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PROVINCIAL FERTILITY AND SOCIAL AND ECONOMIC DEVELOPMENT IN TURKEY, 1935-1965

Ghazi M. Farooq

Baran Tuncer

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I. ECONOMIC DEVELOPMENT AND FERTILITY

I.1 Introduction

There has been a growing body of literature in recent years on the impact of economic development on demographic variables, particularly fertility. This coincides with, and no doubt has basically resulted from, a worldwide revival of interest in questions centering around the "population issue." Unprecedented population increases in the underdeveloped countries since the end of World War II have posed a serious threat to economic growth, undermining the somewhat accelerated but still relatively modest gains in output in these countries. This, combined with the outcries made by environmentalists in the industrial countries, is causing a great deal of global concern. A growing number of governments have adopted anti-natalistic policies and launched ambitious family-planning programs, and aid-giving countries and international agencies have been generous in providing funds to support these national programs.

The body of thought on the relationship between economic development and fertility has developed along two lines which on the surface seem to be opposite to each other. One of these approaches is basically Malthusian, predicting a positive correlation between economic development and fertility. Malthus believed that any improvement in the living levels of the labor class would encourage marriages in general and early marriages in particular. This, coupled with increased marital fertility due to better diet and living conditions, would result in higher birth and pop-

ulation growth rates in the society as a whole. However, critics of Malthus have suggested that the increased growth rates of population in the late 18th century in England were a reflection of only a rapid decline in mortality rates and that fertility was not affected at all by the Industrial Revolution. We do not have sufficient evidence to substantiate either contention in terms of whether or not fertility rates actually increased in the late 18th and early 19th century in Western Europe, but it would be entirely possible for a society to realize a transitory increase in fertility as a result of a rapid decline of mortality. Fertility would be encouraged because declining mortality would result in more marriages lasting through the childbearing ages.

Needless to say, our interest concerning the impact of economic growth on fertility is what happens not in a relatively short and transitional period but rather in the long run. Here, those who postulate an inverse relationship between economic development and fertility appear to have more convincing arguments in their arsenal. This approach, known as the demographic transition model, views demographic change in basically three stages. At first there is a long period of near-balance between birth and death rates (historically when they were a little over thirty per thousand in all societies). This is evidenced by the fact that it took the world population seventeen centuries to increase from roughly 300 million around year one, to roughly 600 million. There was a primitive equilibrium between man and resources; when the balance seemed to be upset on account of excess births, death rates increased,

restoring the equilibrium.

During the second phase, death rates gradually decline as a result of improvements in living levels, health conditions and medical knowledge, while birth rates remain stable. Most of Western Europe went through this phase of demographic change during the later part of the 18th and most of the 19th century. The European population more than doubled in less than one century.

The third stage of the demographic transition is reached when birth rates also become subject to control and begin to decline gradually until a new balance between the birth and death rates is restored at a relatively low level; somewhere around fifteen per thousand (with death rates being slightly lower than birth rates). This is what happened in Europe beginning in the late 19th and most of the 20th century.

The proponents of the transition theory suggest that the demographic history of the now industrialized countries could be expected to repeat itself in the present-day underdeveloped countries. Although present population growth rates in these countries are at alarmingly high levels of around 2.6 percent per annum, what we observe now is claimed to be the second phase of demographic transition, i.e. death rates becoming subject to control but birth rates remaining stable. Eventually, they claim, internal pressures similar to those that helped lower birth rates in industrialized countries will go into action and pull down the birth rates.

The alarmists on the "population explosion" in the developing world

take little comfort from this theory. Firstly, they point to the speed at which population is currently growing. At present rates, the population in the underdeveloped countries will double itself nearly every twenty-five years, compared to the one hundred years that it took the European population to double itself in the second phase of the transition. Secondly, they maintain that external factors such as imported 'highly successful' Western medical practices have been the cause of the sudden fall in the death rates of these countries since the end of World War II and not the changing socio-economic conditions as was the case in the European countries. As a result, the expectation of a decline in fertility to follow the fall in death rates may not be very realistic, at least in the short run.

Keeping in mind the European pattern of demographic change and what is happening in the underdeveloped countries, let us pursue the question of the interrelationship between economic and demographic changes.

Economic development is often associated, and correctly so, not only with annual increases in total or per capita output but also with changes in a number of other socio-economic variables. This latter aspect of development is usually called structural change or is loosely defined as modernization. There is usually a continuous increase in the level of literacy in general, and in female literacy in particular, associated with an improvement in the status of women in the society. The composition of the labor force changes in favor of non-agricultural sectors. Actually the so-called industrialization process is considered

to be taking place once the share of the agricultural labor is at sixty percent or less and is declining continuously.[1] Also migration from the rural part of the country to the cities gains momentum.

In this modernization process, institutional changes also take place; some are the products of deliberate government policy and some are the byproducts of development itself. The economy becomes more monetized as agricultural production becomes more market-oriented. Saving and banking institutions develop. Usually governments assume a crucial role in promoting development, generally through the implementation of development programs. Government's share in the use of total product increases visibly and the government becomes instrumental in the mobilization of domestic resources. Labor becomes better organized, social security and old age pensions programs go into effect, and child labor may become less prevalent. Changes may also take place in the use and distribution of agricultural land.

Meanwhile on the demographic scene, as indicated earlier, mortality rates, including infant mortality, start falling. Life expectancy at birth goes up dramatically. This is generally a response to the combined effects of improvements in nutrition, rudimentary hygiene, public health and sanitation.

This process, basically as described above, has been observed in a

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[1] Simon Kuznets, "Present Underdeveloped Countries and Past Growth Patterns," Readings in Economic Development, edited by Johnson and Kamerachen, (Cincinnati: Southwestern Publishing Company, 1972), p. 39.

majority of underdeveloped countries. Available statistics indicate an average yearly growth rate in output of approximately five percent in underdeveloped countries during the last two decades. Even though the average population growth rates of 2.6 percent allowed only for an overall per capita income growth of a little more than 2 percent, this was still higher than the recorded rates in earlier decades. The structures of the economies were also going through changes. In most countries the share of non-agricultural output increased impressively. There have also been efforts in investing in all types of infrastructure facilities. Enrollments in all levels of schools increased and health conditions improved. During these last two decades most countries made attempts, through planning, to change the socio-economic structure, and to install new institutions that are expected to be conducive to development. Implementation usually falls short of the targets but this should not cover up the fact that some ground has been gained in the fight against poverty.

There have also been dramatic changes in mortality rates and life expectancy at birth in underdeveloped countries. Death rates dropped to below 20 per thousand while the expectation of life rose on the average,[1] to fifty-five years. Life expectancy in these countries is now higher than the levels prevailing in Western Europe at the turn of the century.

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[1] H. J. Habakkuk, Population Growth and Economic Development (Leicester: Leicester University Press, 1971), p. 257.

However, save a few exceptions, there has not been any empirically observed downward trend in fertility rates in the vast majority of underdeveloped countries. Fertility levels have declined only slightly in a few Latin American and Asian countries, and some studies even indicate an increase in crude birth rates in some Latin American countries since 1945.[1]

Thus, there is no clear-cut empirical evidence--in fact not even any crude observation--concerning any discernable impact of recent economic development on the birth rates in underdeveloped countries. Expected declines in fertility are yet to be seen while the consequences of rapid population growth in these countries remain a major concern for the international community. In-depth country studies could shed light on the relationship between changes in development variables and demographic variables, despite the usual serious lack of data. The present study attempts to evaluate the experience of Turkey in the last thirty years. Before the Turkish case is analyzed, however, it seems advisable to advance, within the framework of a formal model, hypothesized relationships, first between the individual indicators of economic development on the one hand and fertility on the other, and second, between the combined effect of the development variables and fertility. Evidence from other studies will also be briefly reviewed.

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[1] For example, see Andrew Collver, Birth Rates in Latin America: New Estimates of Historical Trends and Fluctuations. Research Series No. 7 (Berkeley: University of California, 1965).

I.2 Interrelations between Fertility and Development Variables

Each of the development variables has either an independent and/or an instrumental impact on the fertility behavior of a population. The independent impact is the direct effect (positive or negative) of a change in a development variable on fertility. The instrumental impact of a given variable is its indirect effect on fertility via its relation with another development variable. In the following we will examine the probable impact of each of the important development variables on fertility.

Income: It is difficult to separate the independent impact of income from its instrumental impact since income is very highly correlated with most of the other modernization variables. Leibenstein was one of the first to explore the relationship between income and fertility.[1] He identifies three types of utility accruing to parents from having children: first, a child being a "consumption good," second, a "productive agent" and third, a "potential source of security." He maintains that there is a negative correlation between the level of income and the utility derived from children as productive agents and potential sources of security. However, he feels that the relationship between the income level and the satisfaction from having children is indeterminate. He also points out that the cost of having children, both in terms of "conventional expenses" and "opportunities foregone," increases as the family income increases.

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[1] H. Leibenstein, Economic Backwardness and Economic Growth (New York: John Wiley & Son, 1957), p. 161.

Becker suggests that the demand theory for consumer durables[1] is applicable to the analysis of the demand for children, since children provide "utility" as consumer durables. He maintains that since children are not inferior goods, the demand theory tells us that the demand for children should increase as income goes up. However, at higher income levels, families may also demand "higher quality" children, implying not that the children are superior goods but that more money is spent on them. Thus Becker thinks that Leibenstein is mistaken when he suggests that the cost of children goes up as the family's income increases. Rather, an increase in expenditure on children should indicate that the parents prefer higher quality children.

In a more recent study, Easterlin added a new element by suggesting that "permanent income" is more pertinent to household decision-making than "observed income" at a given time.[2] Given the permanent income, which in effect means the potential income of a family, what determines the demand for children is the "structure of preferences" regarding goods, children, leisure and fertility control practices. Easterlin suggests that besides permanent income and the structure of preferences, the third

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[1]Gary S. Becker, "An Economic Analysis of Fertility," in Demographic and Economic Change in Underdeveloped Countries (Princeton: Princeton University Press, 1960), pp. 209-231.

[2]Richard A. Easterlin, "Toward a Socio-economic Theory of Fertility: A Survey of Recent Research on Economic Factors in American Fertility," Fertility and Family Planning: A World View, edited by S. J. Behrman, et. al. (Ann Arbor: The University of Michigan, 1970), pp. 127-156.

relevant factor is various "price constraints," such as the prices of child care and of different fertility control methods relative to the prices of goods in general.

These pioneering works on the theory of fertility behavior have also stimulated empirical investigation of the relationship between income and fertility. D. Freedman found that potential or expected income had more influence on fertility than did current income.[1] R. Freedman and Coombs concluded that income increases might encourage the demand for children, but with higher economic status, "other reasons" for not having children also become important.[2] Blake attempted to show that as the money income increased, so did the "indirect costs" as well as the "direct costs" of raising children, cancelling the positive effect of income on fertility.[3]

These studies were based on data from developed countries. Those who attempted to investigate the relationship between income and fertility in underdeveloped countries had to face more serious data shortcomings. Detailed family income statistics are needed in order to measure the partial impact of income on fertility with some accuracy. Among the few studies covering underdeveloped countries, Adelman found that the partial

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[1]Deborah S. Freedman, "The Relation of Economic Status to Fertility," American Economic Review, LIII, 3, June 1963, pp. 414-426.

[2]Ronald Freedman and Lolagene Coombs, "Economic Considerations in Family Growth Decisions," Population Studies, XX, 2, November 1966, p. 213.

[3]Judith Blake, "Income and Reproduction Motivation," Population Studies, XXI, No. 3, November 1967, pp. 185-206.

effect of income on fertility was consistently positive for all age groups in a cross section analysis of thirty-seven countries.[1] A similar conclusion was reached by Weintraub based on a study of thirty countries.[2]

The findings of these studies give support to the view that increased income may encourage fertility.[3] However, the instrumental impact of income increases may be quite different. Higher levels of income are usually closely associated with other modernization variables such as education which clearly have depressing effects on fertility. Simon, after analyzing the results of some of the aforementioned studies, maintains that the "unconditional effect" of income on fertility is negative in underdeveloped countries, even though its partial effect may be positive.[4] The historical experience of the industrialized countries also supports the view that the overall impact of income on fertility is negative.

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[1] Irma Adelman, "An Econometric Analysis of Population Growth," American Economic Review, LIII, No. 3, June 1963, pp. 314-339.

[2] Robert Weintraub, "The Birth Rate and Economic Development: An Empirical Study," Econometrica, Vol. 30, No. 4, October 1962, pp. 812-817.

[3] Heer reported that in a study covering 318 localities in 18 Latin American countries, he and E. S. Turner found out that the areas with higher than expected fertility were clustered in nations which had experienced a relatively high rate of growth. (David M. Heer, "Economic Development and Fertility," Demography, Vol. 3, No. 2, 1966, p. 426). In a cross section study of sixty-seven provinces in Turkey in 1965, one of the authors of this study found no significant partial impact of income on fertility. B. Tuncer, "A Study of the Socio-Economic Determinants of Fertility in Turkey," Economic Growth Center Discussion Papers No. 121, Yale University, 1971.

[4] Julian L. Simon, "The Effect of Income on Fertility," Population Studies, Vol. XXIII, No. 3, November 1969, pp. 327-341.

Education: The depressing affect of education on fertility has long been established. Education is expected to have both sizeable independent and instrumental effects. Above all, education helps people to be more conscious of their surroundings and frees them from traditions.

One way education may adversely effect fertility is that it provides opportunities, particularly for women, that conflict with child-bearing and child-rearing. Women with education have a greater opportunity to be gainfully employed outside the home. Since education also provides more economic independence for women and since the proportion of young adults attending schools increases as education spreads, the average age at first marriage usually goes up. There is also a strong association between the educational attainment of parents and the cost of child-rearing. Even if one agrees with Becker (and many do not) that the cost of children is the same for everybody, it is also true that educated couples will tend to opt for higher quality and not quantity of children.

Also literacy and education obviously help people to learn how to avoid unwanted pregnancies through the increased flow of information. This is particularly true in underdeveloped countries. In advanced countries where the literacy level is around 90 percent, more education may not be very significant as far as knowledge of birth control is concerned. However, in underdeveloped countries where illiteracy is at very high levels, lack of contraceptive knowledge can be a factor contributing to high fertility and can result in a significant difference between the number of children couples actually have and the number they would prefer to have. Easterlin suggests that education, by widening hor-

izons,may raise aspirations for material goods and lower the relative desire for children, thus raising the subjective costs of unwanted pregnancies. On the other hand, by directly affecting knowledge of contraceptive technique,education lowers the cost of contraception and works for a reduction in unwanted pregnancies. In suggesting this, Easterlin argues that couples,in considering the use of fertility control methods,weigh the loss of utility attached to the possibility of an unwanted birth against the loss of utility attached to the cost of contraceptive methods.[1]

There is sufficient empirical evidence showing the negative nature of the relationship between education and fertility. Adelman found that in all the child-bearing age groups the regression coefficients of birth rates with respect to education were negative. Quantitatively among all the independent variables, education exerted the largest absolute influence upon fertility.[2] Hughes reported the same strong negative correlation between fertility and education.[3] Dandekar also reached similar conclusions in a study based on data for forty-nine underdeveloped countries.[4] In the same study, he mentioned that a national sample survey in India found that approximately only sixty percent of illiterate

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[1]Easterlin, op.cit., pp. 136-138.

[2]Adelman, op.cit., p. 322.

[3]R. E. Hughes, "Human Fertility Differentials: The Influence of Industrial Urban Development on Birth Rates," Population Review, July 1959, p. 62.

[4]K. Dandekar, "Effect of Education on Fertility," in United Nations, Proceedings of the World Population Conference 1965, Vol. IV (New York, 1967), p. 149.

married couples knew about contraception. The ratio jumped to seventy-eight percent for primary school graduates and to ninety-six percent for university graduates.

The Turkish Demographic Survey also gives supporting evidence to the above conclusions. Birth rates varied considerably among women with different levels of schooling. Within the most fertile age group of 20-24, birth rates varied from 305 per thousand among illiterate women, to 235 for primary school graduates, and to 113 for middle school graduates.[1] In another Turkish study, Timur found that on the average, illiterate women had 4.2 children, literate women without formal education, 3.2, women with primary school education, 2.8, women with secondary education, 2.0 and women with university education only 1.4.[2]

In the cross-section study of Turkey mentioned above, one of the authors also found a strong negative relationship between a number of education variables and fertility in Turkey. In the regression equations, more than sixty-five percent of the variance in fertility was explained by education alone and the remaining independent factors combined explained only fifteen percent. And the female primary school graduate variable was stronger than both the general literacy variable and the male primary school graduate variable.[3]

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[1] School of Public Health, Turkish Demographic Survey 1966-67, Ankara University, 1970.

[2] S. Timur, "Socio-Economic Determinants of Differential Fertility in Turkey," Institute of Population Studies, Hacettepe University, Ankara 1971, pp. 11, 14 (mimeo).

[3] Tuncer, op.cit., p. 32-3.

Urbanization: Urbanization is another variable that generally attracts attention in studies of fertility behavior. Data from a large number of countries indicate that urban fertility rates are lower than rural ones. For example, the Turkish Demographic Survey shows that the total fertility rate for urban localities with a population of more than 2000 was 3.88 while it was 6.12 for rural areas in the survey period of 1966-67.

Even though the figures given for rural and urban settlements are widely disparate, interpretation of them warrants caution. It is an established fact that city dwellers are usually economically better off, better educated, and have better provisions of social services. Thus it is difficult but important to separate and identify the independent impact of urbanization on fertility. However, one could expect urbanization to have a depressing effect on fertility for independent reasons alone. For one thing, the urban setting provides more economic opportunity and social freedom for women. This should discourage both early marriages and frequent pregnancies. It has also been argued that there exists a significant cost differential in child-rearing between rural and urban areas. Having more children in rural areas does not add to the space requirements and to the various expenditures in the same proportion as it does in the cities. Also, children are usually more valuable as productive agents in rural areas where they help as farm labor from an early age.

Industrialization: The potential impact of industrialization on fertility is also complicated. Historically, income or output growth, urbanization

and industrialization all took place at the same time and thus it is hard to separate the independent impact of industrialization on fertility. Nevertheless, the industrialization process as defined either in terms of the increasing share of non-agricultural value added within an increasing total output, or the redistribution of labor force in favor of non-agricultural sectors, is expected to have both independent and instrumental values in depressing fertility. Industrialization increases income levels, improves standards of living, facilitates education and training, influences the family norms and encourages small nuclear families, exposes the labor force to modern technology, encourages urbanization, expedites legislation for old age pension and social security plans. These factors combined are bound to influence attitudes, help the masses break away from tradition, and thus favor lower birth rates. Furthermore, industrialization is often accompanied by increased female labor force participation in areas where it had been low by tradition, a factor that should further discourage early marriages and large families.

General Mortality and Infant Mortality: Economic development helps to bring about a decline in mortality, including infant mortality. Increased incomes enable people to have better nutrition, more adequate shelter and improved sanitation. Governments are more capable of fighting famines and epidemics, and they can provide better public health services. Improvements in other development variables, education in particular, also contribute to lowering the death rates.

We have already indicated that the general declines in mortality in the recent experience of underdeveloped countries were more attributable to improvements in medical conditions than to overall improvements in living levels including nutrition. However, regardless of the cause of the decline in mortality, such a development should have a significant impact on fertility trends, though perhaps with a time lag.

First of all, decreasing infant and child mortality put pressure on families and the society as a whole in the direction of lowering fertility. If fertility remains constant as child mortality declines, the average size of families increases sharply and supporting a family becomes more costly. This should serve as a stimulus to reduce fertility.

Secondly, couples usually have some notion about the number of children they would like to have. Given a high level of infant and child mortality, women tend to bear more children than actually desired with the expectation of losing some of them at early ages. This is even more obvious in countries where great importance is attached to having a surviving son. Once child mortality declines, the number of surviving children approaches the number of births. This should also help to reduce fertility.

The third relevant factor is of a biological nature. Lactation reduces the probability of conception, and in societies where extended breast feeding is prevalent, any improvement in infant mortality should act as a birth control device--however unreliable it is--and thus reduce

pregnancies.

On the other hand declines in adult mortality may have a different impact on fertility, particularly in the short run. As the adult mortality goes down, more marriages last through the reproductive years of women, thus increasing the probable number of children couples have.

A number of institutional factors mentioned above that depress fertility need not be elaborated here. In a developing economy, development of an old-age pension scheme, a social security system, laws limiting child labor, and similar institutional changes should further eliminate the need and the desire for a large number of children.

In view of the foregoing, we hypothesize that the overall long term impact of social and economic development on fertility is negative. Most of the modernization variables associated with economic development are expected to have a depressing effect on fertility. However, since declining fertility also involves changes in the attitudes and traditions of the society, this expected impact may be delayed. This lagged effect is probably stronger for variables like urbanization and industrialization. Meanwhile, it is even conceivable that in the short run the positive impact of increased income, improved health conditions and lower adult mortality may outweigh the negative impact of other variables.

It should also be emphasized that the relationship between economic development and fertility is not unidirectional. Changing fertility also influences the social and economic variables individually as well as the economic development process as a whole. However, the examination of the impact of fertility on economic development is beyond the scope of this study.

II. DESIGN OF THE STUDY

Both the design of the study and the selection of variables have been understandably influenced by the availability of data. It was difficult and sometimes impossible to find information for some of the variables that were thought to be of importance in this study. For other variables, data were not available for the whole period under consideration. The intention was to go as far back as possible in time in order to investigate the influence of a large number of development variables on the fertility pattern. However, the data prior to 1935 are more scarce and less reliable than those for the period after 1935. Therefore the present study covers the period from 1935 to 1965.

The unit of observation in this study is "province." A province is the primary unit of administration and represents a relatively homogenous populace. It is also used as the primary area unit of reporting in the quinquennial Turkish censuses. Presently there are sixty-seven provinces in Turkey. Within the period under study, however, a number of administrative boundary adjustments were made. In the 1940, 1945 and 1950 censuses there were only sixty-two provinces. In 1955 the number increased to sixty-six, and in 1960 to sixty-seven, without any change in the national boundaries. In some cases, a province was divided into two, but in most cases, the creation of new provinces involved boundary changes in more than one province. In order to assure the consistency and homogeneity of the observations, two operations were

performed: the number of provinces was reduced to sixty-two, and appropriate adjustments were made for population changes in the provinces with boundary changes.

Since the present study is designed to explore the impact of a number of development variables on fertility, the selection of an appropriate and reliable measure of the provincial fertility level for the entire period under consideration is essential. Turkey, like many other underdeveloped countries, does not have a long and continuous tradition of vital registration. Even now there are no official estimates of provincial births and deaths. Fortunately, the quinquennial censuses have regularly reported provincial populations by age, and it was possible to construct provincial crude birth rates (CBR), using 'reverse projection technique', though a great deal of data adjustment was involved. By definition, CBR is the total number of live births per thousand of total population during a specified period of time, usually a year. Here, the estimates for provincial CBR's refer to an average of a ten-year period and cover 1935-45, 1940-50, 1945-55, 1950-60, and 1955-65.[1] A detailed explanation of the methodology used in the

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[1] It may be interesting to mention that we also tried "child-woman ratio" as a measure of provincial fertility levels; for one reason, it involved a much smaller degree of data adjustment than did CBR. However, a historical series of provincial child-women ratios gives an obviously erratic pattern of fertility due to, among other reasons, serious age misreporting of both children and women, and wide regional differences in child as well as adult mortality.

estimation of provincial CBR is given in Appendix A.

It should immediately be noted that the estimates given here are not intended to be precise and exact estimates of the CBR is the provinces. The data are inadequate to make such a claim. Nevertheless the authors are convinced that the CBR estimates are reasonable approximations of the actuals and that they realistically reflect inter-provincial differentials in fertility.

Data constraints also influenced the selection of independent variables. Ideally all the development variables discussed in the previous section should be included. But time series data for such vital variables as income and child mortality are not available for any continuous length of time. However, there is a strong correlation between income and some of the included variables. For example the correlation coefficient between the level of income and female literacy is 0.66 for 1965 (the only year for which provincial income estimates are available), between income and urbanization it is 0.79, and between income and 'the proportion of male workers in the industry sector' it is 0.91. As a result the availability of these variables enabled us to gauge the indirect effects of income differentials.

The main source of information for the independent variables used in this study was also the Turkish quenquennial censuses. Despite the uniformity of the source, problems were encountered in the construction of time series for different variables selected because of differences resulting from coverage and/or definitions in different census years. In

the following, we will describe the independent variables selected for this study and the more important assumptions and adjustments made in the construction of their time series.

Literacy Level: Literacy is selected here as the education variable since data do not exist for different levels of schooling for the entire period. A person is enumerated as literate if he or she knows both how to read and how to write. The literacy level is measured as the percentage of total population reported literate, separately for males, females and both sexes.

The 1960 literacy figures required major adjustments. For the majority of provinces these figures were considerably lower than those for the preceding and following census year. The 1960 figures are replaced by a simple average of the 1955, 1960 and 1965 census figures, which give a very plausible trend.

Industrial Composition of Labor Force: The industrial distribution of the male labor force is usually used to indicate structural changes in economic activity, as well as to show the pace of the industrialization process. We have used here Kuznets' classification scheme,[1] and regrouped different industrial categories into three major sectors, namely "agriculture," "industry" (including mining, manufacturing, construction, gas, electricity and water, transportation activities) and "services" (including trade and general services).

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[1] Simon Kuznets, Modern Economic Growth: Rate, Structure and Spread (New Haven: Yale University Press, 1967), pp. 86-87.

The relevant variables are the percentages of male workers fifteen years and over respectively in these three major sectors. Uniform provincial data exist for the industrial distribution of male workers fifteen years and over for the 1955, 1960 and 1965 census years. However, the 1950 census reported only the occupational distribution and included workers between the ages of 5 and 14 years. The 1945 census, though reporting industrial distribution, did not take any minimum age limit. Fortunately, for both years detailed age distributions of the population and labor force for the whole country were reported and it was possible to exclude workers below age fifteen. By probing into the occupation by industry matrices for Turkey and making other relevant assumptions, it was possible to approximate the distribution of male workers into the three sectors from the 1950 provincial occupation distributions.

Female Non-agriculture Labor Force Participation: This is measured as the percentage of women fifteen years and over engaged in non-agricultural activities. The reason for not including women engaged in agriculture is that a preliminary examination of the female labor force statistics revealed a sharp continuous decline in the extent of female participation in agriculture over time. This was undoubtedly due to the uneven coverage in the different census years. In the earlier years practically all the women living in villages were enumerated as agricultural workers whereas in the later years only those who specified their occupation as agricultural work were reported as participating in economic activity.

Urbanization: Urbanization is measured as the percentage of total population living in urban areas. Five different levels of urbanization are taken, namely percentages of the total population living in urban localities of 2,000 and over, 5,000 and over, 10,000 and over, 20,000 and over, and 50,000 and over.

Marital Rate: The marital rate obviously may not be categorized with the development variables discussed earlier. However, there are some important considerations which seem to warrant the inclusion of a marriage variable. First, the continuing influences of religion and associated moral values in Turkish society does not allow any extramarital fertility, i.e., ceteris paribus, there is a direct relationship between marital and fertility levels. Secondly, Turkey has always had the tradition of universality of marriage. At any given time, then, the primary factor influencing the aggregate marital rate is the 'age at marriage.' It is easy to see that given a relatively low average age at marriage, such as exists in many pre-modern societies, the aggregate marital rate will be high, and vice versa. In turn, age at marriage, particularly when it is very low, is known to be significantly affected by social and economic advancement. Here the relevant question is to what extent the differences in birth rates are attributable to the differences in marital rates.

The marital rate is calculated as the percentage of women fifteen years and over, married. Female marital rate is preferred over male or total marital rate as, in the absence of official marriage records, women are more likely to report a marriage than are men. Also, in the case of men

there may be an underreporting of marriages since some men may be married to more than one woman.

Finally, in relating the dependent variable CBR with the independent variables a relevant question is whether or not a time lag should be used in the analysis. As mentioned before, the estimated CBR refers to average fertility rate over a period of ten years, whereas the values of the independent variables are point estimates in a given census year. It would be inappropriate to relate the value of an independent variable for a given year to the average CBR of the ten-year period preceeding it; that is to relate the crude birth rate of say, the 1955-65 period with the values of the independent variables for 1965. Thus the choice was to take either the 1960 values for the independent variables--which means no lag--or to take the 1955 values, that is a five-year lag.

Two considerations favored a no-lag alternative. One was that the results with no lag were not significantly different from the five-year lag alternative. The other was that if a five-year lag alternative were chosen the time period to be studied would be further shortened without much compensation gained in terms of the accuracy of results. As it is, only four periods could be considered. Crude birth rate estimates for the 1935-45 period could not be used because data are not available for the independent variables in 1940, and 1965 data for the independent variables could not be used since they would relate to the 1960-70 crude birth rates which are not available at present. Thus, the crude birth rate estimates that are employed in this study refer to the 1940-50, 1945-55, 1950-60, and 1955-65 periods, and the corresponding

independent variables are for the 1945, 1950, 1955 and 1960 census years.

The analysis itself consists of two parts. In the first part the interrelationships among the variables are examined in depth, using simple correlation and ranking techniques. The purpose is twofold. One is to understand the basic relationship between the dependent variable and the independent variables. The second purpose is to examine the interdependence and collinearity among the independent variables. This also serves the purpose of providing the necessary information for the appropriate use of multiple regression which is applied in the second part of the analysis. In this second part, an attempt is made to approximate a functional relationship, from both cross-sectional as well as pooled data, between CBR and the development variables, as well as among some of the more important independent variables.

III. THE PATTERN OF PROVINCIAL CRUDE BIRTH RATES AND INTERRELATIONSHIPS AMONG THE VARIABLES

III.1 Variations in the Pattern of Provincial Crude Birth Rates

The CBR estimates show a distinct temporal trend in the national average rate (Table 2). First there was a period of increasing birth rates--from 46.6 per thousand in 1935-45 to 49.2 in 1940-50 and 50.4 in 1945-55. Then the national CBR started to decline--to 47 per thousand

in 1950-60 and to an all-time low of 44.1 in 1955-65.[1] Several factors seem to have influenced this pattern. First is the adverse impact of World War II on fertility during the 1935-45 period. There was a large mobilization and a sizeable number of men were kept under arms from 1939 to 1945. Living conditions deteriorated and there were serious food shortages. But with normalization of the situation, Turkey appeared to share the widespread "post-war baby boom" phenomenon. Also, the all-time high national CBR in 1945-55 seems to be especially related to the remarkable overall economic expansion from 1950 to 1954. National output expanded at a rate of more than ten percent annually. Due to rapid expansion of cultivated land and good weather conditions, the increase in farm output was even more impressive. Such a rapid increase in income level might have had a short-run encouraging effect on fertility. Appendix B gives a review of socio-economic changes in Turkey for the 1945-1965 period.

Table 1 provides the frequency distribution of provincial CBR's in different time periods. Overall the provincial CBR's show patterns similar to the national average. In 1935-45 there was a heavy concentration of crude birth rates around 50 per thousand. During the two

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[1]The preliminary results of the 1970 Census indicate a 2.6 percent annual population growth rate for the 1965-70 period, the same as in 1960-65. If it is assumed that mortality continued to decline, then the birth rates must have continued to decline in the 1965-70 period, also. Actually the presumed decline in mortality is quite plausible in view of continuing overall improvements achieved in living standards and health conditions during this period. Also, there is no evidence to suggest that the historical continuous decline in mortality was checked in this period.

Table 1

FREQUENCY DISTRIBUTION OF PROVINCIAL CRUDE BIRTH RATES (CBR), 1935-65

CBR per 1,000 Population	1935-45	1940-50	1945-55	1950-60	1955-65
64.0 and over	2	7	9	6	3
60.0-63.9	5	6	5	4	3
56.0-59.9	7	5	9	5	6
52.0-55.9	8	8	6	11	11
48.0-51.9	12	10	12	8	9
44.0-47.9	9	10	7	7	5
40.0-43.9	9	8	7	12	7
36.0-39.9	5	6	6	6	8
Under 36.0	5	2	1	3	10

Classes in which national (weighted average) CBR's (Table 2) fall are underlined.

Table 2

PARTITION VALUES AND MEASURES OF DISPERSION OF PROVINCIAL CRUDE BIRTH RATES, 1935-65

(Per thousand population)

Partition lines	1935-45	1940-50	1945-55	1950-60	1955-65
National CBR (Weighted average)	46.6	49.2	50.4	47.0	44.1
Median	49.2	49.4	51.3	49.7	48.6
Lower Quartile	42.2	43.7	44.8	42.2	39.3
Upper Quartile	54.6	57.2	58.4	56.0	54.1
Interquartile Range	12.4	13.5	13.6	13.8	14.8
Ratio of Interquartile Range to Median	.252	.273	.265	.277	.304

following periods the number of provinces in the higher crude birth rate class intervals increased, particularly in 1945-55. The number of provinces with a CBR of 48 per thousand or more was 41 in the 1945-55 period, compared to 34 in 1935-45. According to our estimates, after the 1945-55 period the CBR's gradually declined. The pattern of the 1950-60 period was actually not very much different from the 1935-45 one as far as the number of provinces in each class interval is concerned. A further downward shift in CBR is evident in the 1955-65 frequency distribution. For example, the number of provinces with a crude birth rate of less than 36 per thousand jumped to 18, as compared to between 7 and 10 for the earlier periods.

These trends are more clearly shown in Table 2 where the value of the average CBR for Turkey and the values of the median, the lower and the upper quartiles are given. The values of the median for the provinces follow a pattern similar to that of the national CBR with the exception of the 1955-65 value which is similar to the median value for the first period, 1935-45. A somewhat more pronounced pattern is observed with the lower quartile values. The lower quartile value in 1955-65 is 39 per thousand representing a decline of 3 points per thousand from the corresponding value in 1935-45.

It is interesting to note that the ratio of the interquartile range to the median, a measure of 'relative dispersion,' is high throughout the period and does not indicate any noticeable convergence of the crude birth rates among the provinces. This is to be expected as there are still

marked differentials in regional socio-economic development levels. In light of historical experience, the general hypothesis is that only at a high development level do regions become homogenous in their socio-economic characteristics. Regional disparities are more extreme in the early stages of modern economic growth, as is evident in the Turkish case where only a few of the geographical regions have become increasingly industrialized and urbanized.

III.2 Interrelationships among the Variables

In order to investigate the interrelationships among the variables included in this study, the provinces were ranked according to CBR for each time period and according to the independent variable values in corresponding years. Table 3 provides the rank order correlation between CBR and different socio-economic variables, and among the latter for each time period. Section A of Table 3 reveals that the highest rank order correlations between CBR and the independent variables are for the level of literacy variable in all periods. The coefficients' signs are negative as expected and the values are around 0.80. Also note that female literacy has a higher correlation coefficient with CBR than has male literacy. These high values exist because literacy encompasses several factors, most of which seem to have a negative relationship with fertility. It represents both an information or knowledge variable with respect to fertility control and modern medical practices and, as mentioned before, the effects of social and economic advancement, and as such gives

Table 3

RANK ORDER CORRELATIONS AMONG CRUDE BIRTH RATES AND SOCIO-ECONOMIC VARIABLES

A. CRUDE BIRTH RATES *

	1945	1950	1955	1960
CRUDE BIRTH RATES AND:				
Level of Literacy				
MLIT	-0.810	-0.796	-0.781	-0.841
FLIT	-0.830	-0.836	-0.862	-0.911
Industrial Distribution of Male Labor Force				
AGR	0.395	0.446	0.589	0.590
IND	-0.468	-0.437	-0.558	-0.631
Level of Urbanization				
URB02	-0.309	-0.265	-0.419	-0.491
URB05	-0.297	-0.272	-0.404	-0.479
URB10	-0.219	-0.178	-0.356	-0.437
Female Labor Force Participation				
RFLF	-0.528	-0.479	-0.647	-0.586
Female Marital Rates				
RMART	0.603	0.527	0.470	0.526

B. LEVEL OF LITERACY

MALE LITERACY AND:				
AGR	-0.548	-0.590	-0.637	-0.680
IND	0.605	0.577	0.658	0.727
URB02	0.472	0.394	0.446	0.547
URB05	0.433	0.380	0.411	0.503
URB10	0.359	0.306	0.375	0.457
RFLF	0.637	0.622	0.731	0.686
RMART	-0.501	-0.544	-0.490	-0.634
FLIT	0.959	0.947	0.944	0.949
FEMALE LITERACY AND:				
AGR	-0.504	-0.565	-0.581	-0.606
IND	0.551	0.547	0.595	0.653
URB02	0.479	0.414	0.458	0.157
URB05	0.442	0.402	0.435	0.498
URB10	0.369	0.334	0.413	0.458
RFLF	0.591	0.573	0.688	0.609
RMART	-0.457	-0.451	-0.417	-0.559

Table 3 (continued)

C. INDUSTRIAL DISTRIBUTION OF MALE LABOR FORCE

	1945	1950	1955	1960
LABOR FORCE IN AGRICULTURE AND:				
URB02	-0.797	-0.802	-0.770	-0.808
URB05	-0.765	-0.798	-0.756	-0.775
URB10	-0.735	-0.748	-0.760	-0.785
RFLF	-0.799	-0.828	-0.793	-0.712
RMART	0.490	0.526	0.483	0.596
IND	-0.947	-0.982	-0.966	-0.969
LABOR FORCE IN INDUSTRY AND:				
URB02	0.735	0.759	0.722	0.755
URB05	0.723	0.771	0.706	0.723
URB10	0.668	0.705	0.710	0.739
RFLF	0.847	0.827	0.807	0.707
RMART	-0.487	-0.527	-0.480	-0.606

D. LEVEL OF URBANIZATION

URBANIZATION 02 AND:				
URB05	0.956	0.968	0.978	0.982
URB10	0.931	0.941	0.935	0.939
RFLF	0.662	0.696	0.688	0.622
RMART	-0.308	-0.419	-0.274	-0.475
URBANIZATION 05 AND:				
URB10	0.950	0.960	0.960	0.955
RFLF	0.628	0.691	0.672	0.583
RMART	-0.258	-0.442	-0.247	-0.450
URBANIZATION 10 AND:				
RFLF	0.591	0.609	0.657	0.585
RMART	-0.256	-0.379	-0.251	-0.462

Table 3 (continued)

E. FEMALE LABOR FORCE PARTICIPATION

	1945	1950	1955	1960
FEMALE LABOR FORCE PARTICIPATION AND:				
RMART	-0.579	-0.557	-0.452	-0.452

*CBR estimates are for ten-year periods centering around the years shown in corresponding columns (for example 1945 refers to 1940-50 period).

Definition of the variables:

MLIT : Percentage of total males literate,

FLIT : Percentage of total females literate.

AGR : Percentage of male workers 15 years and over in agriculture sector.

IND : Percentage of male workers 15 years and over in industry sector.

URB02 : Percentage of total population living in settlements 2,000 and over.

URB05 : Percentage of total population living in settlements 5,000 and over.

URB10 : Percentage of total population living in settlements 10,000 and over.

RFLF : Percentage of females 15 years and over in non-agricultural sectors.

RMART : Percentage of females 15 years and over married.

a rough indication of the aspiration level of the population for material goods.

The correlation coefficients between CBR and the variables representing the industrial distribution of male labor force, female labor force participation, urbanization and marital rates all have expected signs, though with considerably lower values than the literacy variables. The values of the coefficients for the industrial distribution of male labor force do not vary significantly between agriculture and industry. Among the three urbanization variables included, the correlation coefficients are slightly higher for the 2,000 and over and 5,000 and over urban population levels, but the relationship between CBR and urbanization seems to be weaker than expected in all three cases. However, it is worthwhile to note that the pace of urbanization in Turkey has accelerated since World War II, and a significant portion of this increased urban population consists of rural-to-urban migrants. It is quite plausible that the fertility pattern of these migrants remains unaffected by urbanization for a considerable length of time, thus diluting the overall negative influence of urbanization on fertility.

In the remaining sections of Table 3, interrelations among the independent variables are explored. The purpose is to learn more about the independent variables before an attempt is made to approximate a model to measure the causality between CBR and the independent variables. Table 3 reveals that the female literacy variable, which has the highest correlation with the CBR, has lower correlation coefficients with the

other independent variables than do the other literacy variables[1]--there is less incidence of multicollinearity. This reinforces the choice of female literacy from among the three literacy variables.[2] The choice between the proportion of male workers in agriculture and industry is less obvious and either of the two can be taken to represent the level of industrialization or non-industrialization. Finally, the urbanization variable defined as the percentage of people living in areas with a population of 5,000 or more seems to be preferable to the other urbanization variables in terms of the degree of multicollinearity present.

It is also of interest to observe how the provinces rank in terms of CBR and other variables, as well as how the ranking changes over time. In Table 4, the provinces are classified into three groups according to their CBR's in the 1940-50 period. Group A consists of twenty provinces with CBR's of 55 per thousand or over, and purely for convenience these provinces are labelled as high fertility provinces; group B contains twenty-five provinces with CBR's between 45 and 55 per thousand, labelled

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[1] Results with respect to total literacy rate are not reported here as this variable behaves very similarly to male literacy.

[2] Simple correlation coefficients among the independent variables are usually used as a simple rule of thumb to gauge the degree of multicollinearity problem and to establish reasonable statistical independence among the independent variables. It is important to note, however, that one should not always rule out, a priori, the inclusion of two independent variables highly correlated to each other. The nature and specification of the variables should be carefully scrutinized. For a useful discussion of the multicollinearity problem, see Potluri Rao and Roger LeRoy Miller, Applied Econometrics (Belmont: Wadsworth Publishing Company, 1971), pp. 46-52.

as average fertility provinces; group C has the remaining seventeen provinces with CBR's of less than 45 per thousand and these provinces are labelled as low fertility provinces.

The most striking impression one gets from looking at the table is the high degree of regional homogeneity in each group of provinces. In the high fertility group, eighteen provinces are located in the eastern part of the country, and the two remaining provinces are in central Anatolia. On the other hand, the low fertility provinces are geographically located in the West or North-west. It is an established fact that the eastern provinces of Turkey are far less developed than the western ones, as the ranking of the provinces according to socio-economic variables in Table 4 also indicates. The eastern provinces have relatively low literacy, and low levels of industrialization and urbanization. It would be realistic to assume that the high CBR's in these provinces are associated with the low levels of social and economic achievement. However, a close examination of the data suggests that there may be more to this regional pattern. Distance from the western seaboard may in itself be a significant factor in determining fertility behavior. It has been argued that the populations living in the western provinces of Turkey have been in closer contact with European communities throughout history. There also has been a continuous exchange of populations. It is plausible that the population in contact with European communities has been affected by the norms and values, including the family size, prevailing in that part of the world.

Table 4

RANKING OF PROVINCES BY CRUDE BIRTH RATES AND SELECTED SOCIO-ECONOMIC VARIABLES

Province	CBR				FLIT				RMART				IND				URB05				RFLF			
	1940-50	1945-55	1950-60	1955-65	1945	1950	1955	1960	1945	1950	1955	1960	1945	1950	1955	1960	1945	1950	1955	1960	1945	1950	1955	1960
A. Provinces With High Crude Birth Rates, 1940-50																								
Mus	1	1	3	4	61	55	58	57	1	1	2	3	61	62	52	54	51	50	52	52	62	62	60	51
Hakkari	2	2	1	1	62	62	62	62	5	4	5	7	62	59	62	58	60	60.5	61.5	61.5	61	39	62	30
Siirt	3	4	4	10	58	57.5	60	60	10	6	6	6	31	30	39	43	37	44	48	40	48	41	57	55
Agri	4	10	7	8.5	54	60	56	59	3	5	12	4	60	61	58	62	44	52	44	48	58	61	48	16
Bitlis	5	3	6	3	57	57.5	57	56	41	3	10	10	50	50	46	44	30	36	15	26	57	45	51	59
Van	6	5	5	2	55	59	55	55	4	8	9	13	56	57	55	57	43	35	40	41	50	33	47	37
Mardin	7	8	10	7	59	61	61	61	19	29	25	19	44	46	50	53	42	37	38	36	49	44	55	58
Bingol	8	7	8	6	60	54	54	54	2	2	8	5	43	41	54	61	60	60.5	58	59	59	56	58.5	56
Maras	9	9	9	8.5	51	51	50	51	11	10	13	9	32	26	32	41	29	25	31	32	28	26	27	36
Tunceli	10	6	2	5	43	39	41	44	24	14	16	12	57	51	61	55	60	60.5	61.5	61.5	52	54	61	60
Diyarbakir	11	12	21	14	53	53	53	53	27	27	24	20	33	31	30	34	18	16	19	22	26.5	35	42	42
Urfa	12	11	15	13	56	56	59	58	44	47	49	53	26	32	40	39	10	13	12	15	39	51	52	52
Erzincan	13	15	12	21	29	25	26	29	22	24	34	35	49	36	31	30	48	46	47	44	34	40	43	50
Kars	14	13	11	11	35	36	36	43	6	7	11	17	54	60	56	60	33	42	36	45	51	57	54	44
Malatya	15	14	13	12	52	50	49	49	25	33	33	26	24	24	28	29	22	22	27	27	18	28	36	35
Nigde	16	22	14	15	36	34	34	33	7	13	17	55	38	39	41	40	35	32	35	39	38	23	10	9
Erzurum	17	35	30	27	45	40	39	41	18	35	3	1	46	43	38	45	32	34	32	34	44	46	40	34
Sivas	18	16	16	17	33	44	45	45	21	16	18	18	42	44	35	36	39	38	30	30	46	50	46	45
Elazig	19	19	17	16	42	45	44	42	40	23	41	31	11	11	15	15	26	26	25	23	29	18	41	40
Konya	20	23	25	28	27	28	23	23	28	28	14	33	25	23	26	23	21	17	18	17	25	32	28	26.5
B. Provinces with Average Crude Birth Rates, 1940-50																								
Yozgat	21	24	27	22	44	43	46	46	13	25	19	21	58	58	60	59	56	56	56	54	60	58	56	62
Kayseri	22	17	24	25	31	29	28	27	12	19	1	24	14	15	10	7	15	14	10	12	20	30	4	7
Hazay	23	21	23	30	37	41	37	36	46	52	48	41	18	13	17	18	13	8	8	8	15	14	20	23
Cankiri	24	28	29	23	34	31	29	32	9	9	4	36	52	54	49	51	47	51	53	55	53	55	49	61
Adana	25	20	32	34	24	27	25	23	32	40	59	54	13	8	8	11	6	7	6	6	16	11	16	18
Corum	26	18	33	31	41	42	43	40	8	12	15	2	47	45	48	49	40	40	41	37	47	47	53	54
Gaziantep	27	30	35	33	48	47	47	47	26	32	39	37	6	6	6	8	5	5	4	4	22	19	15	28
Antalya	28	27	34	36	23	22	21	21	52	53	54	52	27	29	36	25	36	41	42	35	12	16	30	29
Icel	29	33	39	39	16	19	19	18	54	54	7	60	10	12	16	16	11	10	11	11	14	9	18	19

Table 4 (continued)

Province	CBR 1940-50	CBR 1945-55	CBR 1950-60	CBR 1955-65	FLIT 1945	FLIT 1950	FLIT 1955	FLIT 1960	RMART 1945	RMART 1950	RMART 1955	RMART 1960	IND 1945	IND 1950	IND 1955	IND 1960	URBOS 1945	URBOS 1950	URBOS 1955	URBOS 1960	RFLF 1945	RFLF 1950	RFLF 1955	RFLF 1960
B. Provinces with Average Crude Birth Rates, 1940-50																								
Afyon	30	26	31	32	32	26	30	30	17	26	23	23	36	40	45	46	28	27	29	25	35	37	29	38
Ordu	31	32	26	20	50	52	52	52	50	50	53	55	59	55	12	56	54	49	55	56	55	60	50	49
Rize	32	25	22	26	49	46	42	38	61	61	61	42	12	21	33	9	38	39	45	47	23	22	32	31
Gumushane	33	31	19	18	38	37	40	39	36	44	40	61	55	56	53	50	55	58	57	58	54	53	45	53
Tokat	34	37.5	28	29	40	38	35	35	14	21	26	14	37	42	43	42	23	28	24	28	41	49	35	47
Samsun	35	37.5	36	35	28	32	33	34	31	41	30	38	34	38	39	28	27	18	22	24	13	24	12	13
Burdur	36	40	41	43	18	16	14	14	42	39	42	34	28	37	22	24	41	29	34	33	4	6	8	8
Trabzon	37	29	18	24	46	49	48	48	57	59	57	56	29	33	25	21	46	45	49	50	30	31	24	25
Eskisehir	38	44	46	41	3	3	3	4	16	30	47	44	4	4	4	4	4	4	5	5	19	29	17	17
Ankara	39	36	38	46	7	8	9	8	37	60	37	45	7	9	5	5	3	3	2	2	6	10	6	6
Denizli	40	41	40	40	21	21	20	20	55	51	55	8	5	5	7	12	57	30	33	29	2	1	3	2
Sinop	41	42	45	37	30	33	32	31	39	22	31	22	53	53	59	52	60	57	59	57	56	59	58.5	57
Isparta	42	39	42	49	14	18	17	17	47	36	36	29	9	14	14	14	20	23	21	21	3	2	1	1
Giresun	43	34	20	19	47	48	51	50	56	55	60	39	51	52	51	48	49	47	50	53	40	48	39	32
Artvin	44	51	37	38	17	14	18	19	51	49	50	46	45	35	21	27	60	60.5	60	60	42	43	44	48
Kocaeli	45	45	48	51	12	13	13	13	34	31	43	40	20	19	13	6	16	19	14	10	24	25	19	22
C. Provinces with Low Crude Birth Rates, 1940-50																								
Zonguldak	46	43	47	42	22	24	27	28	20	18	21	32	2	2	2	2	34	33	28	31	32	38	34	33
Amasya	47	46	52	44	25	20	24	24	29	45	32	30	22	20	27	31	9	12	23	19	5	13	14	26.5
Mugla	48	48	49	48	11	11	11	11	59	56	56	58	21	22	23	26	45	48	43	46	17	15	21	15
Bolu	49	47	43	45	20	23	22	25	25	17	29	27	40	48	42	35	52	54	54	49	45	52	38	46
Kutahya	50	52	53	50	26	30	31	26	30	15	27	11	19	18	18	17	31	31	37	38	9	8	7	11
Edirne	51	49	50	52	10	10	10	10	48	38	44	50	35	27	37	33	12	11	13	14	33	21	26	24
Manisa	52	50	51	53	15	17	15	16	53	48	52	49	17	16	20	20	8	9	9	9	10	7	9	5
Aydin	53	55	56	55	19	15	16	15	58	58	58	59	8	7	9	13	24	21	20	20	7	5	13	10
Kastamonu	54	58	44	47	39	35	38	37	45	34	22	28	48	49	47	47	50	53	51	51	21	42	37	43
Tekirdag	55	54	54	57	5	6	6	6	38	37	45	47	39	34	44	37	25	24	26	13	43	34	31	39
Balikesir	56	57	59	54	13	12	12	12	43	42	46	43	16	17	19	19	14	15	17	16	26.5	20	25	20
Bursa	57	56	57	58	9	9	8	9	49	46	51	48	15	10	11	10	7	6	7	7	11	12	11	12
Izmir	58	61	61	61	2	2	2	3	60	57	35	57	3	3	3	3	2	2	3	3	8	4	5	4
Kirklareli	59	53	55	56	4	4	4	2	35	43	28	51	30	28	24	22	19	20	16	18	36	27	22	21
Bilecik	60	59	58	59	8	7	7	7	15	11	20	25	41	47	34	38	53	55	39	42	37	36	33	41
Canakkale	61	60	60	60	6	5	5	5	33	20	38	15	23	25	29	32	17	43	46	43	31	17	23	14
Istanbul	62	62	62	62	1	1	1	1	62	62	62	62	1	1	1	1	1	1	1	1	1	3	2	3

Another important point about the high fertility provinces is that with the exception of two provinces (namely Erzurum and Konya) they remained in this category throughout the entire period under study. This is also true, though to a lesser extent, for the provinces in the average and low fertility categories.

Table 4 also shows the changes over time in the ranking of the provinces by development variables. Some distinct features can immediately be seen from this table. In a number of provinces where CBR declined in relative terms, literacy rates, if not already high, improved. This pattern is also true with regard to CBR and the industrialization and urbanization variables. Kocaeli, Konya, Adana and Gaziantep provinces are good examples of this pattern. Similarly, provinces like Malatya and Ordu, which raised their ranking in CBR, lowered it in terms of literacy, urbanization and industrialization. The relationship between CBR and urbanization, as expected, is somewhat weaker than in the case of the other development variables. It is interesting to note that provinces like Canakkale, Bilecik, Bolu and Kastamonu, which rank very low in urbanization, are also characterized among the lowest CBR provinces. At the other extreme, Urfa, Diyarbakir, Gaziantep and Adana are examples of both relatively high levels of urbanization and CBR. However, it should also be noted that the latter provinces have singularly centered urban populations. Given similar urbanization levels, it is quite possible that the impact of singular urban concentration may be different from that of more evenly scattered urban centers. We do not, however, have evidence as to whether

urban fertility rates in these provinces are significantly lower than rural ones.

Overall, the relationship between CBR and female labor force participation in non-agricultural activities appears to be as expected, with some important exceptions. Denizli, Isparta, Burdur and Kayseri are relatively high fertility provinces but are also reported among the highest ranking in female labor force participation. However, the female workers in these provinces are primarily engaged in rug weaving or in using small textile machines. It seems that the impact on fertility behavior of the work participation in cottage type industries where the women usually work at home may not be very different from that of work participation in agricultural activities. Needless to say, a further distinction between traditional and cottage industries and relatively more modern industries should have been made. This, however, could not be done as detailed information on industrial distribution was not available.

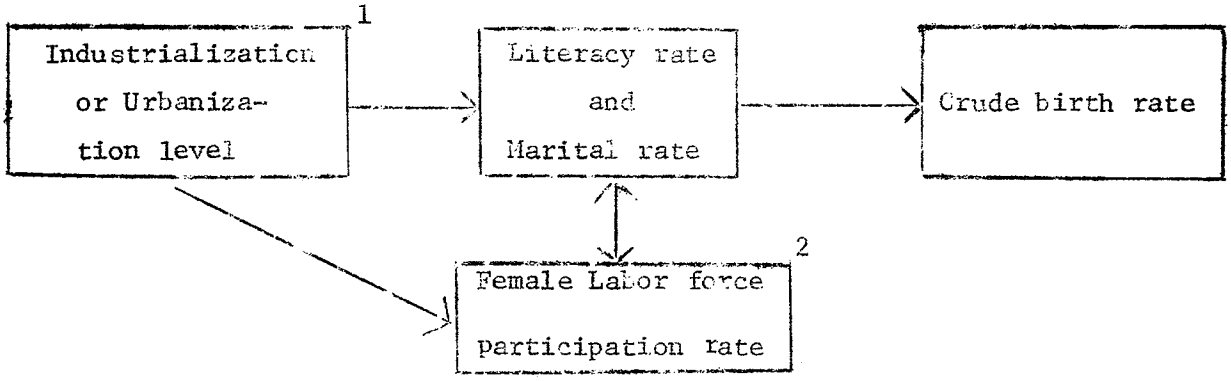
IV. REGRESSION ANALYSIS OF PROVINCIAL CRUDE BIRTH RATES

The rank analysis in the preceding section supports our hypotheses about the relationship between provincial CBR and different development variables. However, these results are not definitive in the sense of measuring causality. Here an attempt is made to approximate a model of functional relationships between CBR and a set of socio-economic variables using regression analysis techniques.

In this section, we will first discuss cross section regression results pertaining to provincial CBR observations in each of the four periods, i.e. 1940-50, 1945-55, 1950-60, and 1955-65; and second, pooled regression results from combined cross section and time series data.

IV.1 Cross Section Results

In light of the earlier discussion and the rank analysis results, we hypothesize that the more immediate variables affecting CBR are variables like marriage and literacy which directly affect the probability of child bearing. (The latter variable, as mentioned before, includes knowledge of fertility control as well as being a crude empirical proxy of aspiration levels for material goods vis-a-vis children.) To verify the validity of this proposed relationship, we attempted regressing CBR directly on different combinations of other socio-economic variables under different hypotheses. The results were either an equation with insignificant coefficients or an equation explaining very little of the variance in CBR. It seems that the other development variables really influence literacy and marital levels and not fertility levels directly. Within our data constraints, we suggest a model of chain relationships of the following type to approximate the Turkish situation:



The following variables are selected for this model:

CBR : Crude birth rate per thousand

FLIT : Female literacy rate

RMART : Refined female marital rate, i.e. for females fifteen years and over

AGR[3] : Industrialization level, measured as proportion of male workers fifteen years and over in the agriculture sector

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[1]It should be noted that the industrialization variable (measured as the proportion of male workers in either the industry sector or in the agriculture sector) and the urbanization variable are interdependent (Table 3) and behave similarly and either of the two could have been used. However, as mentioned before, industrialization is more highly correlated with fertility (Table 3) and seems to be a better measure of the economic development level.

[2]It is quite possible that a direct relationship exists between fertility and total female labor force participation. However, as mentioned before, we were able to measure only non-agricultural work participation and so the latter variable may at best be appropriate only in the urban setting.

[3]Different sets of equations were also run using "proportion of male workers 15 years and over in the industry sector" as the industrialization variable. Given the degree of interdependence between AGR and IND (Table 3) the results were quite similar. AGR was selected as the more appropriate variable as it gives statistically better results.

RFLF : Refined female non-agricultural labor force participation rate, i.e. for females fifteen years and over

It should be mentioned at the outset that three provinces, namely Istanbul, Kastamonu and Kutahya, are excluded from all the cross-section and pooled equations. Istanbul province represents an extreme unit of observation and the other two provinces are highly deviant from the general pattern of the hypothesized relationship.

Table 5 provides a set of six equations approximating the chain relationships for each of the four time periods under consideration. The results seem to be quite consistent over time. The primary or CBR equations, numbered (1) in the table, show that FLIT and RMART combined account in each period for more than seven-tenths of the regional variation in CBR. Standard errors of the estimates,'SE', used as indicators of the accuracy of the explanations, are quite low--less than 10 per cent. The coefficients or parameters of both independent variables are substantial, particularly in the earlier periods. For example, in the 1940-50 CBR equation, FLIT coefficient is -0.89 and RMART, 0.90, implying that in a typical Turkish province, CBR would be lower by almost nine-tenths of a point if FLIT were larger by one percentage point or if RMART were lower by one point. Of the independent variables, FLIT emerges with the lower standard error and is consistently statistically significant at the one percent level. In the following the relative importance of these two explanatory variables is discussed in more detail.

Table 5

CROSS SECTION REGRESSION EQUATIONS*

(Below the regression coefficients are their standard errors)	R^2	SE
I.CBR, 1940-50		
1) CBR = 0.977 - 0.892 FLIT + 0.901 R MART (0.100) (0.214)	0.725	4.88
2) FLIT = 42.301 - 0.410 AGR (0.085)	0.290	6.04
3) R MART = 53.708 + 0.161 AGR (0.042)	0.205	2.99
4) FLIT = 8.060 + 1.478 RFLF (0.501)	0.132	6.68
5) R MART = 67.522 - 0.795 RFLF (0.228)	0.175	3.05
6) RFLF = 9.181 - 0.097 AGR (0.021)	0.271	1.51
II. CBR, 1945-55		
1) CBR = 13.302 - 0.815 FLIT + 0.735 R MART (0.080) (0.201)	0.758	4.73
2) FLIT = 54.431 - 0.516 AGR (0.101)	0.315	7.07
3) R MART = 53.452 + 0.188 AGR (0.042)	0.262	2.93
4) FLIT = 9.455 + 1.714 RFLF (0.508)	0.167	7.79
5) R MART = 70.160 - 0.766 RFLF (0.198)	0.209	3.03
6) RFLF = 12.724 - 0.132 AGR (0.023)	0.363	1.62

Table 5 (continued)

	R^2	SE
III. CBR, 1950-60		
1) CBR = 33.612 - 0.809 FLIT + 0.406 R MART (0.064) (0.160)	0.779	4.41
2) FLIT = 57.109 - 0.529 AGR (0.112)	0.283	8.08
3) R MART = 63.257 + 0.116 AGR (0.050)	0.086	3.64
4) FLIT = 12.747 + 1.534 RFLF (0.491)	0.146	8.82
5) R MART = 72.830 - 0.241 RFLF (0.210)	0.023	3.76
6) RFLF = 11.177 - 0.118 AGR (0.029)	0.227	2.09
IV. CBR, 1955-65		
1) CBR = 39.487 - 0.774 FLIT + 0.296 R MART (0.057) (0.203)	0.836	3.90
2) FLIT = 59.033 - 0.547 AGR (0.111)	0.300	8.90
3) R MART = 64.284 + 0.146 AGR (0.032)	0.272	2.55
4) FLIT = 14.488 + 1.726 RFLF (0.524)	0.160	9.75
5) R MART = 75.673 - 0.228 RFLF (0.158)	0.035	2.94
6) RFLF = 10.147 - 0.107 AGR (0.027)	0.213	2.19

*In each equation, number of observations is 59.

There is a continuous decline in the absolute size of the two regression parameters in the CBR equations over time. The decline in the absolute value of the FLIT coefficient from 0.89 in 1940-50 to 0.77 in 1955-65 is, however, not as pronounced as the corresponding decline in the RMART coefficient from 0.90 to 0.30. An explanation for this decline in the influence of RMART on CBR is not difficult. Firstly, the reporting of marital status improved considerably over time. In the early periods, the proportion of couples married according to Islamic tradition, and not under civil law, was large. It is very likely that a number of these marriages were not reported, particularly if the couples did not have any children. As a result, there existed a built-in bias for a high correlation between marriage and fertility in the earlier years. Even though the practice of marrying outside the civil law still exists, particularly in the villages, the proportion has declined considerably over time. This observation is supported by the statistics on marital rates. Refined marital rates increased from 65 per cent in 1945, to 67 per cent in 1950, to 71 per cent in 1955, and to 74 per cent in 1960, before it dropped to 70 per cent in 1965. In this sense, the high RMART coefficients of 1940-50 and 1945-55 may largely be only statistical artifacts. A second and perhaps more important reason for the declining RMART coefficients may be that adult female expectation of life at age 5 (i.e. e_5^o) improved significantly over the period--from 49.6 years in 1935-40 to 61.9 years in 1960-65.[1] Therefore, on the

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[1]Frederic C. Shorter, "Information on Fertility, Mortality and Population Growth in Turkey," Population Index, January-March, 1968, Table 1.

average, a married woman in the earlier periods had fewer unproductive or infecund years to live (i.e. years after age of 44 or 49). In more recent periods, there is a relatively larger number of married women past the reproductive age. In other words, the average proportion of the reproductive age span in total life-time has declined considerably over time.

The above phenomena also seem to be largely responsible for the marked variation in the constant term. Concomittant with the decline in the RMART coefficient, the value of the intercept increases substantially over time, i.e. the statistical relationship between RMART and CBR weakens.

The influence of FLIT on CBR has remained relatively stable and strong over time even though there has been significant increases in the spread of literacy among women. (Note that FLIT does not have a coverage bias like RMART does.) In light of our earlier discussion about the nature of this variable, it seems that influence of the spread of modernization on fertility level is stable. As is show below, FLIT definitely appears as the representative of the level of changes in the socio-economic structure in the Turkish situation.

Equations numbered (2) to (5) measure the influence of AGR and RFLF on FLIT and RMART. It should be borne in mind that here the purpose is not to explain the levels of FLIT and RMART per se. Therefore the emphasis should not be on the level of R^2 but on the statistical significance of the AGR and RFLF coefficients, namely their standard

errors. Needless to say, literacy and marital rates are determined not only by the industrialization level but also by factors not included in our model.

There seems to be a definite relationship between FLIT and AGR, and also between FLIT and RFLF. These relationships are much more significant and stable over time than the corresponding ones for the RMART. As expected, RFLF is also significantly affected by AGR as shown in equations numbered (6). All the regression coefficients appear with expected signs and are generally highly significant.

IV.2 Pooled Regression Results and Concluding Remark

In the empirical investigation of the association between fertility and social and economic development, Turkish data provide a very rare opportunity to estimate a dynamic equation from pooled cross section and time series data. Such a dynamic equation will provide a functional relationship applicable both across regions as well as across time. Needless to say, such an estimation has more practical value to policy makers than either a corresponding cross section or time series equation.

A very powerful econometric technique, known as the 'error components model' has been recently developed to deal with such pooled data. Recognizing possible correlations among the error terms of a model, this technique explicitly attempts to take them into account to increase the asymptotic efficiency of the causal parameters. This method accounts for three independent components of regression error (assuming that there

are only three), separately associated with time, cross section unit (provinces, here) and interaction of the two.[1] However, given the unstable nature of the RMART coefficient, the model presented in Table 5 could not pass the Chow test[2] on stability of parameters--a prerequisite for using the error components model technique.

The cross section results are, however, consistent enough to encourage estimation of the model from pooled data for all four time periods, though only permitting the use of a simple form of the more traditional and less rigorous method of dummy variables. We hypothesize that introducing time dummies will pick up the inverted U-shaped variation in CBR which is not associated with any explanatory variable included in the model.[3]

Thus our hypothesis is:

$$CBR = \alpha_1 + \alpha_2 D_{45} + \alpha_3 D_{50} + \alpha_4 D_{55} + \beta_1 FLIT + \beta_2 RMART$$

where D_{45}, D_{50} and D_{55} are time dummies such that:

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[1]For examples, see T. D. Wallace and Ashiq Hussain, "The Use of Error Components Model in Combining Cross Section with Time Series Data," Econometrica, Vol. 37, No. 1, January 1969, pp. 55-72; Marc Nerlove, "Further Evidence on the Estimation of Dynamic Economic Relations From a Time Series of Cross Sections," Econometrica, Vol. 39, No. 2, March 1971, pp. 359-396; G. S. Maddala, "The Use of Variance Components Model in Pooling Cross Section and Time Series Data," op.cit., pp. 341-357.

[2]Gregory Chow, "Tests of Equality between Sets of Coefficients in Two Linear Regressions," Econometrica, Vol. 28, No. 3, July 1960, pp. 591-605.

[3]We also attempted to estimate the CBR equation from the pooled data of the last three periods, assuming a linear negative time trend. However the results obtained were weak. Also note that introducing time dummies allowed us to retain the 1940-50 period and estimate the equation from the data of all four time periods.

D_{45} = 1 for every province for time period 1940-50, otherwise 0

D_{50} = 1 for every province for time period 1945-55, otherwise 0

D_{55} = 1 for every province for time period 1950-60, otherwise 0

Here α_1 is the constant term and refers to the estimate of the intercept for the last time period, 1955-65. α_1 plus the coefficient of a specified time dummy gives the estimate of the intercept for that period. For example, for the 1940-50 period, the intercept value is 17.26 + 2.84 = 20.10 (Table 6). As before, β_1 and β_2 are the coefficients of FLIT and RMART, respectively.

Table 6 provides a set of six pooled regression equations similar to that in Table 5. The estimated CBR equation justifies our hypothesis about including time dummies and running the regressions on pooled data. The increase in the overall CBR in 1945-55 over the rate in 1940-50 is picked up by the D_{50} coefficient. Compared to the intercept value of 20.1 in 1940-50, the intercept value in 1945-55 is 22.5. Similarly, the general decline in CBR after 1945-55 seems to be covered by the decrease in the intercept to 19.6 in 1950-60 and to 17.3 in 1955-65. The relationship between CBR and FLIT seem to be relatively stable over time. The pooled FLIT coefficient is consistent with the FLIT coefficients in the cross section equations. The pooled RMART coefficient, as one might expect it, appears to be an average of the RMART coefficients of the four cross section equations in Table 5.[1] As in the

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[1] It is possible that the size of the time dummy coefficients is also influenced by the averaging of the RMART coefficients.

Table 6

POOLED REGRESSION EQUATIONS*

(Below the regression coefficients are their standard errors)

		R^2	SE
1)	CBR = 17.260 − 0.804 FLIT + 0.598 RMART + 2.844 D_{45} (0.036) (0.097) + 5.240 D_{50} + 2.329 D_{55} (1.120) (0.902)	0.774	4.58
2)	FLIT = 47.418 − 0.491 AGR + 2.038 TIME (0.051) (0.445)	0.355	7.58
3)	RMART = 51.195 + 0.146 AGR + 3.233 TIME (0.206) (0.180)	0.596	3.07
4)	FLIT = 5.308 + 1.617 RFLF + 2.358 TIME (0.250) (0.482)	0.234	8.26
5)	RMART = 62.627 − 0.452 RFLF + 3.134 TIME (0.098) (0.189)	0.551	3.24
6)	RFLF = 10.448 − 0.109 AGR (0.013)	0.245	1.88

*In each equation, number of observations is 236.

cross section equations, FLIT has a larger impact on CBR than has RMART and is statistically more significant. In terms of both R^2 and SE, the pooled CBR equation is statistically a good fit.

Among the independent variables, FLIT and RMART appear to have linear time trends (Appendix Table B-1).[1] The pooled equations numbered (2)-(5) hence include TIME as an explanatory variable. In all these equations the TIME coefficients are large and statistically significant. As expected, however, neither time dummies nor TIME were significant in the RFLF equation (6) as RFLF has no distinct pattern of variation over time (Appendix Table B-1). It is important to note that for the RMART equation (3), TIME emerges as statistically more significnat than AGR. This seems to be due to the coverage biases previously discussed. In fact TIME is responsible for a high value of R^2. On the other hand, AGR remains a primary variable in the FLIT equation (2) as well as in the RFLF equation (6).[2]

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[1] In this case, the causal parameters from including time dummies or 'time' itself will be the same, with the latter equation having a simpler specification.

[2] This is further elaborated by the following results of regressing FLIT, RMART and RFLF on TIME.

$$\text{RMART} = 62.905 + 3.064\ \text{TIME} \quad (0.197) \qquad R^2 = 0.510 \qquad SE = 3.38$$

$$\text{FLIT} = 7.892 + 2.608\ \text{TIME} \quad (0.521) \qquad R^2 = 0.097 \qquad SE = 8.95$$

$$\text{RFLF} = 1.598 + 0.155\ \text{TIME} \quad (0.126) \qquad R^2 = 0.006 \qquad SE = 2.16$$

Overall, the pooled coefficients of AGR in the FLIT, RMART and RFLF equations are in line with the corresponding coefficients in the cross section equations. This further establishes our contention about the stability of these relationships. The same is true for the relationship between FLIT and RFLF. However, comparison of the pooled RFLF coefficient in the RMART equation (5) with the corresponding cross-section ones again suggest that the relationship between female labor force participation and female marital rate variables is not a stable one.

Finally, as a concluding remark, the pooled CBR equation is an explanation of fertility over past periods. However, even though one may not be able to exactly predict the future by using the pooled equations, the basic results are still valid. That is, if the female literacy level increases and the marital rate declines with increasing industrialization and female labor force participation levels, the fertility level in Turkey will decline.

APPENDIX A

Explanatory Note on the Estimation of Provincial Crude Birth Rates, 1935-1965

The quinquennial Turkish censuses since 1945 have reported the age distribution of the population by province. This information has enabled us to use reverse projection techniques[1] for estimating average CBR by province for the 1935-45, 40-50, 45-55, 50-60 and 55-65 periods. The formula for computing the average CBR between period t and t + 10 is as follows:

$$CBR_{t,t+10} = \left(\frac{P(0\text{-}9)_{t+10}}{10 \cdot {}_{10}L_0} \right) / P_{t+5}$$

where t refers to census year t,

t+5 refers to the census year 5 years after the census year t,

t+10 refers to the census years 10 years after the census year t,

$P(0\text{-}9)_{t+10}$ refers to population in age group 0-9 in census year t+10,

${}_{10}L_0$ refers to the person-years lived between age 0 and 9 in a life table with a radix of 1.0,

P_{t+5} refers to the total population enumerated in census year t+5.

It can easily be seen that the expression in brackets in the above formula

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[1] See United Nations Manual IV by Ansley J. Coale and Paul Demeny, Methods of Estimating Basic Demographic Measures from Incomplete Data, ST/SOA/Series A/42 (New York, 1967), Chapter 4, Part D and E; Paul Demeny and F. C. Shorter, Estimating Turkish Mortality, Fertility, and Age Structures: Application of Some New Techniques, Reprint No. 53 (Ann Arbor, Population Studies Center, The University of Michigan), pp. 38-42.

gives the average yearly births for the 10 year period. The appropriate denominator is the mid-period total population provided by the total population figure reported in census year t+5. In the following, we will discuss separately the two crucial variables in the above formula; namely the population in age group 0-9 and the mortality level.

Population 0-9

Age group 0-9 was selected for reverse projection of births instead of a perhaps more appropriate age group 0-4 mainly because the proportion of population under 10 is reported more accurately by the censuses. The proportion under 5 is generally understated.[1] For a few provinces, population under 10 was also erroneously reported and necessitated adjustments of age distributions.

Besides adjustments for age misreporting, we faced another serious data limitation. Theoretically, the relevant variable for reverse projections of average yearly births is population 0-9 born in a province, irrespective of whether they are living there or not. But the censuses reported only total population born by province. It is easy to see that estimates of births based on population 0-9 enumerated in the province will be biased due to the migration effects. Fortunately, for the 1965 Census, special tabulations were available for population by place of enumeration and place of birth and by age. This allowed calculation of a correction factor for each province under the assumption that the relationship between the migration activity of the total population and that of the population under 10 in 1965

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[1] Ibid, p. 39.

were similar in the other census years. Applying these correction factors to the respective ratios of total population born to total population enumerated gave the relevant ratios of population 0-9 born to population 0-9 enumerated for the provinces. For general reference, estimates of CBR based on population 0-9 enumerated are given in Table A-2.

Mortality Levels

Mortality data at the province level is non-existent. With the information provided by the recent Turkish Demographic Survey (TDS),life tables have been constructed for the provinces as grouped into five mortality areas. Values of $10^{L}0$ provided by those life tables have been assumed for the 1955-1965 period (Table A-1). A national $10^{L}0$ value is obtained by taking the weighted average of the $10^{L}0$ values for the five regions. This information was invaluable in the estimation of regional differentials in the mortality levels for earlier periods, for which only national $10^{L}0$ values could be estimated. The regional $10^{L}0$ were estimated assuming that the differential between national and regional $10^{L}0$ values were the same as in 1955-1965. It is assumed that within a region, mortality does not vary by province. Needless to say, introducing mortality differential even by very broad regions is a vast improvement over assuming one mortality level for all the provinces.

Levels of adult mortality (e_5^o i.e. expectation of life at age 5), estimated from intercensal survivorship rates, are available for Turkey at five years interval for the 1935-60 period.[1] With such information available, the usual procedure is to assume that a stable relationship exists

[1] Ibid., Table 5.

between adult mortality and child mortality (under age 5) as in a set of regional model life tables,[1] prepared by Coale and Demeny, mainly on the basis of European mortality experience. In the case of Turkey, this assumption may be invalid. Since World War II, adult mortality has been improving rapidly but the decline in child mortality has been sluggish. So the child mortality corresponding to adult mortality in a model life table will be much lower than the true level.[2] However, with high adult mortality for the 1935-1945 period it is quite possible that a stable relationship did exist between adult and child mortality and that "the strongly deviant character of the Turkish age pattern of mortality is of relatively recent origin."[3] For this period we approximated the level of child mortality ($_4L_0$) from the "East" model life table[4] corresponding to the e_5^o value for 1940-45. It is relevant to mention that infant mortality, an indicator of child mortality, was more than 330 per thousand, which appears to be quite reasonable in light of experiences observed elsewhere.

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[1] Ansley J. Coale and P. Demeny, Regional Model Life Tables and Stable Populations (Princeton: Princeton University Press, 1966).

[2] For example, see Demeny and Shorter, pp. 27-28.

[3] Ibid., p. 28.

[4] "East" model life tables are based on mortality experience of Austria, Germany, Czechoslovakia, Hungary, Poland and North and Central Italy. The reason for selecting this family of life tables for Turkey is that they characterize high mortality in infancy. A recent study also used "East" model for extrapolating child mortality in Turkey. F. C. Shorter, "Information on Fertility, Mortality and Population Growth in Turkey," Population Index, Vol. 34, No. 4, January-March 1968, pp. 14-16.

Fortunately the data in the Population Growth Survey of 1963 enabled the calculation of the conventional life-table measures of child mortality. Estimate II of 'proportion surviving from birth to age 2' (=.774) with reference period as 1955-60[1] was used to select the appropriate East Model Life Table for extrapolating $_{10}L_0$ values. Note that all the above calculations were carried out separately for males and females. Results were combined by taking the weighted mean; with weights of 1.05 for males and 0.95 for females (assuming a sex-ratio of 105 for Turkey).

The mortality level for the intervening period, 1945-1955, were estimated assuming that the decline in mortality from the 1940-1945 level to the 1955-1960 level was linear. Table A-1 shows $_{10}L_0$ values estimated for the different periods for the 5 mortality regions and Turkey as a whole.

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[1] For details, see Demeny and Shorter, pp. 20-25.

Table A-1

$10^{L}0$ VALUES BY MORTALITY REGION, 1935-65

Region	1935-45	1940-50	1945-55	1950-60	1955-65[1]
			$10^{L}0$		
Western and Coastal Provinces	.63524	.63873	.69929	.75985	.79051
Central and Eastern Provinces	.57439	.57754	.63230	.68705	.71478
Ankara Province	.61926	.62266	.68170	.74073	.77063
Istanbul Province	.66973	.67341	.73726	.80110	.83343
Izmir Province	.65454	.65813	.72053	.78293	.81452
Turkey	.60991	.61326	.67140	.72954	.75898

[1] 1955-65 estimates of $10^{L}0$ provided by Frederic C. Shorter, Office of Population Research, Princeton University.

Table A-2

CRUDE BIRTH RATES BY PROVINCE

1935-65

(Per thousand population)

	1935-45		1940-50		1945-55		1950-60		1955-65	
PROVINCE	CBR_1*	CBR_2**	CBR_1	CBR_2	CBR_1	CBR_2	CBR_1	CBR_2	CBR_1	CBR_2
Adana	48.68	51.55	52.46	55.56	56.81	60.20	49.68	53.42	45.51	48.54
Afyon	50.30	52.19	50.04	51.93	52.97	53.14	49.77	49.81	48.16	46.64
Agri	66.33	65.80	67.31	66.77	63.93	65.19	63.21	63.06	58.32	57.59
Amasya	43.83	45.91	43.38	45.44	44.77	55.43	40.42	41.60	40.04	40.29
Ankara	45.10	45.04	47.39	47.33	49.79	52.30	46.57	41.86	39.39	45.00
Antalya	50.75	50.05	50.91	50.21	52.47	50.78	49.10	47.77	45.28	45.17
Artvin	44.27	46.05	45.40	47.23	43.16	43.30	47.01	45.87	43.63	41.56
Aydin	39.03	40.17	40.84	42.03	40.55	44.54	37.98	39.45	34.51	35.99
Balikesir	39.90	41.94	38.67	40.64	39.00	40.16	36.58	36.40	34.57	33.22
Bilecik	38.67	41.02	36.09	38.28	37.60	36.95	37.05	35.04	32.21	29.05
Bingol	59.74	66.28	62.46	69.28	65.35	66.53	62.85	62.59	60.48	59.74
Bitlis	60.61	60.11	67.20	66.63	71.49	69.85	64.88	65.44	63.36	63.89
Bolu	43.28	44.57	43.09	44.36	44.70	43.56	43.13	41.62	39.83	38.17
Burdur	45.40	45.54	47.97	48.12	48.36	47.29	44.02	43.50	40.11	38.71
Bursa	37.21	38.55	38.43	39.81	39.64	39.53	37.17	38.59	33.05	33.62
Canakkale	30.66	32.69	31.25	33.31	37.07	38.06	33.27	35.13	31.61	30.58
Cankiri	52.43	54.11	53.65	55.36	52.38	51.24	50.45	47.48	52.05	45.43
Corum	50.19	51.72	52.31	53.91	57.04	56.25	49.41	49.39	49.11	47.37
Denizli	47.87	47.52	46.31	45.97	48.05	46.02	44.62	45.34	41.36	39.14
Diyarbakir	55.87	57.41	61.33	63.02	62.40	62.63	54.49	55.11	54.90	55.57
Edirne	39.93	40.71	42.64	43.46	43.48	45.34	41.40	40.75	36.37	35.63
Elazig	53.73	53.39	55.55	55.20	56.91	57.89	55.66	55.45	54.08	52.93
Erzincan	58.04	57.05	60.64	60.54	59.05	56.86	56.93	53.35	52.27	48.31
Erzurum	54.05	56.23	56.03	57.34	50.17	52.62	49.78	49.59	50.46	48.82
Eskisehir	49.92	51.70	47.81	49.51	46.21	49.36	42.22	44.07	40.87	40.97
Gaziantep	48.86	49.00	51.44	51.58	51.78	51.63	47.76	46.75	47.27	47.10
Giresun	44.78	45.11	45.42	45.75	50.50	49.17	54.50	51.16	52.32	48.43
Gumushane	51.01	51.84	48.31	44.13	51.65	49.31	54.94	52.13	52.44	47.69
Hakkari	63.82	63.25	69.50	68.90	72.16	69.24	69.69	68.61	66.03	66.12
Hatay	49.37	48.83	53.87	53.28	56.71	57.04	53.13	54.36	49.35	50.12
Isparta	42.03	40.55	46.27	44.64	48.89	47.28	45.13	42.30	38.89	37.44
Icel	48.93	49.02	50.78	50.88	50.66	51.54	46.47	48.28	42.76	44.24
Istanbul	22.75	22.82	26.53	26.61	27.67	31.98	24.01	29.52	22.53	29.31
Izmir	33.35	34.09	37.55	38.39	36.69	38.69	32.59	35.53	29.02	32.04
Kars	57.04	58.73	58.04	59.81	60.47	63.63	57.48	57.02	56.63	54.73
Kastamonu	40.76	42.05	40.82	42.32	37.64	37.20	42.85	41.13	39.21	35.92
Kayseri	53.51	54.77	53.89	55.18	57.39	57.12	53.14	52.45	51.25	49.78
Kirklareli	35.08	39.68	37.30	42.19	41.44	44.74	38.12	38.81	34.31	33.22
Kocaeli	42.98	43.33	45.08	45.44	45.60	45.97	41.93	43.64	37.55	38.76
Konya	51.42	51.98	55.03	55.63	56.03	56.20	52.99	52.41	49.98	49.39
Kutahya	42.65	43.77	42.77	43.89	42.63	43.33	40.20	40.86	37.77	37.07

Table A-2 (continued)

PROVINCE	1935-45		1940-50		1945-55		1950-60		1955-65	
	CBR_1	CBR_2	CBR_1	CBR_2	CBR_1	CBR_2	CBR_1	CBR_2	CBR_1	CBR_2
Malatya	54.23	54.57	57.82	58.30	60.16	60.04	56.63	55.13	56.06	53.82
Manisa	40.25	39.79	42.15	41.68	43.30	43.26	40.78	41.66	35.20	36.51
Maras	58.32	58.97	61.84	62.53	63.98	64.47	61.85	60.01	58.32	56.17
Mardin	62.52	62.78	64.98	65.25	64.80	63.39	61.81	59.53	58.51	55.93
Mugla	42.39	43.38	43.25	44.26	44.16	44.29	41.57	41.51	39.11	38.93
Mus	64.07	68.72	71.93	77.15	72.41	75.72	66.21	68.13	62.69	63.19
Nigde	56.08	57.47	56.61	58.12	56.47	56.52	56.60	55.46	54.13	51.63
Ordu	51.34	53.03	49.73	51.37	50.90	50.29	52.12	50.59	52.30	50.47
Rize	49.64	46.08	49.16	45.64	53.14	49.58	54.02	50.32	50.69	47.42
Samsun	46.48	50.77	48.05	52.48	49.73	51.60	47.36	49.42	45.46	46.38
Siirt	61.23	59.98	69.23	67.82	69.62	69.87	65.86	65.75	57.94	58.63
Sinop	45.79	48.63	46.28	49.15	46.30	46.33	42.52	41.82	44.12	41.50
Sivas	53.59	56.09	55.99	58.60	57.84	58.11	55.70	54.52	53.27	49.37
Tekirdag	33.83	37.50	39.93	44.25	40.75	43.01	38.45	38.84	34.22	32.94
Tokat	53.59	55.23	48.16	57.81	49.73	50.06	50.97	50.75	49.77	49.14
Trabzon	44.88	44.47	47.85	47.42	52.12	50.23	55.36	51.81	51.72	48.27
Tunceli	56.67	58.96	61.66	64.16	66.98	65.22	66.67	63.22	65.51	57.65
Urfa	58.28	58.76	61.15	61.65	62.68	63.33	56.43	56.15	55.28	53.71
Van	63.67	63.82	66.08	66.23	68.49	68.61	65.54	64.97	64.20	64.55
Yozgat	47.47	51.53	54.09	56.93	55.82	61.80	51.71	50.73	52.22	50.22
Zonguldak	41.11	41.82	43.98	44.74	46.22	48.53	42.11	44.78	40.69	43.21

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*CBR_1 refers to crude birth rate estimated from population in age group 0-9 born in the province.

**CBR_2 refers to crude birth rate estimated from population in age group 0-9 enumerated in the province.

APPENDIX B

A Review of Socio-Economic Changes in Turkey

The purpose of this appendix is to quickly familiarize the reader with economic and social development in Turkey in recent decades. Most of the criteria used in identification of underdeveloped countries apply to Turkey. Per capita income is relatively low, at approximately U.S. dollars 275 in 1971 at the official rate of exchange; about two-thirds of the total male work force is engaged in agriculture; over forty per cent of the value-added originates in agriculture and more than eithty percent of the export earnings come from agricultural exports; slightly more than fifty per cent of the adult population is still illiterate; the crude birth rate is high at nearly forty-five per thousand; mortality, and particularly infant mortality, is very high. Despite such similarities with other underdeveloped countries, however, Turkey's experience with economic development is somewhat unique.

Turkey was never subjected to colonial rule despite the increasing influence and control of foreign interests during the declining years of the Ottoman Empire, particularly in the late 19th and early 20th centuries. The Ottomans, who once controlled a large territory in Eastern Europe, North Africa, and the Middle East, were a conglomerate of different national and ethnic groups. The Ottomans emerged from World War I as losers and most of the territory once controlled was lost. The modern Turkish Republic, which was proclaimed in 1923, is composed of a more ethnically homogenous population and is confined mainly to Anatolia or

Asia Minor with a relatively small part known as the Thrace in Eastern Europe.

Beginning in the early 1920's under the strong leadership of Kemal Ataturk, Turkey began making efforts to alter its socio-economic structure and to achieve self-sustaining economic development. A number of far-reaching social, cultural, and political reforms were carried out within a relatively short span of time. Also, the government assumed a strong leadership position in encouraging economic development. The declared goal of this early period was to rapidly modernize the country, to raise the standard of living, and eventually to "catch up" with the Western world.

In order to achieve these ambitious goals, all the stumbling blocks inhibiting the modernization of the country had to be removed. First, the sultanate and then the caliphate were abolished, the Islamic religious legal system was replaced by codes borrowed from different European countries, and the religious schools were closed; all with the purpose of breaking away from the religious dogmas and traditional values that nurtured adverse reactions to modernization and progress. Also the Latin alphabet replaced the Arabic script, and an international calendar, clock and metric system were introduced. Even wearing apparel was deliberately changed so that the Turk would adopt a Western outlook. Important changes were made in the legal status of women; a new civil law outlawed poligamy, and women were given equal opportunity in education and the professions as well as the right

to vote.

In the economic sphere, after an initial period of trial and error in the 1920's, a policy of "etatism" was adopted and the government took an active role in guiding economic life and development. In pursuance of this policy a number of state economic enterprises were established to invest in areas where private efforts were inadequate in terms of capital and experience. Infrastructure was also given attention and the main emphasis was put on railroad construction.

It is difficult to quantify the impact of these changes on the society, even in terms of economic growth. Statistics indicate that industrial output rose rapidly during the 1930's and modest gains were recorded in agriculture. However, the outbreak of World War II slowed down the rate of progress even though Turkey did not actively get involved in the War. During the years following the War, and particularly after a change in government in 1950, the overall strategy towards economic development was altered with an increasing emphasis on the private sector. Since 1960 government efforts in the economic field have been better coordinated through the implementation of five-year development plans.

The changes in the socio-economic milieu since 1945 can be followed through the information given in Table B-1. The table shows Turkey averages for all the variables used in this study as well as information on population changes and the structure of the economy. The Turkish per capita income increased from U.S. dollars 132.1 in 1945 to 240.7 in 1965 in 1961 prices, indicating an annual rate of economic growth of 3 per cent. There was also a noticeable change in the composition of

output during these years. The share of agriculture in the total declined from about 56 per cent in 1945 to 42 per cent in 1965, while the share of services increased at a more rapid pace than did that of industry. Meanwhile the population increased from nineteen million in 1945 to about thirty-one million in 1965. The annual rate of population growth was approximately 2.6 per cent during these twenty years.

The literacy level has continued to increase. Despite the efforts made by the governments in the previous twenty years, the crude literacy rate was still as low as 25 per cent in 1945. By 1965 it had risen to 42 per cent. Beginning from a very low base, the increase in the literacy level of the female population was more impressive as compared with that of the male population: the female literacy rate doubled between 1945 and 1965.

The industrial composition of the labor force has changed over this period. The proportion of the male agricultural labor force gradually declined.[1] While in 1950 nearly three-fourths of the total male labor force was engaged in agriculture, the ratio dropped by about ten percentage points by 1965. Meanwhile, the urbanization process seems to have gained momentum, particularly since 1950. For example, the percentage of those living in urban settlements with population of 5,000 and over jumped from 22 per cent in 1950 to 32 per cent

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[1] An apparent increase in the male agricultural labor force between 1945 and 1950 needs interpretation. In 1945 Turkey had a larger army than in 1950. Since the age distribution of the labor force is biased towards agriculture in younger age groups, proportionately more people were under arms from the agricultural sector. This is evidenced by the sharp increase reported in the agricultural labor force in age group 20-24 in 1950 in later census years.

Table B-1

SELECTED SOCIO-ECONOMIC INDICATORS, TURKEY 1945-65

	1945	1950	1955	1960	1965
LITERACY LEVEL					
MLIT	34.97	38.52	44.79	46.87	52.34
FLIT	13.70	16.55	20.59	22.56	26.85
Total	24.39	27.59	32.89	34.93	39.84
INDUSTRIAL DISTRIBUTION OF MALE LABOR FORCE					
AGR	71.45	73.72	70.68	66.77	64.29
IND	15.29	14.75	17.10	19.25	21.27
Services	13.25	11.53	12.22	13.98	14.44
FEMALE LABOR FORCE					
RFLF	2.25	2.81	2.76	3.00	(1)
URBANIZATION					
URB 02	24.23	24.67	28.18	31.41	34.21
URB 05	21.40	21.99	25.67	28.82	31.58
URB 10	18.41	18.76	22.15	25.22	28.41
URB 20	14.04	14.90	18.11	21.76	24.98
URB 50	7.70	9.61	12.88	16.13	18.42
MARITAL RATES					
RMART	64.85	67.00	71.23	73.81	70.29
PER CAPITA GNP (in U.S. dollars)(2)	132.1	156.6	183.0	213.4	240.7
COMPOSITION OF GNP (percent)(2)					
AGR	55.93	50.30	45.43	43.93	41.86
IND	15.50	15.90	17.27	16.50	17.40
Services	28.57	33.80	37.30	39.57	40.74
MIDYEAR POPULATION					
Total (in thousands)	18,929	20,809	23,859	27,509	31,151
Annual intercensal Percent increase	1.06	2.17	2.78	2.85	2.46

(1) Considerable discrepancy in reporting of female participation in non-agricultural labor activity was observed in the 1965 census year. Since the 1965 observations on independent variables are not used in the present study, 1965 RFLF is not re-estimated.

(2) Three years' average centering around the year indicated.

Note: For definition of variables, see Table 3.

in 1965. Larger size cities also gained similar population increases.

Turkish governments maintained a pro-natalistic policy until the 1960's. Turkey emerged from the World War I with significant loses in population and a war-torn economy. The leaders felt the need for a large population mainly for military and political reasons. However, the general attitude has gradually changed and a new population policy emphasizing the need for family planning programs was adopted in 1965.

It is against this background that the changes in provincial fertility in Turkey should be evaluated.