	0.0006	0.9994	95,149	5,676,941	59.64
11	95,118	61	0.0006	0.9994	95,088	5,581,792	58.68
12	95,057	64	0.0007	0.9993	95,025	5,486,705	57.72
13	94,993	68	0.0007	0.9993	94,959	5,391,680	56.76
14	94,925	77	0.0008	0.9992	94,887	5,296,721	55.80
15	94,848	87	0.0009	0.9991	94,805	5,201,834	54.84
16	94,761	100	0.0011	0.9989	94,711	5,107,030	53.89
17	94,661	115	0.0012	0.9988	94,604	5,012,319	52.95
18	94,546	130	0.0014	0.9986	94,481	4,917,715	52.01
19	94,416	144	0.0015	0.9985	94,344	4,823,234	51.08
20	94,272	154	0.0016	0.9984	94,195	4,728,890	50.16
21	94,118	161	0.0017	0.9983	94,038	4,634,695	49.24
22	93,957	167	0.0018	0.9982	93,874	4,540,658	48.33
23	93,790	173	0.0018	0.9982	93,704	4,446,784	47.41
24	93,617	177	0.0019	0.9981	93,529	4,353,081	46.50
25	93,440	179	0.0019	0.9981	93,351	4,259,552	45.59
26	93,261	181	0.0019	0.9981	93,171	4,166,202	44.67
27	93,080	182	0.0020	0.9980	92,989	4,073,031	43.76
28	92,898	183	0.0020	0.9980	92,807	3,980,042	42.84
29	92,715	185	0.0020	0.9980	92,623	3,887,236	41.93
30	92,530	187	0.0020	0.9980	92,437	3,794,613	41.01
31	92,343	190	0.0021	0.9979	92,248	3,702,177	40.09
32	92,153	194	0.0021	0.9979	92,056	3,609,929	39.17
33	91,959	200	0.0022	0.9978	91,859	3,517,873	38.25
34	91,759	207	0.0023	0.9977	91,656	3,426,014	37.34
35	91,552	218	0.0024	0.9976	91,443	3,334,358	36.42
36	91,334	230	0.0025	0.9975	91,219	3,242,915	35.51
37	91,104	244	0.0027	0.9973	90,982	3,151,696	34.59
38	90,860	260	0.0029	0.9971	90,730	3,060,714	33.69
39	90,600	278	0.0031	0.9969	90,461	2,969,984	32.78
40	90,322	298	0.0033	0.9967	90,173	2,879,523	31.88
41	90,024	319	0.0035	0.9965	89,865	2,789,350	30.98
42	89,705	342	0.0038	0.9962	89,534	2,699,486	30.09
43	89,363	369	0.0041	0.9959	89,179	2,609,952	29.21
44	88,994	402	0.0045	0.9955	88,793	2,520,773	28.33
45	88,592	440	0.0050	0.9950	88,372	2,431,980	27.45
46	88,152	482	0.0055	0.9945	87,911	2,343,608	26.59
47	87,670	529	0.0060	0.9940	87,406	2,255,697	25.73
48	87,141	581	0.0067	0.9933	86,851	2,168,292	24.88
49	86,560	640	0.0074	0.9926	86,240	2,081,441	24.05
50	85,920	705	0.0082	0.9918	85,568	1,995,201	23.22
51	85,215	777	0.0091	0.9909	84,827	1,909,634	22.41
52	84,438	853	0.0101	0.9899	84,012	1,824,807	21.61

Table 4. SM 1948-1953 Mortality Table (Continued)

x	lx	dx	qx	px	Lx	Tx	ex
53	83,585	932	0.0112	0.9888	83,119	1,740,796	20.83
54	82,653	1,013	0.0123	0.9877	82,147	1,657,677	20.06
55	81,640	1,092	0.0134	0.9866	81,094	1,575,530	19.30
56	80,548	1,170	0.0145	0.9855	79,963	1,494,436	18.55
57	79,378	1,251	0.0158	0.9842	78,753	1,414,473	17.82
58	78,127	1,338	0.0171	0.9829	77,458	1,335,721	17.10
59	76,789	1,434	0.0187	0.9813	76,072	1,258,263	16.39
60	75,355	1,533	0.0203	0.9797	74,589	1,182,191	15.69
61	73,822	1,632	0.0221	0.9779	73,006	1,107,602	15.00
62	72,190	1,737	0.0241	0.9759	71,322	1,034,596	14.33
63	70,453	1,851	0.0263	0.9737	69,528	963,275	13.67
64	68,602	1,977	0.0288	0.9712	67,614	893,747	13.03
65	66,625	2,111	0.0317	0.9683	65,570	826,134	12.40
66	64,514	2,244	0.0348	0.9652	63,392	760,564	11.79
67	62,270	2,379	0.0382	0.9618	61,081	697,172	11.20
68	59,891	2,515	0.0420	0.9580	58,634	636,092	10.62
69	57,376	2,651	0.0462	0.9538	56,051	577,458	10.06
70	54,725	2,778	0.0508	0.9492	53,336	521,408	9.53
71	51,947	2,889	0.0556	0.9444	50,503	468,072	9.01
72	49,058	2,988	0.0609	0.9391	47,564	417,569	8.51
73	46,070	3,076	0.0668	0.9332	44,532	370,005	8.03
74	42,994	3,151	0.0733	0.9267	41,419	325,473	7.57
75	39,843	3,207	0.0805	0.9195	38,240	284,055	7.13
76	36,636	3,232	0.0882	0.9118	35,020	245,815	6.71
77	33,404	3,226	0.0966	0.9034	31,791	210,795	6.31
78	30,178	3,188	0.1056	0.8944	28,584	179,004	5.93
79	26,990	3,116	0.1155	0.8845	25,432	150,420	5.57
80	23,874	3,001	0.1257	0.8743	22,374	124,988	5.24
81	20,873	2,845	0.1363	0.8637	19,451	102,615	4.92
82	18,028	2,673	0.1483	0.8517	16,692	83,164	4.61
83	15,355	2,477	0.1613	0.8387	14,117	66,473	4.33
84	12,878	2,255	0.1751	0.8249	11,751	52,356	4.07
85	10,623	2,013	0.1895	0.8105	9,617	40,606	3.82
86	8,610	1,757	0.2041	0.7959	7,732	30,989	3.60
87	6,853	1,499	0.2187	0.7813	6,104	23,258	3.39
88	5,354	1,248	0.2331	0.7669	4,730	17,154	3.20
89	4,106	1,018	0.2479	0.7521	3,597	12,424	3.03
90	3,088	813	0.2633	0.7367	2,682	8,827	2.86
91	2,275	635	0.2791	0.7209	1,958	6,146	2.70
92	1,640	484	0.2951	0.7049	1,398	4,188	2.55
93	1,156	361	0.3123	0.6877	976	2,790	2.41
94	795	262	0.3296	0.6704	664	1,815	2.28
95	533	185	0.3471	0.6529	441	1,151	2.16
96	348	127	0.3649	0.6351	285	710	2.04
97	221	85	0.3846	0.6154	179	426	1.93
98	136	55	0.4044	0.5956	109	247	1.82
99	81	34	0.4198	0.5802	64	139	1.71
100	47	21	0.4468	0.5532	37	75	1.59
101	26	12	0.4615	0.5385	20	38	1.46
102	14	7	0.5000	0.5000	11	18	1.29
103	7	4	0.5714	0.4286	5	8	1.07
104	3	2	0.6667	0.3333	2	3	0.83
105	1	1	1.0000	0.0000	1	1	0.50

Table 5. CSO 1980 Commutation Table (For 9% Interest Rate)

x	Dx	Nx	Sx	Cx	Mx	Rx
0	100,000.0000	1,189,641.8418	14,008,753.5125	383.4862	1,772.6920	32,955.7720
1	91,359.6330	1,089,641.8418	12,819,111.6706	89.6810	1,389.2057	31,183.0800
2	83,726.4961	998,282.2088	11,729,469.8288	76.0446	1,299.5247	29,793.8743
3	76,737.2545	914,555.7127	10,731,187.6200	68.9935	1,223.4801	28,494.3496
4	70,332.1574	837,818.4582	9,816,631.9073	61.3015	1,154.4866	27,270.8695
5	64,463.6135	767,486.3008	8,978,813.4491	53.2288	1,093.1850	26,116.3830
6	59,087.7011	703,022.6872	8,211,327.1483	46.6183	1,039.9562	25,023.1979
7	54,162.2818	643,934.9862	7,508,304.4611	54.8088	993.3380	23,983.2417
8	49,635.3580	589,772.7044	6,864,369.4749	20.8021	938.5292	22,989.9037
9	45,516.2235	540,137.3464	6,274,596.7705	30.9036	917.7270	22,051.3745
10	41,727.0997	494,621.1229	5,734,459.4241	27.9450	886.8235	21,133.6475
11	38,253.7978	452,894.0232	5,239,838.3013	27.0242	858.8785	20,246.8240
12	35,068.2032	414,640.2254	4,786,944.2781	27.3468	831.8543	19,387.9455
13	32,145.3166	379,572.0222	4,372,304.0527	29.1945	804.5075	18,556.0913
14	29,461.9217	347,426.7056	3,992,732.0305	31.0832	775.3130	17,751.5838
15	26,998.2028	317,964.7839	3,645,305.3249	32.9446	744.2298	16,976.2708
16	24,736.0488	290,966.5811	3,327,340.5410	34.2658	711.2852	16,232.0410
17	22,659.3569	266,230.5323	3,036,373.9599	34.7182	677.0194	15,520.7558
18	20,753.6826	243,571.1754	2,770,143.4275	33.8898	642.3012	14,843.7365
19	19,006.1860	222,817.4928	2,526,572.2521	32.4334	608.4113	14,201.4353
20	17,404.4345	203,811.3068	2,303,754.7593	30.3382	575.9780	13,593.0240
21	15,937.0329	186,406.8724	2,099,943.4524	27.9263	545.6398	13,017.0460
22	14,593.2048	170,469.8394	1,913,536.5801	25.3036	517.7135	12,471.4062
23	13,362.9578	155,876.6346	1,743,066.7406	22.8035	492.4099	11,953.6927
24	12,236.7908	142,513.6769	1,587,190.1060	20.4312	469.6065	11,461.2828
25	11,205.9824	130,276.8860	1,444,676.4292	18.1974	449.1753	10,991.6763
26	10,262.5204	119,070.9036	1,314,399.5431	16.2878	430.9779	10,542.5010
27	9,398.8685	108,808.3832	1,195,328.6395	14.7450	414.6901	10,111.5231
28	8,608.0701	99,409.5147	1,086,520.2563	13.4257	399.9450	9,696.8330
29	7,883.8863	90,801.4446	987,110.7415	12.3684	386.5194	9,296.8880
30	7,220.5548	82,917.5583	896,309.2970	11.4599	374.1509	8,910.3686
31	6,612.9024	75,697.0034	813,391.7387	10.7991	362.6911	8,536.2177
32	6,056.0838	69,084.1010	737,694.7353	10.1676	351.8920	8,173.5266
33	5,545.8726	63,028.0173	668,610.6342	9.7179	341.7244	7,821.6346
34	5,078.2386	57,482.1447	605,582.6170	9.3181	332.0065	7,479.9102
35	4,649.6164	52,403.9060	548,100.4723	9.0004	322.6884	7,147.9037
36	4,256.7027	47,754.2896	495,696.5663	8.7479	313.6880	6,825.2154
37	3,896.4840	43,497.5869	447,942.2766	8.5794	304.9401	6,511.5274
38	3,566.1766	39,601.1030	404,444.6897	8.4411	296.3607	6,206.5873
39	3,263.2805	36,034.9264	364,843.5867	8.3526	287.9196	5,910.2266
40	2,985.4827	32,771.6460	328,808.6603	8.2719	279.5670	5,622.3070
41	2,730.7030	29,786.1633	296,037.0143	8.2420	271.2950	5,342.7401
42	2,496.9902	27,055.4602	266,250.8511	8.1554	263.0531	5,071.4450
43	2,282.6613	24,558.4701	239,195.3908	8.1045	254.8977	4,808.3920
44	2,086.0801	22,275.8088	214,636.9207	8.0189	246.7931	4,553.4943
45	1,905.8161	20,189.7287	192,361.1119	7.9555	238.7743	4,306.7011
46	1,740.4996	18,283.9126	172,171.3832	7.8563	230.8188	4,067.9269
47	1,588.9324	16,543.4130	153,887.4705	7.7552	222.9625	3,837.1081
48	1,449.9809	14,954.4806	137,344.0576	7.6357	215.2073	3,614.1456
49	1,322.6221	13,504.4997	122,389.5769	7.5352	207.5716	3,398.9383
50	1,205.8795	12,181.8776	108,885.0772	7.4233	200.0364	3,191.3667

Table 5. CSO 1980 Commutation Table (For 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
51	1,098.8881	10,975.9981	96,703.1996	7.3595	192.6131	2,991.3303
52	1,000.7947	9,877.1100	85,727.2015	7.3086	185.2535	2,798.7172
53	910.8517	8,876.3153	75,850.0915	7.2785	177.9450	2,613.4637
54	828.3653	7,965.4635	66,973.7762	7.2653	170.6665	2,435.5187
55	752.7029	7,137.0982	59,008.3127	7.2301	163.4012	2,264.8522
56	683.3230	6,384.3953	51,871.2145	7.1843	156.1711	2,101.4510
57	619.7176	5,701.0723	45,486.8192	7.1011	148.9868	1,945.2799
58	561.4471	5,081.3547	39,785.7469	7.0001	141.8857	1,796.2931
59	508.0890	4,519.9077	34,704.3922	6.8849	134.8856	1,654.4074
60	459.2518	4,011.8187	30,184.4845	6.7750	128.0007	1,519.5218
61	414.5569	3,552.5669	26,172.6658	6.6709	121.2257	1,391.5211
62	373.6565	3,138.0100	22,620.0990	6.5784	114.5548	1,270.2954
63	336.2257	2,764.3534	19,482.0890	6.4962	107.9764	1,155.7406
64	301.9677	2,428.1277	16,717.7356	6.4106	101.4801	1,047.7642
65	270.6240	2,126.1600	14,289.6079	6.3112	95.0696	946.2841
66	241.9677	1,855.5359	12,163.4479	6.1824	88.7583	851.2145
67	215.8063	1,613.5682	10,307.9120	6.0267	82.5759	762.4562
68	191.9607	1,397.7619	8,694.3437	5.8451	76.5492	679.8803
69	170.2656	1,205.8012	7,296.5818	5.6500	70.7040	603.3312
70	150.5570	1,035.5356	6,090.7806	5.4574	65.0541	532.6271
71	132.6683	884.9786	5,055.2449	5.2702	59.5967	467.5731
72	116.4438	752.3103	4,170.2663	5.0904	54.3265	407.9764
73	101.7388	635.8665	3,417.9560	4.9133	49.2361	353.6499
74	88.4250	534.1277	2,782.0895	4.7206	44.3227	304.4138
75	76.4033	445.7026	2,247.9618	4.4994	39.6021	260.0911
76	65.5954	369.2994	1,802.2592	4.2444	35.1028	220.4890
77	55.9348	303.7040	1,432.9598	3.9575	30.8583	185.3862
78	47.3588	247.7692	1,129.2558	3.6453	26.9008	154.5279
79	39.8031	200.4104	881.4866	3.3248	23.2555	127.6271
80	33.1918	160.6073	681.0762	3.0098	19.9306	104.3716
81	27.4414	127.4155	520.4689	2.7059	16.9208	84.4410
82	22.4697	99.9741	393.0534	2.4170	14.2150	67.5202
83	18.1974	77.5044	293.0793	2.1413	11.7979	53.3052
84	14.5536	59.3070	215.5749	1.8726	9.6566	41.5073
85	11.4793	44.7535	156.2679	1.6108	7.7840	31.8506
86	8.9207	33.2742	111.5144	1.3593	6.1733	24.0666
87	6.8248	24.3535	78.2403	1.1242	4.8140	17.8933
88	5.1371	17.5287	53.8868	0.9109	3.6897	13.0793
89	3.8020	12.3916	36.3581	0.7231	2.7789	9.3896
90	2.7651	8.5896	23.9664	0.5626	2.0558	6.6107
91	1.9742	5.8245	15.3768	0.4292	1.4933	4.5549
92	1.3820	3.8503	9.5523	0.3213	1.0640	3.0616
93	0.9465	2.4684	5.7020	0.2363	0.7427	1.9976
94	0.6321	1.5219	3.2336	0.1716	0.5064	1.2549
95	0.4083	0.8898	1.7118	0.1236	0.3348	0.7484
96	0.2510	0.4815	0.8220	0.0885	0.2112	0.4136
97	0.1417	0.2305	0.3405	0.0624	0.1227	0.2024
98	0.0676	0.0888	0.1100	0.0408	0.0602	0.0797
99	0.0212	0.0212	0.0212	0.0195	0.0195	0.0195

Table 6. CSO 1953-1958 Commutation Table (For 9% Interest Rate)

x	Dx	Nx	Sx	Cx	Mx	Rx
0	100,000.0000	1,181,682.0591	13,851,118.9543	649.5413	2,429.9217	38,011.6867
1	91,093.5780	1,081,682.0591	12,669,436.8952	147.0836	1,780.3804	35,581.7650
2	83,425.0063	990,588.4811	11,587,754.8361	116.3372	1,633.2969	33,801.3846
3	76,420.3659	907,163.4748	10,597,166.3549	102.3604	1,516.9597	32,168.0877
4	70,008.0671	830,743.1089	9,690,002.8801	89.9180	1,414.5993	30,651.1280
5	64,137.6664	760,735.0419	8,859,259.7712	79.4347	1,324.6813	29,236.5287
6	58,762.4611	696,597.3754	8,098,524.7293	70.0860	1,245.2466	27,911.8473
7	53,840.4287	637,834.9144	7,401,927.3539	62.2364	1,175.1606	26,666.6007
8	49,332.6523	583,994.4856	6,764,092.4395	55.6703	1,112.9241	25,491.4402
9	45,203.6437	534,661.8333	6,180,097.9539	50.1782	1,057.2538	24,378.5160
10	41,421.0546	489,458.1896	5,645,436.1206	45.9808	1,007.0756	23,321.2622
11	37,954.9867	448,037.1350	5,155,977.9310	42.8313	961.0949	22,314.1866
12	34,778.2575	410,082.1483	4,707,940.7960	40.2015	918.2636	21,353.0917
13	31,866.4567	375,303.8908	4,297,858.6477	38.5908	878.0621	20,434.8281
14	29,196.6906	343,437.4341	3,922,554.7569	37.2328	839.4712	19,556.7661
15	26,748.7218	314,240.7435	3,579,117.3229	35.8285	802.2384	18,717.2948
16	24,504.2833	287,492.0217	3,264,876.5794	34.6217	766.4099	17,915.0564
17	22,446.3721	262,987.7384	2,977,384.5577	33.3615	731.7882	17,148.6465
18	20,559.6405	240,541.3663	2,714,396.8193	31.8769	698.4268	16,416.8583
19	18,830.1787	219,981.7258	2,473,855.4530	30.0585	666.5499	15,718.4315
20	17,245.3348	201,151.5471	2,253,873.7273	28.3198	636.4915	15,051.8816
21	15,793.0883	183,906.2123	2,052,722.1802	26.5146	608.1717	14,415.3901
22	14,462.5573	168,113.1240	1,868,815.9678	24.6794	581.6571	13,807.2184
23	13,243.7217	153,650.5668	1,700,702.8438	22.9640	556.9777	13,225.5613
24	12,127.2395	140,406.8450	1,547,052.2771	21.2499	534.0137	12,668.5836
25	11,104.6578	128,279.6056	1,406,645.4321	19.6624	512.7638	12,134.5699
26	10,168.0971	117,174.9477	1,278,365.8265	18.2839	493.1014	11,621.8061
27	9,310.2455	107,006.8507	1,161,190.8787	16.9972	474.8175	11,128.7047
28	8,524.5125	97,696.6052	1,054,184.0281	15.8755	457.8203	10,653.8873
29	7,804.7781	89,172.0927	956,487.4229	14.8933	441.9447	10,196.0670
30	7,145.4535	81,367.3146	867,315.3302	13.9630	427.0514	9,754.1222
31	6,541.4989	74,221.8611	785,948.0155	13.1432	413.0884	9,327.0708
32	5,988.2320	67,680.3622	711,726.1545	12.3612	399.9452	8,913.9824
33	5,481.4297	61,692.1301	644,045.7923	11.6668	387.5841	8,514.0372
34	5,017.1678	56,210.7005	582,353.6622	11.0468	375.9173	8,126.4532
35	4,591.8594	51,193.5327	526,142.9617	10.5738	364.8704	7,750.5359
36	4,202.1412	46,601.6733	474,949.4290	10.1778	354.2966	7,385.6654
37	3,844.9977	42,399.5321	428,347.7556	9.8772	344.1189	7,031.3688
38	3,517.6436	38,554.5344	385,948.2235	9.7137	334.2417	6,687.2499
39	3,217.4823	35,036.8908	347,393.6891	9.5933	324.5280	6,353.0082
40	2,942.2253	31,819.4086	312,356.7983	9.5285	314.9347	6,028.4803
41	2,689.7608	28,877.1833	280,537.3897	9.4760	305.4062	5,713.5456
42	2,458.1945	26,187.4225	251,660.2064	9.4043	295.9302	5,408.1394
43	2,245.8200	23,729.2281	225,472.7839	9.3335	286.5259	5,112.2092
44	2,051.0518	21,483.4081	201,743.5558	9.2579	277.1924	4,825.6833
45	1,872.4410	19,432.3563	180,260.1478	9.1904	267.9345	4,548.4909
46	1,708.6453	17,559.9154	160,827.7914	9.1388	258.7441	4,280.5564
47	1,558.4257	15,851.2700	143,267.8761	9.0932	249.6053	4,021.8123
48	1,420.6552	14,292.8443	127,416.6061	9.0583	240.5121	3,772.2071
49	1,294.2950	12,872.1891	113,123.7618	9.0245	231.4537	3,531.6950
50	1,178.4021	11,577.8941	100,251.5727	8.9947	222.4292	3,300.2413

Table 6. CSO 1953-1958 Commutation Table (For 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
51	1,072.1081	10,399.4920	88,673.6786	8.9604	213.4345	3,077.8121
52	974.6250	9,327.3838	78,274.1866	8.9057	204.4741	2,864.3776
53	885.2457	8,352.7588	68,946.8028	8.8444	195.5683	2,659.9035
54	803.3076	7,467.5131	60,594.0440	8.7701	186.7240	2,464.3352
55	728.2094	6,664.2055	53,126.5309	8.6851	177.9539	2,277.6112
56	659.3969	5,935.9961	46,462.3254	8.5964	169.2688	2,099.6573
57	596.3550	5,276.5992	40,526.3293	8.5022	160.6725	1,930.3885
58	538.6125	4,680.2442	35,249.7302	8.4004	152.1703	1,769.7160
59	485.7395	4,141.6317	30,569.4860	8.2843	143.7699	1,617.5457
60	437.3483	3,655.8922	26,427.8543	8.1612	135.4856	1,473.7758
61	393.0758	3,218.5439	22,771.9621	8.0202	127.3244	1,338.2902
62	352.5998	2,825.4682	19,553.4182	7.8639	119.3043	1,210.9658
63	315.6221	2,472.8684	16,727.9500	7.6937	111.4403	1,091.6615
64	281.8679	2,157.2463	14,255.0816	7.5096	103.7466	980.2212
65	251.0848	1,875.3784	12,097.8353	7.3137	96.2371	876.4745
66	223.0393	1,624.2936	10,222.4569	7.1086	88.9234	780.2375
67	197.5146	1,401.2542	8,598.1634	6.8931	81.8148	691.3141
68	174.3130	1,203.7396	7,196.9092	6.6655	74.9217	609.4994
69	153.2547	1,029.4266	5,993.1696	6.4128	68.2562	534.5777
70	134.1879	876.1718	4,963.7430	6.1295	61.8434	466.3215
71	116.9786	741.9840	4,087.5712	5.8114	55.7139	404.4781
72	101.5084	625.0054	3,345.5872	5.4619	49.9025	348.7642
73	87.6651	523.4970	2,720.5818	5.0878	44.4406	298.8618
74	75.3389	435.8318	2,197.0849	4.7083	39.3528	254.4212
75	64.4099	360.4929	1,761.2530	4.3356	34.6445	215.0684
76	54.7561	296.0830	1,400.7601	3.9776	30.3089	180.4239
77	46.2574	241.3269	1,104.6771	3.6369	26.3313	150.1150
78	38.8010	195.0695	863.3502	3.3127	22.6944	123.7837
79	32.2846	156.2685	668.2807	2.9971	19.3817	101.0894
80	26.6217	123.9839	512.0121	2.6861	16.3845	81.7077
81	21.7375	97.3622	388.0282	2.3802	13.6984	65.3232
82	17.5625	75.6247	290.6660	2.0812	11.3183	51.6247
83	14.0312	58.0622	215.0413	1.7942	9.2370	40.3065
84	11.0784	44.0310	156.9791	1.5247	7.4428	31.0694
85	8.6390	32.9526	112.9481	1.2772	5.9182	23.6266
86	6.6486	24.3135	79.9955	1.0541	4.6410	17.7084
87	5.0455	17.6650	55.6820	0.8569	3.5869	13.0674
88	3.7719	12.6195	38.0170	0.6860	2.7300	9.4805
89	2.7744	8.8476	25.3975	0.5408	2.0439	6.7505
90	2.0046	6.0731	16.5500	0.4196	1.5031	4.7066
91	1.4195	4.0685	10.4769	0.3201	1.0836	3.2035
92	0.9822	2.6490	6.4083	0.2396	0.7635	2.1199
93	0.6615	1.6668	3.7593	0.1756	0.5239	1.3564
94	0.4313	1.0053	2.0925	0.1253	0.3483	0.8325
95	0.2704	0.5740	1.0872	0.0871	0.2230	0.4843
96	0.1609	0.3036	0.5132	0.0591	0.1359	0.2613
97	0.0885	0.1427	0.2095	0.0397	0.0767	0.1254
98	0.0415	0.0542	0.0668	0.0255	0.0371	0.0487
99	0.0126	0.0126	0.0126	0.0116	0.0116	0.0116

Table 7. ADST 1949-1951 Commutation Table (For 9% Interest Rate)

x	Dx	Nx	Sx	Cx	Mx	Rx
0	100,000.0000	1,120,412.7332	13,083,200.0978	5,666.9725	7,488.8569	40,148.4984
1	86,076.1468	1,020,412.7332	11,962,787.3711	328.2552	1,821.8844	32,659.6475
2	78,640.6868	934,336.5864	10,942,374.6379	177.6022	1,493.6292	30,837.7631
3	71,969.8169	855,695.8996	10,008,038.0515	128.2250	1,316.0270	29,344.1339
4	65,899.1300	783,726.0827	9,152,342.1519	92.2903	1,187.8021	28,028.1069
5	60,365.6272	717,826.9527	8,368,616.0692	66.7819	1,095.5118	26,840.3048
6	55,314.5274	657,461.3256	7,650,789.1164	51.9683	1,028.7299	25,744.7930
7	50,695.3046	602,146.7982	6,993,327.7909	43.6624	976.7616	24,716.0632
8	46,465.7914	551,451.4936	6,391,180.9927	33.6112	933.0992	23,739.3016
9	42,595.5552	504,985.7022	5,839,729.4991	29.1463	899.4880	22,806.2023
10	39,049.3446	462,390.1471	5,334,743.7968	25.1896	870.3417	21,906.7143
11	35,799.8972	423,340.8024	4,872,353.6497	22.7542	845.1520	21,036.3727
12	32,821.1881	387,540.9053	4,449,012.8473	21.2016	822.3978	20,191.2206
13	30,089.9802	354,719.7171	4,061,471.9420	21.5457	801.1962	19,368.8228
14	27,583.9407	324,629.7369	3,706,752.2249	22.2376	779.6504	18,567.6266
15	25,284.1300	297,045.7963	3,382,122.4880	24.1795	757.4129	17,787.9762
16	23,172.2700	271,761.6663	3,085,076.6917	25.1870	733.2334	17,030.5633
17	21,233.7764	248,589.3963	2,813,315.0254	26.4992	708.0464	16,297.3299
18	19,454.0296	227,355.6199	2,564,725.6291	27.6175	681.5472	15,589.2836
19	17,820.1160	207,901.5904	2,337,370.0092	28.3705	653.9296	14,907.7364
20	16,320.3598	190,081.4743	2,129,468.4189	28.1561	625.5591	14,253.8067
21	14,944.6511	173,761.1146	1,939,386.9445	27.1829	597.4031	13,628.2476
22	13,683.5062	158,816.4635	1,765,625.8299	26.0407	570.2202	13,030.8445
23	12,527.6347	145,132.9574	1,606,809.3664	24.5226	544.1795	12,460.6244
24	11,468.7203	132,605.3227	1,461,676.4090	23.0776	519.6569	11,916.4449
25	10,498.6841	121,136.6024	1,329,071.0863	21.4913	496.5793	11,396.7879
26	9,610.3290	110,637.9183	1,207,934.4839	19.9120	475.0880	10,900.2086
27	8,796.9036	101,027.5893	1,097,296.5656	18.1783	455.1761	10,425.1206
28	8,052.3754	92,230.6857	996,268.9763	16.5952	436.9977	9,969.9445
29	7,370.9052	84,178.3102	904,038.2907	15.2250	420.4025	9,532.9468
30	6,747.0734	76,807.4051	819,859.9804	14.1062	405.1775	9,112.5443
31	6,175.8694	70,060.3317	743,052.5754	13.3221	391.0714	8,707.3668
32	5,652.6132	63,884.4623	672,992.2437	12.6295	377.7493	8,316.2954
33	5,173.2542	58,231.8491	609,107.7814	12.0138	365.1198	7,938.5461
34	4,734.0909	53,058.5949	550,875.9323	11.4627	353.1060	7,573.4262
35	4,331.7399	48,324.5040	497,817.3374	10.9657	341.6433	7,220.3202
36	3,963.1076	43,992.7641	449,492.8333	10.4726	330.6776	6,878.6769
37	3,625.4060	40,029.6565	405,500.0692	9.9861	320.2050	6,547.9994
38	3,316.0744	36,404.2504	365,470.4128	9.5433	310.2189	6,227.7943
39	3,032.7268	33,088.1760	329,066.1623	9.2011	300.6756	5,917.5755
40	2,773.1171	30,055.4492	295,977.9863	8.9671	291.4745	5,616.8999
41	2,535.1770	27,282.3321	265,922.5371	8.7626	282.5074	5,325.4254
42	2,317.0879	24,747.1551	238,640.2050	8.5554	273.7448	5,042.9180
43	2,117.2133	22,430.0672	213,893.0499	8.4354	265.1894	4,769.1732
44	1,933.9621	20,312.8539	191,462.9827	8.3597	256.7540	4,503.9838
45	1,765.9175	18,378.8918	171,150.1287	8.3528	248.3943	4,247.2298
46	1,611.7550	16,612.9743	152,771.2369	8.4469	240.0415	3,998.8355
47	1,470.2274	15,001.2194	136,158.2625	8.5324	231.5946	3,758.7940
48	1,340.3001	13,530.9920	121,157.0431	8.6341	223.0622	3,527.1994
49	1,220.9990	12,190.6919	107,626.0512	8.6878	214.4281	3,304.1372
50	1,111.4948	10,969.6929	95,435.3593	8.6737	205.7404	3,089.7091

Table 7. ADST 1949-1951 Commutation Table (For 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
51	1,011.0463	9,858.1980	84,465.6664	8.5914	197.0667	2,883.9687
52	918.9741	8,847.1517	74,607.4684	8.4636	188.4753	2,686.9020
53	834.6319	7,928.1776	65,760.3168	8.3268	180.0117	2,498.4267
54	757.3905	7,093.5457	57,832.1392	8.1725	171.6849	2,318.4149
55	686.6812	6,336.1552	50,738.5934	8.0350	163.5124	2,146.7301
56	621.9478	5,649.4740	44,402.4382	7.8718	155.4774	1,983.2177
57	562.7225	5,027.5263	38,752.9642	7.6808	147.6057	1,827.7402
58	508.5784	4,464.8038	33,725.4380	7.4986	139.9249	1,680.1346
59	459.0871	3,956.2254	29,260.6342	7.3226	132.4263	1,540.2097
60	413.8582	3,497.1383	25,304.4088	7.1818	125.1037	1,407.7834
61	372.5047	3,083.2801	21,807.2705	7.0335	117.9219	1,282.6797
62	334.7139	2,710.7754	18,723.9905	6.8695	110.8884	1,164.7578
63	300.2075	2,376.0615	16,013.2151	6.7007	104.0190	1,053.8694
64	268.7191	2,075.8539	13,637.1536	6.5462	97.3183	949.8504
65	239.9851	1,807.1348	11,561.2997	6.3986	90.7721	852.5321
66	213.7713	1,567.1497	9,754.1648	6.2338	84.3736	761.7600
67	189.8866	1,353.3785	8,187.0151	6.0413	78.1397	677.3864
68	168.1666	1,163.4919	6,833.6366	5.8433	72.0985	599.2467
69	148.4380	995.3253	5,670.1447	5.6559	66.2552	527.1482
70	130.5257	846.8873	4,674.8194	5.4839	60.5993	460.8930
71	114.2644	716.3615	3,827.9322	5.3018	55.1153	400.2937
72	99.5280	602.0971	3,111.5706	5.0938	49.8135	345.1784
73	86.2163	502.5691	2,509.4735	4.8670	44.7198	295.3649
74	74.2305	416.3528	2,006.9044	4.6258	39.8528	250.6451
75	63.4756	342.1223	1,590.5516	4.3726	35.2270	210.7923
76	53.8619	278.6466	1,248.4293	4.0956	30.8544	175.5653
77	45.3190	224.7847	969.7827	3.7959	26.7588	144.7109
78	37.7812	179.4657	744.9980	3.4803	22.9629	117.9521
79	31.1813	141.6845	565.5323	3.1585	19.4826	94.9892
80	25.4482	110.5032	423.8478	2.8335	16.3241	75.5066
81	20.5135	85.0549	313.3446	2.5091	13.4906	59.1825
82	16.3106	64.5415	228.2897	2.1869	10.9815	45.6919
83	12.7770	48.2309	163.7482	1.8735	8.7946	34.7104
84	9.8485	35.4539	115.5173	1.5771	6.9211	25.9158
85	7.4582	25.6054	80.0634	1.3013	5.3440	18.9947
86	5.5411	18.1472	54.4580	1.0502	4.0427	13.6507
87	4.0334	12.6062	36.3107	0.8236	2.9925	9.6080
88	2.8767	8.5728	23.7046	0.6352	2.1689	6.6155
89	2.0040	5.6960	15.1318	0.4791	1.5337	4.4466
90	1.3594	3.6920	9.4358	0.3524	1.0546	2.9129
91	0.8948	2.3326	5.7438	0.2483	0.7022	1.8583
92	0.5726	1.4377	3.4112	0.1676	0.4539	1.1561
93	0.3577	0.8651	1.9734	0.1101	0.2863	0.7022
94	0.2181	0.5074	1.1083	0.0704	0.1762	0.4158
95	0.1297	0.2893	0.6010	0.0439	0.1058	0.2396
96	0.0751	0.1596	0.3117	0.0265	0.0619	0.1339
97	0.0424	0.0845	0.1521	0.0157	0.0354	0.0720
98	0.0232	0.0421	0.0676	0.0089	0.0197	0.0366
99	0.0124	0.0189	0.0254	0.0049	0.0109	0.0168
100	0.0065	0.0065	0.0065	0.0060	0.0060	0.0060

Table 8. SM 1948-1953 Commutation Table (For 9% Interest Rate)

x	Dx	Nx	Sx	Cx	Mx	Rx
0	100,000.0000	1,150,849.0189	13,489,384.7148	3,294.4954	4,975.7691	37,046.5949
1	88,448.6239	1,050,849.0189	12,338,535.7123	297.1130	1,681.2737	32,070.8329
2	80,848.4134	962,400.3951	11,287,686.7013	162.9307	1,384.1606	30,389.5629
3	74,009.9256	881,551.9816	10,325,286.3099	102.0132	1,221.2299	29,005.4041
4	67,797.0011	807,542.0560	9,443,734.3297	77.3418	1,119.2167	27,784.1751
5	62,121.7418	739,745.0549	8,636,192.2742	61.4155	1,041.8748	26,664.9587
6	56,931.0081	677,623.3131	7,896,447.2194	48.6860	980.4593	25,623.0840
7	52,181.5966	620,692.3050	7,218,823.9063	38.6437	931.7733	24,642.6247
8	47,834.3807	568,510.7084	6,598,131.6013	32.2299	893.1296	23,710.8514
9	43,852.5230	520,676.3277	6,029,620.8929	27.0343	860.8996	22,817.7218
10	40,204.6382	476,823.8047	5,508,944.5653	23.6395	833.8653	21,956.8222
11	36,861.3497	436,619.1665	5,032,120.7606	21.6876	810.2258	21,122.9569
12	33,796.0644	399,757.8168	4,595,501.5941	20.8754	788.5382	20,312.7311
13	30,984.6882	365,961.7525	4,195,743.7773	20.3488	767.6628	19,524.1929
14	28,405.9707	334,977.0643	3,829,782.0248	21.1394	747.3140	18,756.5301
15	26,039.3841	306,571.0936	3,494,804.9606	21.9127	726.1746	18,009.2161
16	23,867.4306	280,531.7094	3,188,233.8670	23.1073	704.2619	17,283.0415
17	21,873.6180	256,664.2788	2,907,702.1576	24.3793	681.1546	16,578.7796
18	20,043.1602	234,790.6609	2,651,037.8788	25.2837	656.7753	15,897.6250
19	18,362.9367	214,747.5007	2,416,247.2179	25.6940	631.4917	15,240.8497
20	16,821.0368	196,384.5640	2,201,499.7172	25.2095	605.7976	14,609.3580
21	15,406.9344	179,563.5272	2,005,115.1532	24.1793	580.5881	14,003.5604
22	14,110.6229	164,156.5928	1,825,551.6260	23.0095	556.4089	13,422.9723
23	12,922.5161	150,045.9699	1,661,395.0332	21.8681	533.3994	12,866.5634
24	11,833.6513	137,123.4537	1,511,349.0634	20.5263	511.5313	12,333.1641
25	10,836.0346	125,289.8024	1,374,225.6096	19.0443	491.0050	11,821.6328
26	9,922.2718	114,453.7678	1,248,935.8073	17.6670	471.9607	11,330.6278
27	9,085.3347	104,531.4960	1,134,482.0394	16.2978	454.2937	10,858.6670
28	8,318.8716	95,446.1613	1,029,950.5435	15.0343	437.9959	10,404.3733
29	7,616.9580	87,127.2897	934,504.3822	13.9437	422.9616	9,966.3774
30	6,974.0912	79,510.3317	847,377.0925	12.9306	409.0180	9,543.4158
31	6,385.3182	72,536.2404	767,866.7608	12.0533	396.0873	9,134.3978
32	5,846.0368	66,150.9222	695,330.5204	11.2909	384.0340	8,738.3105
33	5,352.0456	60,304.8855	629,179.5981	10.6790	372.7432	8,354.2764
34	4,899.4546	54,952.8398	568,874.7127	10.1401	362.0642	7,981.5333
35	4,484.7724	50,053.3852	513,921.8728	9.7972	351.9241	7,619.4691
36	4,104.6729	45,568.6128	463,868.4877	9.4830	342.1269	7,267.5450
37	3,756.2719	41,463.9399	418,299.8749	9.2296	332.6438	6,925.4181
38	3,436.8914	37,707.6680	376,835.9350	9.0228	323.4142	6,592.7743
39	3,144.0886	34,270.7766	339,128.2670	8.8508	314.3915	6,269.3600
40	2,875.6341	31,126.6880	304,857.4904	8.7042	305.5406	5,954.9686
41	2,629.4922	28,251.0538	273,730.8025	8.5483	296.8364	5,649.4279
42	2,403.8299	25,621.5616	245,479.7486	8.4079	288.2881	5,352.5915
43	2,196.9407	23,217.7317	219,858.1870	8.3226	279.8803	5,064.3034
44	2,007.2193	21,020.7910	196,640.4553	8.3183	271.5576	4,784.4232
45	1,833.1673	19,013.5718	175,619.6643	8.3528	263.2393	4,512.8655
46	1,673.4520	17,180.4045	156,606.0926	8.3946	254.8865	4,249.6262
47	1,526.8825	15,506.9524	139,425.6881	8.4525	246.4919	3,994.7397
48	1,392.3571	13,980.0700	123,918.7356	8.5168	238.0394	3,748.2478
49	1,268.8750	12,587.7129	109,938.6656	8.6071	229.5226	3,510.2084
50	1,155.4985	11,318.8379	97,350.9528	8.6984	220.9155	3,280.6858
51	1,051.3920	10,163.3394	86,032.1149	8.7951	212.2172	3,059.7703
52	955.7846	9,111.9474	75,868.7755	8.8582	203.4220	2,847.5531

Table 8. SM 1948-1953 Commutation Table (For 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
53	868.0085	8,156.1628	66,756.8281	8.8794	194.5638	2,644.1311
54	787.4586	7,288.1543	58,600.6653	8.8543	185.6844	2,449.5673
55	713.5848	6,500.6957	51,312.5109	8.7567	176.8301	2,263.8829
56	645.9083	5,787.1109	44,811.8152	8.6075	168.0735	2,087.0528
57	583.9690	5,141.2026	39,024.7043	8.4435	159.4660	1,918.9793
58	527.3079	4,557.2336	33,883.5017	8.2850	151.0225	1,759.5133
59	475.4837	4,029.9257	29,326.2681	8.1463	142.7375	1,608.4908
60	428.0773	3,554.4420	25,296.3423	7.9896	134.5913	1,465.7532
61	384.7419	3,126.3647	21,741.9003	7.8033	126.6016	1,331.1620
62	345.1709	2,741.6229	18,615.5355	7.6196	118.7984	1,204.5603
63	309.0510	2,396.4520	15,873.9127	7.4492	111.1788	1,085.7620
64	276.0838	2,087.4010	13,477.4607	7.2994	103.7296	974.5832
65	245.9885	1,811.3172	11,390.0597	7.1505	96.4302	870.8536
66	218.5270	1,565.3287	9,578.7424	6.9734	89.2797	774.4234
67	193.5100	1,346.8017	8,013.4138	6.7825	82.3062	685.1437
68	170.7496	1,153.2916	6,666.6121	6.5782	75.5237	602.8374
69	150.0728	982.5420	5,513.3204	6.3614	68.9454	527.3138
70	131.3200	832.4693	4,530.7784	6.1158	62.5840	458.3683
71	114.3613	701.1493	3,698.3091	5.8350	56.4683	395.7843
72	99.0836	586.7880	2,997.1598	5.5366	50.6333	339.3160
73	85.3658	487.7043	2,410.3719	5.2291	45.0966	288.6828
74	73.0882	402.3385	1,922.6676	4.9143	39.8675	243.5861
75	62.1391	329.2504	1,520.3291	4.5887	34.9533	203.7186
76	52.4197	267.1113	1,191.0787	4.2426	30.3646	168.7653
77	43.8488	214.6916	923.9674	3.8851	26.1220	138.4007
78	36.3432	170.8428	709.2758	3.5223	22.2370	112.2787
79	29.8201	134.4996	538.4330	3.1585	18.7147	90.0418
80	24.1994	104.6794	403.9334	2.7907	15.5562	71.3271
81	19.4106	80.4800	299.2540	2.4272	12.7654	55.7709
82	15.3807	61.0694	218.7740	2.0922	10.3382	43.0055
83	12.0185	45.6887	157.7046	1.7787	8.2460	32.6673
84	9.2475	33.6702	112.0159	1.4856	6.4674	24.4212
85	6.9983	24.4228	78.3456	1.2166	4.9818	17.9539
86	5.2038	17.4244	53.9228	0.9742	3.7651	12.9721
87	3.7999	12.2206	36.4984	0.7626	2.7909	9.2070
88	2.7236	8.4207	24.2778	0.5824	2.0283	6.4161
89	1.9163	5.6971	15.8571	0.4359	1.4459	4.3877
90	1.3222	3.7808	10.1601	0.3194	1.0100	2.9419
91	0.8937	2.4586	6.3793	0.2288	0.6907	1.9318
92	0.5910	1.5649	3.9207	0.1600	0.4618	1.2412
93	0.3822	0.9739	2.3558	0.1095	0.3018	0.7794
94	0.2411	0.5917	1.3819	0.0729	0.1923	0.4776
95	0.1483	0.3506	0.7902	0.0472	0.1194	0.2853
96	0.0888	0.2022	0.4397	0.0297	0.0721	0.1659
97	0.0518	0.1134	0.2375	0.0183	0.0424	0.0938
98	0.0292	0.0616	0.1241	0.0108	0.0241	0.0514
99	0.0160	0.0324	0.0625	0.0061	0.0133	0.0272
100	0.0085	0.0164	0.0301	0.0035	0.0071	0.0139
101	0.0043	0.0079	0.0136	0.0018	0.0037	0.0068
102	0.0021	0.0036	0.0057	0.0010	0.0018	0.0031
103	0.0010	0.0015	0.0021	0.0005	0.0009	0.0013
104	0.0004	0.0005	0.0006	0.0002	0.0003	0.0005
105	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Table 9. Turkey 2001 Female Commutation Table (From The Infant Mortality Rate and 9% Interest Rate)

x	Dx	Nx	Sx	Cx	Mx	Rx
0	100,000.0000	1,162,864.4685	13,729,820.6437	2,642.2018	3,983.6677	29,209.5530
1	89,100.9174	1,062,864.4685	12,566,956.1752	280.2794	1,341.4659	25,225.8852
2	81,463.6815	973,763.5511	11,504,091.7067	140.5374	1,061.1865	23,884.4193
3	74,596.7851	892,299.8696	10,530,328.1556	87.8447	920.6491	22,823.2329
4	68,349.5728	817,703.0845	9,638,028.2860	61.0936	832.8043	21,902.5838
5	62,644.9365	749,353.5117	8,820,325.2016	44.7200	771.7108	21,069.7795
6	57,427.6988	686,708.5752	8,070,971.6899	34.4632	726.9907	20,298.0687
7	52,651.4990	629,280.8764	7,384,263.1147	27.6026	692.5276	19,571.0779
8	48,276.5249	576,629.3773	6,754,982.2383	22.5610	664.9249	18,878.5503
9	44,267.8289	528,352.8524	6,178,352.8610	19.8533	642.3640	18,213.6254
10	40,592.8337	484,085.0236	5,650,000.0086	17.8265	622.5107	17,571.2614
11	37,223.3053	443,492.1898	5,165,914.9850	16.3546	604.6842	16,948.7507
12	34,133.4668	406,268.8845	4,722,422.7951	15.9828	588.3296	16,344.0666
13	31,299.1244	372,135.4177	4,316,153.9106	15.5608	572.3468	15,755.7370
14	28,699.2322	340,836.2933	3,944,018.4930	15.6487	556.7860	15,183.3902
15	26,313.9222	312,137.0610	3,603,182.1997	15.6159	541.1373	14,626.6042
16	24,125.5971	285,823.1389	3,291,045.1386	15.4819	525.5214	14,085.4669
17	22,118.0934	261,697.5418	3,005,221.9998	15.6875	510.0395	13,559.9455
18	20,276.1413	239,579.4484	2,743,524.4580	15.5592	494.3520	13,049.9060
19	18,586.4053	219,303.3071	2,503,945.0097	15.5235	478.7928	12,555.5540
20	17,036.2245	200,716.9018	2,284,641.7026	15.3876	463.2693	12,076.7612
21	15,614.1761	183,680.6773	2,083,924.8008	15.0182	447.8817	11,613.4919
22	14,309.9141	168,066.5012	1,900,244.1235	14.6048	432.8635	11,165.6102
23	13,113.7567	153,756.5871	1,732,177.6223	14.2838	418.2587	10,732.7467
24	12,016.6857	140,642.8304	1,578,421.0353	13.8002	403.9749	10,314.4880
25	11,010.6821	128,626.1447	1,437,778.2049	13.1927	390.1748	9,910.5131
26	10,088.3506	117,615.4626	1,309,152.0602	12.6890	376.9821	9,520.3383
27	9,242.6785	107,527.1120	1,191,536.5976	12.0890	364.2931	9,143.3563
28	8,467.4325	98,284.4336	1,084,009.4856	11.6659	352.2040	8,779.0632
29	7,756.6207	89,817.0011	985,725.0520	11.0042	340.5381	8,426.8592
30	7,105.1616	82,060.3803	895,908.0509	10.5105	329.5339	8,086.3211
31	6,507.9864	74,955.2187	813,847.6706	10.0867	319.0234	7,756.7872
32	5,960.5431	68,447.2323	738,892.4519	9.5449	308.9367	7,437.7638
33	5,458.8433	62,486.6892	670,445.2197	9.0771	299.3919	7,128.8270
34	4,999.0360	57,027.8459	607,958.5305	8.7195	290.3148	6,829.4352
35	4,577.5520	52,028.8100	550,930.6845	8.3141	281.5952	6,539.1204
36	4,191.2749	47,451.2579	498,901.8746	7.9987	273.2811	6,257.5252
37	3,837.2076	43,259.9831	451,450.6166	7.6409	265.2823	5,984.2441
38	3,512.7330	39,422.7755	408,190.6335	7.3917	257.6414	5,718.9617
39	3,215.2991	35,910.0425	368,767.8580	7.1316	250.2497	5,461.3203
40	2,942.6841	32,694.7434	332,857.8155	6.8933	243.1181	5,211.0706
41	2,692.8169	29,752.0594	300,163.0721	6.6993	236.2248	4,967.9525
42	2,463.7749	27,059.2425	270,411.0127	6.5395	229.5256	4,731.7277
43	2,253.8045	24,595.4675	243,351.7702	6.4055	222.9861	4,502.2021
44	2,061.3051	22,341.6630	218,756.3027	6.2697	216.5806	4,279.2160
45	1,884.8358	20,280.3579	196,414.6397	6.1507	210.3109	4,062.6354
46	1,723.0565	18,395.5221	176,134.2817	6.0609	204.1601	3,852.3246
47	1,574.7249	16,672.4657	157,738.7596	5.9918	198.0993	3,648.1644
48	1,438.7099	15,097.7408	141,066.2939	5.9369	192.1074	3,450.0651
49	1,313.9805	13,659.0309	125,968.5531	5.8905	186.1706	3,257.9577
50	1,199.5962	12,345.0504	112,309.5222	5.8483	180.2801	3,071.7871

Table 9. Turkey 2001 Female Commutation Table (From The Infant Mortality Rate and 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
51	1,094.6987	11,145.4542	99,964.4718	5.8182	174.4319	2,891.5070
52	998.4926	10,050.7555	88,819.0176	5.8051	168.6137	2,717.0751
53	910.2432	9,052.2629	78,768.2622	5.7926	162.8086	2,548.4614
54	829.2929	8,142.0197	69,715.9993	5.7776	157.0161	2,385.6528
55	755.0416	7,312.7268	61,573.9796	5.7736	151.2385	2,228.6367
56	686.9251	6,557.6851	54,261.2529	5.7751	145.4649	2,077.3982
57	624.4314	5,870.7600	47,703.5678	5.7707	139.6898	1,931.9333
58	567.1022	5,246.3286	41,832.8077	5.7648	133.9191	1,792.2435
59	514.5124	4,679.2264	36,586.4791	5.7660	128.1542	1,658.3245
60	466.2637	4,164.7140	31,907.2527	5.7538	122.3882	1,530.1702
61	422.0111	3,698.4503	27,742.5387	5.7425	116.6344	1,407.7820
62	381.4236	3,276.4393	24,044.0883	5.7289	110.8920	1,291.1476
63	344.2010	2,895.0156	20,767.6491	5.7026	105.1630	1,180.2556
64	310.0781	2,550.8146	17,872.6334	5.6711	99.4604	1,075.0926
65	278.8042	2,240.7365	15,321.8188	5.6297	93.7893	975.6322
66	250.1540	1,961.9323	13,081.0823	5.5781	88.1596	881.8429
67	223.9210	1,711.7782	11,119.1501	5.5110	82.5815	793.6833
68	199.9211	1,487.8572	9,407.3719	5.4326	77.0705	711.1018
69	177.9812	1,287.9361	7,919.5147	5.3392	71.6379	634.0313
70	157.9464	1,109.9549	6,631.5785	5.2308	66.2987	562.3934
71	139.6742	952.0085	5,521.6236	5.1059	61.0679	496.0947
72	123.0356	812.3344	4,569.6151	4.9604	55.9621	435.0267
73	107.9163	689.2988	3,757.2807	4.8007	51.0017	379.0646
74	94.2051	581.3825	3,067.9819	4.6195	46.2010	328.0629
75	81.8072	487.1774	2,486.5994	4.4212	41.5815	281.8619
76	70.6312	405.3703	1,999.4219	4.2045	37.1602	240.2804
77	60.5947	334.7391	1,594.0517	3.9706	32.9557	203.1202
78	51.6209	274.1444	1,259.3125	3.7212	28.9852	170.1644
79	43.6375	222.5234	985.1682	3.4585	25.2640	141.1793
80	36.5759	178.8859	762.6447	3.1841	21.8055	115.9153
81	30.3718	142.3101	583.7588	2.9016	18.6214	94.1098
82	24.9624	111.9383	441.4487	2.6150	15.7198	75.4884
83	20.2863	86.9759	329.5104	2.3280	13.1048	59.7686
84	16.2832	66.6896	242.5345	2.0436	10.7767	46.6638
85	12.8952	50.4064	175.8449	1.7685	8.7332	35.8871
86	10.0620	37.5112	125.4385	1.5060	6.9647	27.1539
87	7.7252	27.4492	87.9273	1.2601	5.4587	20.1892
88	5.8272	19.7241	60.4780	1.0337	4.1987	14.7305
89	4.3123	13.8968	40.7540	0.8311	3.1649	10.5318
90	3.1252	9.5845	26.8571	0.6529	2.3338	7.3669
91	2.2143	6.4593	17.2727	0.5006	1.6810	5.0331
92	1.5309	4.2450	10.8134	0.3736	1.1804	3.3521
93	1.0309	2.7141	6.5684	0.2715	0.8068	2.1717
94	0.6743	1.6832	3.8544	0.1909	0.5353	1.3649
95	0.4277	1.0089	2.1712	0.1297	0.3444	0.8296
96	0.2627	0.5812	1.1623	0.0855	0.2147	0.4852
97	0.1555	0.3185	0.5811	0.0539	0.1292	0.2705
98	0.0887	0.1629	0.2626	0.0327	0.0753	0.1413
99	0.0487	0.0742	0.0997	0.0192	0.0426	0.0660
100	0.0255	0.0255	0.0255	0.0234	0.0234	0.0234

Table 10. Turkey 2001 Male Commutation Table (From The Infant Mortality Rate and 9% Interest Rate)

x	Dx	Nx	Sx	Cx	Mx	Rx
0	100,000.0000	1,158,387.3518	13,636,563.9672	2,765.1376	4,353.3379	32,432.5289
1	88,977.9817	1,058,387.3518	12,478,176.6154	368.1566	1,588.2003	28,079.1909
2	81,263.0192	969,409.3702	11,419,789.2635	175.9456	1,220.0437	26,490.9906
3	74,377.2830	888,146.3510	10,450,379.8934	106.4482	1,044.0981	25,270.9469
4	68,129.5913	813,769.0679	9,562,233.5424	71.8798	937.6499	24,226.8488
5	62,432.3323	745,639.4767	8,748,464.4745	51.5496	865.7700	23,289.1990
6	57,225.8195	683,207.1444	8,002,824.9978	38.8506	814.2204	22,423.4289
7	52,461.9012	625,981.3249	7,319,617.8534	30.3220	775.3698	21,609.2086
8	48,099.8626	573,519.4237	6,693,636.5285	24.7119	745.0478	20,833.8387
9	44,103.6025	525,419.5610	6,120,117.1049	20.6356	720.3360	20,088.7909
10	40,441.3850	481,315.9586	5,594,697.5438	18.1801	699.7003	19,368.4550
11	37,084.0080	440,874.5736	5,113,381.5853	16.6708	681.5203	18,668.7546
12	34,005.3549	403,790.5656	4,672,507.0117	16.2227	664.8495	17,987.2344
13	31,181.3505	369,785.2107	4,268,716.4460	16.8780	648.6267	17,322.3849
14	28,589.8656	338,603.8602	3,898,931.2353	17.8359	631.7487	16,673.7582
15	26,211.3987	310,013.9945	3,560,327.3751	18.9973	613.9129	16,042.0094
16	24,028.1575	283,802.5959	3,250,313.3806	20.0602	594.9156	15,428.0966
17	22,024.1210	259,774.4384	2,966,510.7847	21.0138	574.8554	14,833.1810
18	20,184.6017	237,750.3174	2,706,736.3463	21.2957	553.8416	14,258.3255
19	18,496.6876	217,565.7157	2,468,986.0289	21.2118	532.5459	13,704.4840
20	16,948.2263	199,069.0282	2,251,420.3131	20.8354	511.3341	13,171.9381
21	15,527.9961	182,120.8018	2,052,351.2850	19.8018	490.4987	12,660.6040
22	14,226.0662	166,592.8058	1,870,230.4831	18.6636	470.6969	12,170.1053
23	13,032.7733	152,366.7396	1,703,637.6774	17.4567	452.0333	11,699.4084
24	11,939.2160	139,333.9663	1,551,270.9378	16.1015	434.5766	11,247.3751
25	10,937.3077	127,394.7503	1,411,936.9715	14.7503	418.4751	10,812.7985
26	10,019.4769	116,457.4426	1,284,542.2212	13.4206	403.7248	10,394.3234
27	9,178.7601	106,437.9657	1,168,084.7786	12.2945	390.3042	9,990.5986
28	8,408.5863	97,259.2056	1,061,646.8130	11.3400	378.0097	9,600.2944
29	7,702.9594	88,850.6193	964,387.6074	10.4591	366.6697	9,222.2847
30	7,056.4761	81,147.6599	875,536.9881	9.7107	356.2106	8,855.6150
31	6,464.1206	74,091.1838	794,389.3282	9.0735	346.4999	8,499.4044
32	5,921.3123	67,627.0632	720,298.1444	8.5832	337.4264	8,152.9045
33	5,423.8135	61,705.7509	652,671.0812	8.1606	328.8432	7,815.4781
34	4,967.8150	56,281.9374	590,965.3303	7.8391	320.6826	7,486.6349
35	4,549.7894	51,314.1224	534,683.3928	7.5969	312.8435	7,165.9523
36	4,166.5218	46,764.3330	483,369.2704	7.4539	305.2466	6,853.1089
37	3,815.0432	42,597.8112	436,604.9374	7.3151	297.7927	6,547.8623
38	3,492.7245	38,782.7681	394,007.1262	7.2098	290.4776	6,250.0696
39	3,197.1247	35,290.0435	355,224.3581	7.1569	283.2679	5,959.5919
40	2,925.9850	32,092.9188	319,934.3146	7.1136	276.1110	5,676.3241
41	2,677.2763	29,166.9338	287,841.3958	7.0985	268.9974	5,400.2130
42	2,449.1183	26,489.6575	258,674.4620	7.0777	261.8989	5,131.2157
43	2,239.8198	24,040.5391	232,184.8045	7.0893	254.8212	4,869.3167
44	2,047.7912	21,800.7193	208,144.2654	7.1015	247.7318	4,614.4956
45	1,871.6060	19,752.9281	186,343.5461	7.1258	240.6303	4,366.7637
46	1,709.9439	17,881.3220	166,590.6180	7.1535	233.5045	4,126.1334
47	1,561.6024	16,171.3781	148,709.2960	7.1776	226.3510	3,892.6289
48	1,425.4851	14,609.7757	132,537.9179	7.1928	219.1733	3,666.2779
49	1,300.5917	13,184.2906	117,928.1422	7.2189	211.9805	3,447.1046
50	1,185.9845	11,883.6990	104,743.8515	7.2465	204.7616	3,235.1241

Table 10. Turkey 2001 Male Commutation Table (From The Infant Mortality Rate and 9% Interest Rate) (Continued)

x	Dx	Nx	Sx	Cx	Mx	Rx
51	1,080.8127	10,697.7145	92,860.1525	7.2682	197.5152	3,030.3625
52	984.3031	9,616.9018	82,162.4380	7.2784	190.2469	2,832.8473
53	895.7519	8,632.5988	72,545.5362	7.2893	182.9685	2,642.6004
54	814.5014	7,736.8469	63,912.9375	7.2932	175.6792	2,459.6318
55	739.9559	6,922.3454	56,176.0906	7.2977	168.3861	2,283.9526
56	671.5609	6,182.3895	49,253.7452	7.2886	161.0884	2,115.5665
57	608.8223	5,510.8286	43,071.3557	7.2668	153.7998	1,954.4782
58	551.2858	4,902.0063	37,560.5270	7.2426	146.5330	1,800.6784
59	498.5242	4,350.7205	32,658.5207	7.2080	139.2904	1,654.1454
60	450.1536	3,852.1963	28,307.8001	7.1570	132.0824	1,514.8550
61	405.8280	3,402.0427	24,455.6038	7.1001	124.9254	1,382.7726
62	365.2191	2,996.2147	21,053.5612	7.0263	117.8252	1,257.8473
63	328.0371	2,630.9956	18,057.3465	6.9399	110.7990	1,140.0220
64	294.0115	2,302.9585	15,426.3509	6.8378	103.8590	1,029.2231
65	262.8976	2,008.9469	13,123.3924	6.7220	97.0212	925.3641
66	234.4685	1,746.0494	11,114.4454	6.5866	90.2992	828.3429
67	208.5220	1,511.5809	9,368.3961	6.4355	83.7126	738.0436
68	184.8691	1,303.0589	7,856.8152	6.2669	77.2771	654.3310
69	163.3378	1,118.1897	6,553.7563	6.0795	71.0102	577.0539
70	143.7718	954.8519	5,435.5666	5.8722	64.9308	506.0436
71	126.0285	811.0801	4,480.7147	5.6482	59.0585	441.1129
72	109.9743	685.0517	3,669.6346	5.4039	53.4104	382.0543
73	95.4900	575.0774	2,984.5829	5.1433	48.0065	328.6439
74	82.4622	479.5874	2,409.5055	4.8660	42.8632	280.6374
75	70.7873	397.1252	1,929.9181	4.5733	37.9972	237.7742
76	60.3693	326.3379	1,532.7929	4.2679	33.4239	199.7770
77	51.1167	265.9687	1,206.4550	3.9515	29.1560	166.3531
78	42.9446	214.8520	940.4863	3.6274	25.2045	137.1971
79	35.7713	171.9074	725.6343	3.2992	21.5771	111.9926
80	29.5185	136.1361	553.7270	2.9697	18.2779	90.4155
81	24.1115	106.6176	417.5909	2.6439	15.3082	72.1376
82	19.4768	82.5061	310.9733	2.3254	12.6643	56.8294
83	15.5432	63.0293	228.4672	2.0183	10.3389	44.1651
84	12.2415	47.4861	165.4379	1.7269	8.3206	33.8261
85	9.5038	35.2447	117.9518	1.4548	6.5936	25.5055
86	7.2643	25.7409	82.7071	1.2050	5.1389	18.9119
87	5.4595	18.4767	56.9662	0.9799	3.9339	13.7730
88	4.0287	13.0172	38.4895	0.7814	2.9539	9.8392
89	2.9147	8.9885	25.4723	0.6099	2.1725	6.8852
90	2.0642	6.0738	16.4839	0.4652	1.5627	4.7127
91	1.4286	4.0096	10.4101	0.3461	1.0975	3.1500
92	0.9645	2.5810	6.4006	0.2508	0.7514	2.0525
93	0.6341	1.6165	3.8195	0.1766	0.5006	1.3011
94	0.4051	0.9824	2.2030	0.1206	0.3240	0.8005
95	0.2511	0.5773	1.2206	0.0797	0.2034	0.4765
96	0.1506	0.3262	0.6433	0.0509	0.1237	0.2731
97	0.0873	0.1756	0.3171	0.0313	0.0728	0.1494
98	0.0487	0.0884	0.1415	0.0185	0.0414	0.0767
99	0.0262	0.0396	0.0531	0.0105	0.0229	0.0352
100	0.0135	0.0135	0.0135	0.0124	0.0124	0.0124

Table 11. q(x) Values of Foreign and Turkey Mortality Tables

x	ADST	CSO 53-58	CSO 80	Swiss Male	Turkey Female Interpolation	Turkey Female Orphanhood	Turkey Male Interpolation	Turkey Male Orphanhood
0	0.0618	0.0071	0.0042	0.0359	0.0288	0.0288	0.0301	0.0301
1	0.0042	0.0018	0.0011	0.0037	0.0034	0.0042	0.0045	0.0045
2	0.0025	0.0015	0.0010	0.0022	0.0019	0.0017	0.0024	0.0024
3	0.0019	0.0015	0.0010	0.0015	0.0013	0.0009	0.0016	0.0016
4	0.0015	0.0014	0.0010	0.0012	0.0010	0.0006	0.0012	0.0012
5	0.0012	0.0013	0.0009	0.0011	0.0008	0.0004	0.0009	0.0009
6	0.0010	0.0013	0.0009	0.0009	0.0007	0.0003	0.0007	0.0008
7	0.0009	0.0013	0.0011	0.0008	0.0006	0.0002	0.0006	0.0006
8	0.0008	0.0012	0.0005	0.0007	0.0005	0.0002	0.0006	0.0006
9	0.0007	0.0012	0.0007	0.0007	0.0005	0.0002	0.0005	0.0005
10	0.0007	0.0012	0.0007	0.0006	0.0005	0.0001	0.0005	0.0005
11	0.0007	0.0012	0.0008	0.0006	0.0005	0.0001	0.0005	0.0005
12	0.0007	0.0013	0.0009	0.0007	0.0005	0.0002	0.0005	0.0005
13	0.0008	0.0013	0.0010	0.0007	0.0005	0.0002	0.0006	0.0006
14	0.0009	0.0014	0.0011	0.0008	0.0006	0.0002	0.0007	0.0007
15	0.0010	0.0015	0.0013	0.0009	0.0006	0.0003	0.0008	0.0008
16	0.0012	0.0015	0.0015	0.0011	0.0007	0.0003	0.0009	0.0009
17	0.0014	0.0016	0.0017	0.0012	0.0008	0.0003	0.0010	0.0010
18	0.0015	0.0017	0.0018	0.0014	0.0008	0.0004	0.0012	0.0011
19	0.0017	0.0017	0.0019	0.0015	0.0009	0.0004	0.0013	0.0012
20	0.0019	0.0018	0.0019	0.0016	0.0010	0.0005	0.0013	0.0013
21	0.0020	0.0018	0.0019	0.0017	0.0010	0.0005	0.0014	0.0014
22	0.0021	0.0019	0.0019	0.0018	0.0011	0.0005	0.0014	0.0014
23	0.0021	0.0019	0.0019	0.0018	0.0012	0.0005	0.0015	0.0014
24	0.0022	0.0019	0.0018	0.0019	0.0013	0.0005	0.0015	0.0015
25	0.0022	0.0019	0.0018	0.0019	0.0013	0.0005	0.0015	0.0015
26	0.0023	0.0020	0.0017	0.0019	0.0014	0.0005	0.0015	0.0015
27	0.0023	0.0020	0.0017	0.0020	0.0014	0.0005	0.0015	0.0015
28	0.0022	0.0020	0.0017	0.0020	0.0015	0.0005	0.0015	0.0015
29	0.0023	0.0021	0.0017	0.0020	0.0015	0.0005	0.0015	0.0015
30	0.0023	0.0021	0.0017	0.0020	0.0016	0.0005	0.0015	0.0015
31	0.0024	0.0022	0.0018	0.0021	0.0017	0.0006	0.0015	0.0015
32	0.0024	0.0023	0.0018	0.0021	0.0017	0.0006	0.0016	0.0016
33	0.0025	0.0023	0.0019	0.0022	0.0018	0.0006	0.0016	0.0016
34	0.0026	0.0024	0.0020	0.0023	0.0019	0.0007	0.0017	0.0017
35	0.0028	0.0025	0.0021	0.0024	0.0020	0.0007	0.0018	0.0018
36	0.0029	0.0026	0.0022	0.0025	0.0021	0.0008	0.0020	0.0019
37	0.0030	0.0028	0.0024	0.0027	0.0022	0.0008	0.0021	0.0021
38	0.0031	0.0030	0.0026	0.0029	0.0023	0.0009	0.0023	0.0022
39	0.0033	0.0032	0.0028	0.0031	0.0024	0.0010	0.0024	0.0024
40	0.0035	0.0035	0.0030	0.0033	0.0026	0.0011	0.0027	0.0026
41	0.0038	0.0038	0.0033	0.0035	0.0027	0.0013	0.0029	0.0029
42	0.0040	0.0042	0.0036	0.0038	0.0029	0.0014	0.0032	0.0031
43	0.0043	0.0045	0.0039	0.0041	0.0031	0.0016	0.0035	0.0034
44	0.0047	0.0049	0.0042	0.0045	0.0033	0.0017	0.0038	0.0038
45	0.0052	0.0053	0.0046	0.0050	0.0036	0.0019	0.0042	0.0041
46	0.0057	0.0058	0.0049	0.0055	0.0038	0.0022	0.0046	0.0045
47	0.0063	0.0064	0.0053	0.0060	0.0041	0.0024	0.0050	0.0050
48	0.0070	0.0070	0.0057	0.0067	0.0045	0.0027	0.0055	0.0055
49	0.0078	0.0076	0.0062	0.0074	0.0049	0.0031	0.0061	0.0060
50	0.0085	0.0083	0.0067	0.0082	0.0053	0.0034	0.0067	0.0066

Table 11. q(x) Values of Foreign and Turkey Mortality Tables (Continued)

x	ADST	CSO 53-58	CSO 80	Swiss Male	Turkey Female Interpolation	Turkey Female Orphanhood	Turkey Male Interpolation	Turkey Male Orphanhood
51	0.0093	0.0091	0.0073	0.0091	0.0058	0.0039	0.0073	0.0073
52	0.0100	0.0100	0.0080	0.0101	0.0063	0.0043	0.0081	0.0080
53	0.0109	0.0109	0.0087	0.0112	0.0069	0.0049	0.0089	0.0088
54	0.0118	0.0119	0.0096	0.0123	0.0076	0.0055	0.0098	0.0097
55	0.0128	0.0130	0.0105	0.0134	0.0083	0.0062	0.0108	0.0107
56	0.0138	0.0142	0.0115	0.0145	0.0092	0.0069	0.0118	0.0118
57	0.0149	0.0155	0.0125	0.0158	0.0101	0.0078	0.0130	0.0130
58	0.0161	0.0170	0.0136	0.0171	0.0111	0.0087	0.0143	0.0143
59	0.0174	0.0186	0.0148	0.0187	0.0122	0.0098	0.0158	0.0157
60	0.0189	0.0203	0.0161	0.0203	0.0135	0.0110	0.0173	0.0173
61	0.0206	0.0222	0.0175	0.0221	0.0148	0.0123	0.0191	0.0190
62	0.0224	0.0243	0.0192	0.0241	0.0164	0.0138	0.0210	0.0209
63	0.0243	0.0266	0.0211	0.0263	0.0181	0.0155	0.0231	0.0230
64	0.0266	0.0290	0.0231	0.0288	0.0199	0.0174	0.0254	0.0253
65	0.0291	0.0318	0.0254	0.0317	0.0220	0.0195	0.0279	0.0278
66	0.0318	0.0347	0.0279	0.0348	0.0243	0.0219	0.0306	0.0305
67	0.0347	0.0380	0.0304	0.0382	0.0268	0.0246	0.0336	0.0336
68	0.0379	0.0417	0.0332	0.0420	0.0296	0.0275	0.0370	0.0369
69	0.0415	0.0456	0.0362	0.0462	0.0327	0.0308	0.0406	0.0405
70	0.0458	0.0498	0.0395	0.0508	0.0361	0.0345	0.0445	0.0444
71	0.0506	0.0542	0.0433	0.0556	0.0398	0.0386	0.0489	0.0487
72	0.0558	0.0586	0.0476	0.0609	0.0439	0.0432	0.0536	0.0534
73	0.0615	0.0633	0.0526	0.0668	0.0485	0.0483	0.0587	0.0586
74	0.0679	0.0681	0.0582	0.0733	0.0535	0.0540	0.0643	0.0642
75	0.0751	0.0734	0.0642	0.0805	0.0589	0.0603	0.0704	0.0703
76	0.0829	0.0792	0.0705	0.0882	0.0649	0.0673	0.0771	0.0769
77	0.0913	0.0857	0.0771	0.0966	0.0714	0.0750	0.0843	0.0841
78	0.1004	0.0931	0.0839	0.1056	0.0786	0.0836	0.0921	0.0919
79	0.1104	0.1012	0.0911	0.1155	0.0864	0.0930	0.1005	0.1003
80	0.1214	0.1100	0.0988	0.1257	0.0949	0.1033	0.1097	0.1095
81	0.1333	0.1193	0.1075	0.1363	0.1041	0.1147	0.1195	0.1193
82	0.1461	0.1292	0.1173	0.1483	0.1142	0.1271	0.1301	0.1299
83	0.1598	0.1394	0.1283	0.1613	0.1251	0.1407	0.1415	0.1413
84	0.1746	0.1500	0.1402	0.1751	0.1368	0.1554	0.1538	0.1535
85	0.1902	0.1611	0.1529	0.1895	0.1495	0.1714	0.1669	0.1666
86	0.2066	0.1728	0.1661	0.2041	0.1631	0.1887	0.1808	0.1806
87	0.2226	0.1851	0.1796	0.2187	0.1778	0.2072	0.1957	0.1954
88	0.2407	0.1982	0.1933	0.2331	0.1934	0.2271	0.2114	0.2112
89	0.2606	0.2125	0.2073	0.2479	0.2101	0.2483	0.2281	0.2278
90	0.2825	0.2281	0.2218	0.2633	0.2277	0.2708	0.2456	0.2454
91	0.3025	0.2458	0.2370	0.2791	0.2464	0.2945	0.2641	0.2638
92	0.3191	0.2659	0.2535	0.2951	0.2660	0.3194	0.2834	0.2832
93	0.3355	0.2893	0.2721	0.3123	0.2870	0.3453	0.3036	0.3033
94	0.3519	0.3167	0.2959	0.3296	0.3086	0.3723	0.3245	0.3242
95	0.3691	0.3512	0.3300	0.3471	0.3305	0.4000	0.3462	0.3459
96	0.3844	0.4006	0.3846	0.3649	0.3547	0.4284	0.3685	0.3682
97	0.4033	0.4884	0.4802	0.3846	0.3780	0.4572	0.3914	0.3911
98	0.4167	0.6681	0.6580	0.4044	0.4019	0.4864	0.4148	0.4145
99	0.4286	1.0000	1.0000	0.4198	0.4291	0.5156	0.4386	0.4383
100	1.0000			0.4468	1.0000	1.0000	1.0000	1.0000

Table 12. Income Life Insurance Net Single Premiums for 1 YTL Annuity

x	ADST	CSO 53-58	CSO 80	Swiss Male	Turkey Female Interpolation	Turkey Female Orphanhood	Turkey Male Interpolation	Turkey Male Orphanhood
20	11.6469	11.6641	11.7103	11.6749	11.7818	11.9055	11.7457	11.7477
21	11.6270	11.6447	11.6965	11.6547	11.7637	11.8923	11.7285	11.7303
22	11.6064	11.6240	11.6815	11.6335	11.7448	11.8782	11.7104	11.7121
23	11.5850	11.6018	11.6648	11.6112	11.7248	11.8630	11.6910	11.6927
24	11.5623	11.5778	11.6463	11.5876	11.7040	11.8464	11.6703	11.6718
25	11.5383	11.5519	11.6257	11.5623	11.6819	11.8285	11.6477	11.6492
26	11.5124	11.5238	11.6025	11.5350	11.6585	11.8090	11.6231	11.6246
27	11.4844	11.4935	11.5768	11.5055	11.6338	11.7878	11.5961	11.5978
28	11.4538	11.4607	11.5484	11.4735	11.6073	11.7647	11.5667	11.5684
29	11.4203	11.4253	11.5173	11.4386	11.5794	11.7396	11.5346	11.5364
30	11.3838	11.3873	11.4835	11.4008	11.5494	11.7124	11.4997	11.5016
31	11.3442	11.3463	11.4469	11.3598	11.5174	11.6828	11.4619	11.4639
32	11.3018	11.3022	11.4074	11.3155	11.4834	11.6508	11.4210	11.4230
33	11.2563	11.2548	11.3649	11.2676	11.4469	11.6162	11.3768	11.3789
34	11.2078	11.2037	11.3193	11.2161	11.4078	11.5789	11.3293	11.3315
35	11.1559	11.1488	11.2706	11.1607	11.3661	11.5386	11.2784	11.2807
36	11.1006	11.0900	11.2186	11.1016	11.3214	11.4952	11.2238	11.2263
37	11.0414	11.0272	11.1633	11.0386	11.2738	11.4486	11.1657	11.1682
38	10.9781	10.9603	11.1046	10.9714	11.2228	11.3986	11.1039	11.1065
39	10.9104	10.8895	11.0425	10.9001	11.1685	11.3449	11.0381	11.0408
40	10.8381	10.8147	10.9770	10.8243	11.1105	11.2873	10.9682	10.9710
41	10.7615	10.7360	10.9079	10.7439	11.0487	11.2258	10.8943	10.8970
42	10.6803	10.6531	10.8352	10.6586	10.9828	11.1600	10.8160	10.8188
43	10.5941	10.5660	10.7587	10.5682	10.9129	11.0898	10.7332	10.7362
44	10.5032	10.4743	10.6783	10.4726	10.8386	11.0150	10.6460	10.6490
45	10.4076	10.3781	10.5937	10.3720	10.7597	10.9353	10.5540	10.5572
46	10.3074	10.2771	10.5050	10.2664	10.6761	10.8505	10.4573	10.4606
47	10.2033	10.1713	10.4117	10.1560	10.5875	10.7604	10.3556	10.3590
48	10.0955	10.0607	10.3136	10.0406	10.4939	10.6649	10.2490	10.2525
49	9.9842	9.9453	10.2104	9.9204	10.3952	10.5635	10.1371	10.1408
50	9.8693	9.8251	10.1021	9.7956	10.2910	10.4564	10.0201	10.0239
51	9.7505	9.7000	9.9883	9.6666	10.1813	10.3430	9.8978	9.9017
52	9.6272	9.5702	9.8693	9.5335	10.0659	10.2234	9.7703	9.7743
53	9.4990	9.4355	9.7451	9.3964	9.9449	10.0974	9.6373	9.6414
54	9.3658	9.2960	9.6159	9.2553	9.8180	9.9647	9.4989	9.5031
55	9.2272	9.1515	9.4820	9.1099	9.6852	9.8252	9.3551	9.3594
56	9.0835	9.0022	9.3432	8.9596	9.5464	9.6790	9.2060	9.2104
57	8.9343	8.8481	9.1995	8.8039	9.4018	9.5259	9.0516	9.0561
58	8.7790	8.6894	9.0505	8.6425	9.2511	9.3658	8.8920	8.8966
59	8.6176	8.5264	8.8959	8.4754	9.0945	9.1988	8.7272	8.7319
60	8.4501	8.3592	8.7356	8.3033	8.9321	9.0250	8.5575	8.5622
61	8.2772	8.1881	8.5696	8.1259	8.7639	8.8443	8.3830	8.3878
62	8.0988	8.0132	8.3981	7.9428	8.5900	8.6570	8.2039	8.2087
63	7.9147	7.8349	8.2217	7.7542	8.4108	8.4631	8.0204	8.0253
64	7.7250	7.6534	8.0410	7.5608	8.2264	8.2631	7.8329	7.8378
65	7.5302	7.4691	7.8565	7.3634	8.0370	8.0570	7.6416	7.6465

Table 12. Income Life Insurance Net Single Premiums for 1 YTL Annuity (Continued)

x	ADST	CSO 53-58	CSO 80	Swiss Male	Turkey Female Interpolation	Turkey Female Orphanhood	Turkey Male Interpolation	Turkey Male Orphanhood
66	7.3310	7.2825	7.6685	7.1631	7.8429	7.8454	7.4468	7.4518
67	7.1273	7.0944	7.4769	6.9599	7.6446	7.6285	7.2490	7.2540
68	6.9187	6.9056	7.2815	6.7543	7.4422	7.4069	7.0485	7.0535
69	6.7053	6.7171	7.0819	6.5471	7.2364	7.1812	6.8459	6.8507
70	6.4883	6.5294	6.8780	6.3392	7.0274	6.9518	6.6414	6.6462
71	6.2693	6.3429	6.6706	6.1310	6.8159	6.7194	6.4357	6.4404
72	6.0495	6.1572	6.4607	5.9221	6.6024	6.4847	6.2292	6.2338
73	5.8292	5.9716	6.2500	5.7131	6.3873	6.2485	6.0224	6.0269
74	5.6089	5.7850	6.0405	5.5048	6.1715	6.0114	5.8158	5.8203
75	5.3898	5.5969	5.8336	5.2986	5.9552	5.7744	5.6101	5.6145
76	5.1734	5.4073	5.6300	5.0956	5.7393	5.5382	5.4057	5.4099
77	4.9600	5.2170	5.4296	4.8962	5.5242	5.3035	5.2032	5.2072
78	4.7501	5.0274	5.2317	4.7008	5.3107	5.0714	5.0030	5.0069
79	4.5439	4.8403	5.0350	4.5104	5.0994	4.8424	4.8057	4.8095
80	4.3423	4.6572	4.8388	4.3257	4.8908	4.6175	4.6119	4.6154
81	4.1463	4.4790	4.6432	4.1462	4.6856	4.3974	4.4219	4.4253
82	3.9570	4.3060	4.4493	3.9705	4.4843	4.1829	4.2361	4.2394
83	3.7748	4.1381	4.2591	3.8015	4.2874	3.9745	4.0551	4.0582
84	3.5999	3.9745	4.0751	3.6410	4.0956	3.7729	3.8791	3.8820
85	3.4332	3.8144	3.8986	3.4898	3.9089	3.5787	3.7085	3.7112
86	3.2750	3.6570	3.7300	3.3484	3.7280	3.3922	3.5435	3.5460
87	3.1255	3.5011	3.5684	3.2160	3.5532	3.2138	3.3843	3.3867
88	2.9800	3.3456	3.4122	3.0917	3.3848	3.0438	3.2311	3.2333
89	2.8423	3.1889	3.2592	2.9730	3.2226	2.8823	3.0838	3.0858
90	2.7158	3.0296	3.1065	2.8595	3.0668	2.7294	2.9425	2.9443
91	2.6067	2.8662	2.9503	2.7511	2.9171	2.5850	2.8067	2.8083
92	2.5107	2.6970	2.7861	2.6478	2.7729	2.4489	2.6760	2.6775
93	2.4183	2.5198	2.6078	2.5481	2.6327	2.3203	2.5494	2.5507
94	2.3264	2.3309	2.4077	2.4537	2.4962	2.1984	2.4249	2.4261
95	2.2307	2.1229	2.1793	2.3634	2.3588	2.0808	2.2993	2.3003
96	2.1262	1.8866	1.9184	2.2762	2.2123	1.9633	2.1660	2.1669
97	1.9940	1.6122	1.6265	2.1904	2.0477	1.8369	2.0126	2.0132
98	1.8157	1.3044	1.3138	2.1085	1.8360	1.6806	1.8135	1.8139
99	1.5242	1.0000	1.0000	2.0286	1.5237	1.4444	1.5151	1.5153
100	1.0000			1.9323	1.0000	1.0000	1.0000	1.0000
101				1.8370				
102				1.6942				
103				1.5134				
104				1.3058				
105				1.0000				

Table 13. Pure Endowment Net Single Premiums for 15 Years Policy (for 10.000 YTL Compensation)

x	ADST	CSO 53-58	CSO 80	Swiss Male	Turkey Female Interpolation	Turkey Female Orphanhood	Turkey Male Interpolation	Turkey Male Orphanhood
20	2,654	2,663	2,672	2,666	2,687	2,724	2,685	2,685
21	2,652	2,661	2,671	2,664	2,684	2,723	2,683	2,684
22	2,649	2,659	2,670	2,662	2,682	2,722	2,682	2,682
23	2,647	2,656	2,669	2,660	2,679	2,721	2,680	2,680
24	2,644	2,653	2,667	2,657	2,676	2,720	2,678	2,678
25	2,641	2,650	2,664	2,654	2,673	2,719	2,675	2,676
26	2,638	2,645	2,661	2,650	2,669	2,717	2,672	2,672
27	2,634	2,640	2,657	2,646	2,666	2,715	2,668	2,669
28	2,629	2,635	2,652	2,641	2,662	2,713	2,664	2,664
29	2,624	2,628	2,646	2,635	2,657	2,710	2,658	2,659
30	2,617	2,620	2,639	2,629	2,653	2,706	2,652	2,653
31	2,610	2,612	2,632	2,621	2,648	2,703	2,645	2,646
32	2,601	2,602	2,624	2,612	2,642	2,698	2,637	2,638
33	2,591	2,592	2,615	2,602	2,636	2,693	2,628	2,629
34	2,579	2,580	2,604	2,590	2,628	2,688	2,618	2,619
35	2,566	2,566	2,594	2,576	2,621	2,681	2,607	2,607
36	2,551	2,551	2,582	2,561	2,612	2,674	2,594	2,595
37	2,535	2,535	2,568	2,545	2,602	2,666	2,580	2,581
38	2,517	2,517	2,554	2,526	2,591	2,656	2,565	2,565
39	2,497	2,497	2,538	2,505	2,579	2,646	2,548	2,548
40	2,476	2,475	2,521	2,481	2,566	2,634	2,529	2,530
41	2,453	2,452	2,502	2,456	2,551	2,621	2,508	2,509
42	2,429	2,426	2,482	2,429	2,534	2,606	2,486	2,487
43	2,402	2,398	2,460	2,400	2,516	2,589	2,461	2,462
44	2,374	2,368	2,436	2,369	2,496	2,571	2,434	2,436
45	2,344	2,336	2,410	2,335	2,474	2,550	2,405	2,406
46	2,311	2,301	2,382	2,299	2,449	2,527	2,373	2,375
47	2,277	2,263	2,352	2,261	2,422	2,501	2,339	2,340
48	2,240	2,222	2,319	2,220	2,392	2,473	2,301	2,303
49	2,201	2,178	2,283	2,176	2,360	2,441	2,261	2,262
50	2,159	2,131	2,244	2,129	2,324	2,406	2,217	2,218
51	2,114	2,080	2,202	2,078	2,285	2,367	2,169	2,171
52	2,066	2,027	2,156	2,025	2,243	2,324	2,118	2,120
53	2,015	1,969	2,107	1,967	2,196	2,277	2,064	2,066
54	1,960	1,908	2,055	1,906	2,146	2,225	2,005	2,007
55	1,901	1,843	2,000	1,840	2,092	2,168	1,943	1,945
56	1,837	1,774	1,942	1,771	2,033	2,106	1,877	1,879
57	1,769	1,702	1,879	1,697	1,970	2,039	1,806	1,808
58	1,695	1,628	1,812	1,619	1,903	1,966	1,732	1,734
59	1,617	1,551	1,740	1,537	1,831	1,888	1,654	1,656
60	1,534	1,473	1,664	1,452	1,755	1,803	1,573	1,575

Table 14. Whole Life Insurance Net Single Premiums (for 10.000 YTL Compensation)

x	ADST	CSO 53-58	CSO 80	Swiss Male	Turkey Female Interpolation	Turkey Female Orphanhood	Turkey Male Interpolation	Turkey Male Orphanhood
20	383	369	331	360	272	170	302	300
21	400	385	342	377	287	181	316	314
22	417	402	355	394	302	192	331	329
23	434	421	368	413	319	205	347	345
24	453	440	384	432	336	219	364	363
25	473	462	401	453	354	233	383	381
26	494	485	420	476	374	249	403	402
27	517	510	441	500	394	267	425	424
28	543	537	465	527	416	286	450	448
29	570	566	490	555	439	307	476	474
30	601	598	518	586	464	329	505	503
31	633	631	548	620	490	354	536	534
32	668	668	581	657	518	380	570	568
33	706	707	616	696	548	409	606	605
34	746	749	654	739	581	439	646	644
35	789	795	694	785	615	473	688	686
36	834	843	737	834	652	509	733	731
37	883	895	783	886	691	547	781	779
38	936	950	831	941	733	588	832	830
39	991	1,009	882	1,000	778	633	886	884
40	1,051	1,070	936	1,063	826	680	944	941
41	1,114	1,135	993	1,129	877	731	1,005	1,002
42	1,181	1,204	1,053	1,199	932	785	1,069	1,067
43	1,253	1,276	1,117	1,274	989	843	1,138	1,135
44	1,328	1,351	1,183	1,353	1,051	905	1,210	1,207
45	1,407	1,431	1,253	1,436	1,116	971	1,286	1,283
46	1,489	1,514	1,326	1,523	1,185	1,041	1,366	1,363
47	1,575	1,602	1,403	1,614	1,258	1,115	1,449	1,447
48	1,664	1,693	1,484	1,710	1,335	1,194	1,538	1,535
49	1,756	1,788	1,569	1,809	1,417	1,278	1,630	1,627
50	1,851	1,888	1,659	1,912	1,503	1,366	1,727	1,723
51	1,949	1,991	1,753	2,018	1,593	1,460	1,827	1,824
52	2,051	2,098	1,851	2,128	1,689	1,559	1,933	1,930
53	2,157	2,209	1,954	2,241	1,789	1,663	2,043	2,039
54	2,267	2,324	2,060	2,358	1,893	1,772	2,157	2,153
55	2,381	2,444	2,171	2,478	2,003	1,887	2,276	2,272
56	2,500	2,567	2,285	2,602	2,118	2,008	2,399	2,395
57	2,623	2,694	2,404	2,731	2,237	2,135	2,526	2,522
58	2,751	2,825	2,527	2,864	2,361	2,267	2,658	2,654
59	2,885	2,960	2,655	3,002	2,491	2,405	2,794	2,790
60	3,023	3,098	2,787	3,144	2,625	2,548	2,934	2,930
61	3,166	3,239	2,924	3,291	2,764	2,697	3,078	3,074
62	3,313	3,384	3,066	3,442	2,907	2,852	3,226	3,222
63	3,465	3,531	3,211	3,597	3,055	3,012	3,378	3,374
64	3,622	3,681	3,361	3,757	3,208	3,177	3,532	3,528
65	3,782	3,833	3,513	3,920	3,364	3,347	3,690	3,686

Table 14. Whole Life Insurance Net Single Premiums (for 10.000 YTL Compensation) (Continued)

x	ADST	CSO 53-58	CSO 80	Swiss Male	Turkey Female Interpolation	Turkey Female Orphanhood	Turkey Male Interpolation	Turkey Male Orphanhood
66	3,947	3,987	3,668	4,086	3,524	3,522	3,851	3,847
67	4,115	4,142	3,826	4,253	3,688	3,701	4,015	4,010
68	4,287	4,298	3,988	4,423	3,855	3,884	4,180	4,176
69	4,463	4,454	4,153	4,594	4,025	4,071	4,347	4,343
70	4,643	4,609	4,321	4,766	4,198	4,260	4,516	4,512
71	4,823	4,763	4,492	4,938	4,372	4,452	4,686	4,682
72	5,005	4,916	4,665	5,110	4,548	4,646	4,857	4,853
73	5,187	5,069	4,839	5,283	4,726	4,841	5,027	5,024
74	5,369	5,223	5,012	5,455	4,904	5,036	5,198	5,194
75	5,550	5,379	5,183	5,625	5,083	5,232	5,368	5,364
76	5,728	5,535	5,351	5,793	5,261	5,427	5,537	5,533
77	5,905	5,692	5,517	5,957	5,439	5,621	5,704	5,700
78	6,078	5,849	5,680	6,119	5,615	5,813	5,869	5,866
79	6,248	6,003	5,843	6,276	5,790	6,002	6,032	6,029
80	6,415	6,155	6,005	6,428	5,962	6,187	6,192	6,189
81	6,576	6,302	6,166	6,577	6,131	6,369	6,349	6,346
82	6,733	6,445	6,326	6,722	6,297	6,546	6,502	6,500
83	6,883	6,583	6,483	6,861	6,460	6,718	6,652	6,649
84	7,028	6,718	6,635	6,994	6,618	6,885	6,797	6,795
85	7,165	6,851	6,781	7,119	6,772	7,045	6,938	6,936
86	7,296	6,980	6,920	7,235	6,922	7,199	7,074	7,072
87	7,419	7,109	7,054	7,345	7,066	7,346	7,206	7,204
88	7,539	7,238	7,183	7,447	7,205	7,487	7,332	7,330
89	7,653	7,367	7,309	7,545	7,339	7,620	7,454	7,452
90	7,758	7,498	7,435	7,639	7,468	7,746	7,570	7,569
91	7,848	7,633	7,564	7,728	7,591	7,866	7,683	7,681
92	7,927	7,773	7,700	7,814	7,710	7,978	7,790	7,789
93	8,003	7,919	7,847	7,896	7,826	8,084	7,895	7,894
94	8,079	8,075	8,012	7,974	7,939	8,185	7,998	7,997
95	8,158	8,247	8,201	8,049	8,052	8,282	8,101	8,101
96	8,244	8,442	8,416	8,121	8,173	8,379	8,212	8,211
97	8,354	8,669	8,657	8,191	8,309	8,483	8,338	8,338
98	8,501	8,923	8,915	8,259	8,484	8,612	8,503	8,502
99	8,741	9,174	9,174	8,325	8,742	8,807	8,749	8,749
100	9,174				9,174	9,174	9,174	9,174

Table 15. Term Life Insurance Net Single Premiums for 15 Years Policy (for 10.000 YTL Compensation)

x	ADST	CSO 53-58	CSO 80	Swiss Male	Turkey Female Interpolation	Turkey Female Orphanhood	Turkey Male Interpolation	Turkey Male Orphanhood
20	174	158	146	151	107	41	117	116
21	178	161	146	155	112	42	119	118
22	183	164	146	159	117	43	122	121
23	187	168	147	162	122	45	124	123
24	191	173	148	167	128	46	127	126
25	195	178	151	171	134	48	130	130
26	200	185	156	176	140	51	134	134
27	206	192	161	183	146	54	140	139
28	213	201	169	190	153	57	147	146
29	222	211	177	199	160	61	154	153
30	232	223	187	209	168	66	164	163
31	245	236	199	221	176	72	175	174
32	259	251	213	235	186	79	188	187
33	275	268	228	252	197	87	202	201
34	293	288	245	271	208	96	219	218
35	314	310	264	292	221	106	238	236
36	337	335	284	316	236	118	259	257
37	363	363	307	344	252	132	282	281
38	393	394	332	375	270	147	308	306
39	425	428	359	409	290	164	337	335
40	461	466	389	448	312	183	368	367
41	501	506	422	490	337	205	403	401
42	544	550	457	536	365	229	441	440
43	592	598	495	587	395	256	483	482
44	643	651	536	642	429	287	530	528
45	698	707	581	702	466	321	580	578
46	758	769	630	767	508	359	635	633
47	821	836	682	836	554	402	695	693
48	888	909	740	911	604	449	760	758
49	959	987	802	991	660	502	831	829
50	1,034	1,071	870	1,077	721	561	908	906
51	1,115	1,161	945	1,169	788	626	992	989
52	1,201	1,259	1,026	1,267	862	698	1,082	1,079
53	1,293	1,363	1,113	1,371	942	778	1,180	1,177
54	1,392	1,475	1,207	1,482	1,030	867	1,285	1,282
55	1,499	1,594	1,307	1,601	1,125	964	1,398	1,394
56	1,614	1,722	1,413	1,728	1,229	1,070	1,519	1,515
57	1,738	1,857	1,527	1,864	1,341	1,187	1,649	1,645
58	1,872	2,000	1,650	2,009	1,462	1,315	1,787	1,783
59	2,016	2,150	1,782	2,163	1,593	1,454	1,934	1,930
60	2,172	2,306	1,925	2,328	1,733	1,605	2,090	2,086

Table 16. Endowment Life Insurance Net Single Premiums for 15 Years Policy (for 10.000 YTL Compensation)

x	ADST	CSO 53-58	CSO 80	Swiss Male	Turkey Female Interpolation	Turkey Female Orphanhood	Turkey Male Interpolation	Turkey Male Orphanhood
20	2,828	2,820	2,817	2,817	2,794	2,765	2,802	2,801
21	2,830	2,821	2,816	2,819	2,796	2,765	2,803	2,802
22	2,832	2,823	2,816	2,821	2,799	2,766	2,803	2,803
23	2,834	2,824	2,815	2,822	2,801	2,766	2,804	2,803
24	2,835	2,826	2,815	2,823	2,804	2,766	2,805	2,804
25	2,837	2,828	2,816	2,825	2,806	2,767	2,805	2,805
26	2,838	2,830	2,816	2,827	2,809	2,768	2,807	2,806
27	2,840	2,832	2,818	2,829	2,811	2,769	2,808	2,808
28	2,843	2,835	2,820	2,831	2,814	2,770	2,810	2,810
29	2,846	2,839	2,823	2,834	2,817	2,771	2,813	2,812
30	2,850	2,843	2,827	2,838	2,821	2,773	2,816	2,816
31	2,854	2,848	2,831	2,842	2,824	2,775	2,820	2,820
32	2,860	2,854	2,837	2,847	2,828	2,777	2,825	2,824
33	2,865	2,860	2,843	2,853	2,832	2,780	2,830	2,830
34	2,872	2,868	2,850	2,860	2,837	2,784	2,837	2,836
35	2,880	2,876	2,857	2,869	2,842	2,788	2,844	2,844
36	2,888	2,887	2,866	2,878	2,848	2,792	2,853	2,852
37	2,898	2,898	2,876	2,889	2,854	2,797	2,862	2,861
38	2,910	2,911	2,886	2,900	2,861	2,803	2,872	2,872
39	2,923	2,925	2,898	2,914	2,869	2,809	2,884	2,883
40	2,938	2,941	2,910	2,929	2,878	2,817	2,897	2,896
41	2,954	2,958	2,924	2,946	2,888	2,825	2,911	2,911
42	2,973	2,976	2,939	2,965	2,899	2,835	2,927	2,927
43	2,994	2,997	2,955	2,987	2,911	2,846	2,945	2,944
44	3,017	3,019	2,972	3,011	2,925	2,858	2,964	2,963
45	3,042	3,043	2,991	3,037	2,940	2,871	2,985	2,984
46	3,069	3,070	3,011	3,066	2,957	2,886	3,008	3,007
47	3,098	3,099	3,034	3,097	2,976	2,903	3,034	3,033
48	3,128	3,130	3,058	3,131	2,997	2,922	3,061	3,060
49	3,160	3,164	3,085	3,167	3,020	2,943	3,092	3,091
50	3,193	3,202	3,115	3,206	3,045	2,967	3,125	3,124
51	3,229	3,242	3,147	3,248	3,073	2,993	3,161	3,160
52	3,267	3,285	3,182	3,292	3,104	3,023	3,201	3,199
53	3,308	3,332	3,221	3,339	3,138	3,055	3,244	3,242
54	3,352	3,383	3,262	3,388	3,176	3,092	3,290	3,289
55	3,400	3,437	3,307	3,441	3,217	3,132	3,341	3,339
56	3,451	3,496	3,355	3,498	3,262	3,177	3,396	3,394
57	3,507	3,560	3,406	3,560	3,311	3,226	3,455	3,453
58	3,567	3,628	3,462	3,628	3,365	3,281	3,519	3,517
59	3,633	3,701	3,523	3,701	3,424	3,342	3,588	3,586
60	3,705	3,778	3,588	3,779	3,488	3,408	3,663	3,660

Table 17. Turkey Male Mortality Table Using Interpolation Method (From East Model Life Table)

x	lx	dx	qx	px	Lx	Tx	ex
0	100,000	3,014	0.03014	0.96986	97,375	6,933,975	69.34
1	96,986	925	0.00954	0.99046	385,688	6,836,600	70.49
5	96,061	190	0.00198	0.99802	479,828	6,450,912	67.15
10	95,871	197	0.00205	0.99795	478,861	5,971,084	62.28
15	95,674	400	0.00418	0.99582	477,459	5,492,222	57.41
20	95,274	570	0.00598	0.99402	474,990	5,014,763	52.64
25	94,704	580	0.00612	0.99388	472,086	4,539,773	47.94
30	94,125	633	0.00673	0.99327	469,082	4,067,687	43.22
35	93,491	796	0.00851	0.99149	465,571	3,598,605	38.49
40	92,696	1,183	0.01276	0.98724	460,747	3,133,034	33.80
45	91,513	1,982	0.02166	0.97834	453,052	2,672,287	29.20
50	89,531	3,449	0.03852	0.96148	439,760	2,219,235	24.79
55	86,082	5,444	0.06324	0.93676	417,743	1,779,475	20.67
60	80,638	7,888	0.09782	0.90218	384,624	1,361,732	16.89
65	72,750	10,906	0.14991	0.85009	337,920	977,108	13.43
70	61,844	14,598	0.23604	0.76396	274,141	639,188	10.34
75	47,246	16,981	0.35942	0.64058	194,053	365,047	7.73
80	30,265	15,376	0.50805	0.49195	111,383	170,994	5.65
85	14,889	10,117	0.67952	0.32048	46,463	59,610	4.00
90	4,772	4,003	0.83884	0.16116	11,766	13,148	2.76
95	769	728	0.94651	0.05349	1,358	1,382	1.80
100+	41	41	1.00000	0.00000	24	24	0.58

Table 18. Turkey Female Mortality Table Using Interpolation Method (From East Model Life Table)

x	lx	dx	qx	px	Lx	Tx	ex
0	100,000	2,880	0.02880	0.97120	97,481	7,279,584	72.80
1	97,120	728	0.00750	0.99250	386,707	7,182,103	73.95
5	96,392	167	0.00173	0.99827	481,541	6,795,396	70.50
10	96,225	138	0.00143	0.99857	480,780	6,313,855	65.62
15	96,087	221	0.00230	0.99770	479,921	5,833,075	60.71
20	95,866	313	0.00326	0.99674	478,584	5,353,153	55.84
25	95,554	374	0.00391	0.99609	476,867	4,874,569	51.01
30	95,180	473	0.00497	0.99503	474,773	4,397,702	46.20
35	94,707	652	0.00688	0.99312	471,999	3,922,930	41.42
40	94,055	935	0.00994	0.99006	468,096	3,450,931	36.69
45	93,121	1,453	0.01560	0.98440	462,231	2,982,834	32.03
50	91,668	2,207	0.02408	0.97592	453,198	2,520,603	27.50
55	89,461	3,293	0.03681	0.96319	439,669	2,067,405	23.11
60	86,167	5,264	0.06109	0.93891	418,740	1,627,736	18.89
65	80,904	8,612	0.10645	0.89355	384,725	1,208,996	14.94
70	72,291	13,650	0.18882	0.81118	329,569	824,271	11.40
75	58,641	18,474	0.31504	0.68496	248,294	494,702	8.44
80	40,167	18,609	0.46330	0.53670	153,374	246,408	6.13
85	21,558	13,823	0.64119	0.35881	70,318	93,034	4.32
90	7,735	6,305	0.81516	0.18484	20,021	22,716	2.94
95	1,430	1,341	0.93801	0.06199	2,643	2,696	1.89
100+	89	89	1.00000	0.00000	53	53	0.59

Table 19. Turkey Male Mortality Table Using Orphanhood Method (From East Model Life Table)

x	lx	dx	qx	px	Lx	Tx	ex
0	100,000	3,014	0.03014	0.96986	97,375	6,894,146	68.94
1	96,986	925	0.00954	0.99046	385,689	6,796,771	70.08
5	96,061	221	0.00230	0.99770	479,753	6,411,082	66.74
10	95,840	216	0.00226	0.99774	478,661	5,931,329	61.89
15	95,624	415	0.00435	0.99565	477,173	5,452,668	57.02
20	95,209	622	0.00653	0.99347	474,542	4,975,495	52.26
25	94,587	631	0.00667	0.99333	471,370	4,500,953	47.59
30	93,956	690	0.00734	0.99266	468,098	4,029,583	42.89
35	93,266	865	0.00927	0.99073	464,277	3,561,485	38.19
40	92,401	1,274	0.01379	0.98621	459,055	3,097,208	33.52
45	91,127	2,103	0.02308	0.97692	450,832	2,638,152	28.95
50	89,024	3,598	0.04042	0.95958	436,861	2,187,320	24.57
55	85,425	5,613	0.06571	0.93429	414,042	1,750,459	20.49
60	79,812	8,067	0.10107	0.89893	380,047	1,336,417	16.74
65	71,745	11,072	0.15432	0.84568	332,462	956,370	13.33
70	60,673	14,664	0.24169	0.75831	268,054	623,908	10.28
75	46,009	16,847	0.36616	0.63384	188,257	355,854	7.73
80	29,162	14,931	0.51201	0.48799	106,747	167,597	5.75
85	14,231	9,362	0.65787	0.34213	45,132	60,850	4.28
90	4,869	3,796	0.77966	0.22034	13,050	15,718	3.23
95	1,073	930	0.86713	0.13287	2,397	2,668	2.49
100+	143	143	1.00000	0.00000	271	271	1.90

Table 20. Turkey Female Mortality Table Using Orphanhood Method (From East Model Life Table)

x	lx	dx	qx	px	Lx	Tx	ex
0	100,000	2,880	0.02880	0.97120	97,513	7,290,137	72.90
1	97,120	728	0.00750	0.99250	386,643	7,192,624	74.06
5	96,392	155	0.00161	0.99839	481,571	6,805,981	70.61
10	96,237	134	0.00139	0.99861	480,848	6,324,410	65.72
15	96,103	216	0.00225	0.99775	480,011	5,843,561	60.81
20	95,887	299	0.00311	0.99689	478,720	5,363,550	55.94
25	95,588	358	0.00374	0.99626	477,079	4,884,831	51.10
30	95,231	454	0.00477	0.99523	475,072	4,407,751	46.28
35	94,777	629	0.00664	0.99336	472,401	3,932,679	41.49
40	94,148	910	0.00966	0.99034	468,618	3,460,278	36.75
45	93,238	1,423	0.01526	0.98474	462,891	2,991,659	32.09
50	91,815	2,169	0.02363	0.97637	454,026	2,528,768	27.54
55	89,646	3,242	0.03616	0.96384	440,717	2,074,742	23.14
60	86,404	5,195	0.06012	0.93988	420,088	1,634,025	18.91
65	81,209	8,532	0.10506	0.89494	386,453	1,213,937	14.95
70	72,677	13,590	0.18699	0.81301	331,663	827,484	11.39
75	59,087	18,488	0.31289	0.68711	251,020	495,822	8.39
80	40,599	19,421	0.47836	0.52164	153,405	244,802	6.03
85	21,178	13,769	0.65014	0.34986	68,132	91,397	4.32
90	7,409	5,859	0.79070	0.20930	19,632	23,265	3.14
95	1,551	1,372	0.88497	0.11503	3,318	3,634	2.34
100+	178	178	1.00000	0.00000	316	316	1.77