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Life-cycle analysis of household composition and family consumption behavior

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University of Hawai'i, 1991
LIFE-CYCLE ANALYSIS
OF
HOUSEHOLD COMPOSITION
AND
FAMILY CONSUMPTION BEHAVIOR

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DOCTOR OF PHILOSOPHY

IN ECONOMICS

MAY 1991

By

Nav Raj Kanel

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To

g mother

in appreciation of her love and affection

and

my brother Tej

in appreciation of his support and encouragement

that I pursue my education, which led finally to this dissertation
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ABSTRACT

The purpose of this study is to assess the demographic impact of household composition on the consumption behavior of Nepali households over the family life-cycle, employing consumer demand theory. Household size and household composition are distinguished, and particular attention is focused on changing household composition and life-cycle consumption. Other factors examined are future household composition, demographic scaling, effects of different lifetime discount rates, and bequest motives.

The life-cycle model of consumer demand theory originally advanced by Modigliani and Brumberg (1954) is employed and extended to investigate how changing household size and composition over the family life-cycle affects the consumption behavior of selected households. A sample of 614 households from Kathmandu Valley was taken during the winter of 1987–88 to represent the demographic structure and income–expenditure patterns of Nepali households.

This study shows the life-cycle consumption of Kathmandu households in a changing household composition pattern. HOMES, A Household Model for Economic and Social Studies, is applied to project a family of curves of future household membership. This information is used to estimate the life-cycle consumption function that explicitly incorporates expected lifetime household membership. Equivalence scales are estimated to measure the effect of household age–sex composition on consumption.

The findings confirm the importance of demographic variables in household consumption. The equivalent adult units that provide an alternative measure of the net effect on consumption of a specific household member are estimated. The estimated equivalent adult units for children, teenagers, and adult females
are respectively 0.94, 1.46, and 0.92, assuming that the equivalent adult unit of an adult male is one. These large values of the equivalent units suggest that children have a stronger effect in Nepal than typically found in the literature. The demographic variables are jointly, but not individually, significant. This study is limited by a small sample size. Therefore, no firm conclusions could be drawn.

Two factors may account for the teenage coefficients. First, teenagers do not contribute to the household income. Second, education in Kathmandu, particularly up to high school, is very expensive. Heavy outlays for tuition, fees, and school supplies make teenagers more expensive to support than other members. Yet, the value of 1.46 cannot be distinguished from unity.

Testing our model's general specification to examine the validity of the model and variables therein suggests that the relationship between demographic variables and consumption is not as simple as specified by the model. The equivalent adult unit for teenagers is also significantly different from one. This model also rejected the hypothesis that the bequest parameter is equal to zero. This confirms that the bequest motive is important and should be incorporated in the life-cycle model.

The model developed here provides a better way for assessing the impact of current demographic characteristics on current needs relative to lifetime needs. The effect of demographic variables is not only through the existing age-sex composition of the household but also through the expected lifetime composition. The findings suggest that household composition has an important role in determining household consumption ratio, which in turn affects saving and economic development.
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CHAPTER 1

INTRODUCTION

1.1 Statement of the Research Problem

The microeconomic theory of consumer behavior tells us that the consumption combinations of an individual depend upon the tastes and income of the consumer and the relative prices of all commodities that he faces. This theory is based on the assumption that a rational consumer will always try to maximize his utility function subject to a budget constraint. But when we take a household as a consumer unit, consumption depends not only on those variables, but also on the composition of the household.

In economics, the terms “household” and “family” have often been used synonymously because of their close relationship. By definition, a “household” corresponds to the living arrangements of its members, whereas a “family” corresponds to the relationship among the household members.¹ Household composition is described by the number of members and the age-sex structure of the household. As the composition of a household changes, the tastes and necessities of the household will also change. Consequently, a change will occur in the demand for commodities. However, when we take a family as a consumer unit, consumption depends not only on those variables, but also on the life-cycle of the family.

¹ Pressat (1985), and Howard (1971) and references therein have a more detailed discussion on the definitions and concepts of household and family.
The family life-cycle is an idealized construct representing the important stages in the life of an ordinary family. Births, deaths, marriages, changes in the age-sex structure of the family, and the formation of a new household will elicit different turning points in the family regarding its consumption patterns. Such turning points in a family will introduce new stages in the family life-cycle. Although the concept of the life-cycle is clearly related to the process of aging, the concept derives its analytical utility from the social and economic significance of the events and stages that mark the life-cycle.

Demographically, as well as economically, Nepal is typical of many less developed countries with its low per capita income, high total fertility rate, high birth rate, high death rate, high infant mortality rate, and low life expectancy (Kanel, 1986). A very large proportion of Nepali households is family households. Therefore, the concepts of household and family can be regarded as synonyms in the context of Nepal.

The traditional as well as the modern form of family in Nepal, both rural and urban, is the extended family consisting of three (or even more) generations. The extended family system is part of the culture and tradition of Nepali society. Higher co-residence rates, i.e., the proportion of the elderly over 65 who reside with their children and/or other relatives, is mainly due to the traditional values accorded to the family and household in Nepal. Older parents also do some household work such as cooking, baby-sitting, and household management. This does not mean, however, that there are no nuclear families in Nepal. Economic scarcity in such societies requires that all members of the family be engaged in the productive activities of the household.
Economists have agreed that the life-cycle of a family (or a household) is an important determinant of household consumption patterns. Modigliani and Brumberg (1954) originally advanced the life-cycle hypothesis of consumption theory. This theory assumes that households (or individuals) have a finite life span and that they strive to maximize their utility from current and future consumption subject to current resources and their expected future income. According to this hypothesis, the planned consumption path reflects the allocation of lifetime resources to consumption over the life span. It emphasizes the process of saving during working years for consumption during retirement. The life-cycle model provides a crucial link between the microeconomics of rational household behavior and the macroeconomics of the rate of saving.

This model was later further developed and modified by many economists such as Fisher (1956), and Modigliani and Ando (1957). They applied this theory to analyzing the case of different countries which have a nuclear family system. Some of its applications and extensions will be discussed in Chapter 2 (Review of the Literature). However, no attempts appear to have been made so far to apply this theory to the case of an extended family system. This study seeks to extend this model to examine the consumption behavior of extended families by incorporating inheritances and bequests into the objective function and the budget constraint of the household.

1.2 Objectives and Methodology

The objective of this study is to examine the effect of changing household size and composition on the consumption patterns of Nepali households over the family life-cycle, employing consumer demand theory. Consumption behavior in such
systems is explained by demographic variables and by a household bequest motive. This theory is based on the postulate that a household tries to maximize its welfare by adjusting consumption expenditures as it moves through different life-cycle stages. Household size and household composition are distinguished, and particular attention is focused on changing household composition and life-cycle consumption. Other factors examined are future household composition, demographic scaling, effects of different lifetime discount rates, and bequest motives.

The life-cycle model of consumer demand theory originally advanced by Modigliani and Brumberg (1954) is employed and extended to investigate how changing household demographics over the family life-cycle affects the consumption behavior of selected households. The effect of demographic variables is not only through the existing age-sex composition of the household but also through the expected lifetime composition. A nonlinear consumption function, where consumption is a function of current and expected lifetime household composition, bequest motive, household income and assets, and life expectancy of the household head, is derived. An alternative specification is also examined to test the validity of the general model and variables therein.

HOMES, Household Model for Economic and Social Studies, is applied to project a family of curves of future household membership. This information is used to estimate the life-cycle consumption function that explicitly incorporates expected lifetime household membership. Nonlinear regression equations are estimated using maximum likelihood method. Equivalence scales are estimated to measure the effect of household age-sex composition on consumption. The analysis and the inferences drawn therefrom are based on a sample of 614 households.
taken from Kathmandu Valley during the winter of 1987–88 to represent the demographic structure and income-expenditure patterns of Nepali households.

1.3 Outline of the Study

This dissertation is divided into seven chapters. Chapter 2 reviews the relevant literature on life-cycle analysis and the incorporation of demographic variables into consumption theory. Chapter 3 is devoted to examining the theoretical framework and model specification for the present study. In Chapter 4, I will discuss the data. Projection of future household composition is described in Chapter 5. In Chapter 6 estimated consumption functions and their interpretations are reported. Statistical tests of the model and their analyses are also presented in that chapter. And finally, a summary of findings, the policy implications of the study, and suggestions for further research are included in Chapter 7.
CHAPTER 2

REVIEW OF THE LITERATURE

Eizenga's (1961) analysis of the 1950 U.S. Survey of Consumer Expenditures is one of the first attempts to examine the relationship between household size and household consumption. His findings show that the absolute level of standardized household savings declines as household size increases. Controlling for household income and age and occupation of head, Eizenga finds that saving declines very substantially as family size increases from one to three members, but declines much more gradually thereafter. Similarly, David (1962) found that the size of the family or the age of the household head is more important in determining expenditures on housing, whereas marital status appears to be a more important factor in consumption of automobiles.

Barten (1964) was the first economist to introduce and discuss demand functions incorporating household size and composition into the model. He introduced a set of parameters, known as "specific equivalent adults," to measure the size and composition of a household. Muellbauer (1974), and Bojer (1977) have further explored Barten functions, both theoretically and empirically, to examine the effects of household composition on household demand. None of these studies were based on life-cycle models. We shall, however, confine our literature survey to the discussion of studies that utilized the theoretical construct of the life-cycle hypothesis and procedures for incorporating demographic variables into household utility functions.

Analysis of demographic variables in the life-cycle model has received considerable attention because the costs of rearing children have significant effects on
the allocation of household's resources over its lifetime. Both direct costs, such as the increase in household expenditures, and the indirect costs of rearing children have been examined intensively. Direct costs have been estimated by many researchers (for example, Pollak and Wales, 1978, 1981; Olson, 1983; Deaton and Muellabauer, 1986). The estimates and findings show that expenditures on children definitely increase with the number and age of children. Devaney (1984), examining indirect costs, concludes that the presence of children in a household has a pronounced negative influence on female labor force participation and consequently on household income.

2.1 Life-cycle Analysis of Consumption: A Forward-Looking Theory

A number of different theories of consumption have been developed in response to the myopic nature of the simple consumption function.

One of these is the life-cycle hypothesis of consumption theory, which has been widely tested, applied, and developed. This theory derives its name from its emphasis on an individual (or family) looking ahead over its entire lifetime. The life-cycle model is an attempt to examine the magnitude and implications of transitory saving and hump wealth by relating it to the classical theory of consumer choice and more particularly to the hypothesis of optimal allocation of time. We can also refer to it as a forward-looking theory of consumption because this theory embodies the basic idea that individual consumers are forward-looking decision makers. This theory is the microfoundation of macroeconomics and offers a simple story of a representative consumer or household. It provides a crucial link between the microeconomics of rational household behavior and the macroeconomics of the rate of saving.
The life-cycle model originally advanced, developed, and popularized by Modigliani and his associates (Modigliani and Brumberg, 1954; Modigliani and Ando, 1957; Ando and Modigliani, 1963) emphasizes the importance of saving during periods of relatively high earnings for consumption during periods of relatively low earnings. Therefore, this theory breaks rank with the simple consumption function by saying that consumers do not concentrate exclusively on a single year's disposable income. Instead, they also look ahead to their likely future incomes, which will depend on their future earnings, wealth, and the tax structure.

According to the Modigliani and Brumberg (1954) model, the consumption function can simply be expressed as

$$C_t^r = \gamma_t^r V_r$$  \hspace{1cm} (2.1)

where $C_t^r$ is the household consumption in period $r$ as anticipated from period $t$, $\gamma_t^r$ is the proportion of total household resources consumed in period $r$ as anticipated from period $t$ (depending upon the utility function and the rate of interest but not on $V_t$), $V_t$ is the size of expected total (discounted) lifetime household resources as anticipated from the planning period $t$, and $L$ is the final period of the household's life.

If there is no bequest or inheritance, and the real rate of interest is zero, then

$$\sum_{r=t}^{L} \gamma_t^r = 1.$$  \hspace{1cm} (2.2)

Or, all resources will be consumed during the total life span.
If we further assume that consumption is constant in each period, i.e., $\gamma_r = \gamma$, then from (2.2) we have $(L + 1 - \tau)\gamma = 1$. Therefore,

$$\gamma = \gamma_r = \frac{1}{L + 1 - \tau} = \frac{1}{L_r} \quad (2.3)$$

where $L_r = (L + 1 - \tau)$ denotes the remaining life span at time $\tau$. This shows that the fraction of lifetime resources consumed in each period is equal to the inverse of the life span.

Equation (2.3) shows that $\gamma_r$, the proportion of total resources consumed in period $\tau$, depends on the age of the consumer, not on the income level. This is the unique feature of the life-cycle model.

This hypothesis shares some traits with the permanent income hypothesis (Friedman, 1957) which shows that the marginal propensity to consume out of transitory income is zero. In both models, the marginal propensity to consume is independent of lifetime income. Friedman (1957) assumed, as Modigliani and Brumberg (1954) did, that households strive to maximize their utility of future consumption. The decisive difference between the two theories concerns the length of the planning period. In the Modigliani-Brumberg version, the planning period is finite, i.e., people save only for themselves. According to Friedman, however, this period is infinite.

2.2 Further Development and Applications of the Life-cycle Model

2.2.1 Development of the Model

Modigliani and Brumberg's work (1954) is the cornerstone of the life-cycle hypothesis of consumption theory. This hypothesis assumes that households (or
individuals) strive to maximize their utility from current and future consumption subject to their expected total income, that is, the sum of current income and assets and discounted future earnings. Based upon this hypothesis, four successive models have been developed as its extension in order to examine the relationship between household consumption and demographic variables.

The original formulation by Modigliani and Brumberg (1954) was aimed at analyzing the case of an individual. Their theory assumes that individuals (or households) strive to maximize their utility from current and future consumption subject to their expected future income. Fisher (1956) introduced family size into the life cycle model. Both Tobin's (1967) simulation model and Leff’s (1969) econometric approach have employed the life-cycle framework for modeling the relationship between saving and demographic factors.¹ Other empirical studies such as Ando and Modigliani (1963), using aggregate time-series data, and Modigliani (1970), using cross-country data, demonstrate the usefulness of this model.

This theory can be applied to stationary economies, as well as to growing economies, and we can also allow for different assumptions. Accordingly, several recent extensions and applications of this model, namely the introduction of social security by Feldstein (1976), Evans (1982), and David and Menchik (1985); incorporation of initial assets and intended bequests by Blinder (1976), Mariger (1983), and David and Menchik (1985); determination of the role of bequests in the process of wealth accumulation by White (1978), Kotlikoff and Summers

¹ Because the saving ratio equals one minus the consumption ratio, factors that increase the consumption ratio, by definition, decrease the saving ratio by an equal amount. Therefore, these two ratios are complement to each other.
(1981), Evans (1982, 1984), Kotlikoff (1988), and Modigliani (1988); examination of the effect of uncertainty on saving behavior by Short (1986); investigation of the effect of government expenditures and taxes on private consumption by Modigliani and Sterling (1986); and a study on the effect of household composition on the consumption behavior of chicken farm households in Thailand by Arphasil (1988), have proved the applicability of the life-cycle hypothesis. A number of studies have also rejected the "textbook" version definition of the life cycle hypothesis—that the elderly dissave out of accumulated wealth to finance the continuation of preretirement consumption levels after retirement.

The original Modigliani-Brumberg model treated households as though they were individual consumers. They did not, however, include family size in their model. Fisher (1956) was the first to call attention to the absence of families in the life-cycle model and to do an empirical study introducing family size. To capture the effect of variations in household size on $\gamma^t$, Fisher disaggregated it into two parts: $\gamma_r$, which is independent of family size, and $b_r$, which measures the effect of household size. Therefore, $\gamma^t_r$ can be rewritten as

$$\gamma^t_r = \gamma_r + b_r (J_f^t - 1)$$  \hspace{1cm} (2.4)

where $J_f^t$ is the expected family size in period $t$.

Modigliani and Ando (1957) later refined the Modigliani-Brumberg model as well as the empirical work of Fisher. They modified the model to measure the effect of the age of members as well as their numbers. If we assume that adults consume more than children, a household with older children, ceteris paribus, should consume more than a household with younger children. Redefining $b_r$ as $b_r = a_r g_r$, and with some rearrangement of terms, they derived the relationship
\[ C_r = \frac{V_t[1 + a_r(mJ^t_r - 1)]}{L_1[1 + a_r(mJ^t_r - 1)]} \]  

(2.5)

where \( mJ^t_r(= \sum_{r=t}^L J^t_r/L_r) \) is the weighted mean of the numbers in the family in each time period, the weight is the number of periods in which \( J \) members are in the family, \( a_r \) measures the effect of age and household size, and \( L_r = (L + 1 - \tau) \) is the remaining period of life.\(^2\)

Equation (2.5) shows that consumption depends on the size of the household, as well as its life span. Therefore, it provides us with the basic function to estimate the effect of household size in the life-cycle model. However, this model does not answer all other questions that remain to be answered. It does not allow for the effect of the age of children on household consumption and economies of scale in childrearing. The works of Fisher and Modigliani-Ando provide an evaluation of the life-cycle hypothesis when allowing for variations in household size but they fail to determine the effect of household size on household consumption.

A different approach to analyzing the size and savings behavior of households was undertaken by Somermeyer and Bannink (1973). Those authors applied the life-cycle saving model directly by estimating lifetime household resources. They defined the ratio of current consumption to estimated lifetime resources as a measure of the household’s “urgency to consume.” Using the same notations as Fisher, the “urgency to consume” can be simply defined as

\[ \gamma^t_r = \frac{C_r}{V_r}. \]  

(2.6)

Somermeyer and Bannink (1973) estimate the value of lifetime resources as

\(^2\) The full derivation of (2.5) from (2.4) is given in Modigliani and Ando (1957: 111-112).
\[ V_t = A_t + Y_t + K_t \]

where \( A_t \) is the value of assets held at the beginning of period \( t \), \( Y_t \) is the value of all household labor income if held to period \( L \), \( K_t \) is the value of capital income earned from \( A_t \) if held to period \( L \), and \( L_r = (L - \tau + 1) \) is the remaining length of life.

The authors state that if the earnings rate on \( A_t \) is less than the interest rate \( r \), then the household will consume out of \( A_t \) at a price below that asserted in the model. If, however, the return to \( A_t \) exceeds \( r \) and the household’s consumption in period \( t \) exceeds the income earnings \( Y_t + K_t \), the household must be consuming out of \( A_t \) and at a price that is above that assumed in the model. Estimations of the interest rate, \( Y_t \) for individual members of the household, and variations in future income from changes in the composition of the household are some of the additional problems with this approach. They take the Netherlands as their case study. With an interest rate equal to 4.08 percent throughout the analysis, their results show that the mean values of \( \gamma_t L_t \) range from 1.50 to 1.97. If the childless households plan to consume equal amounts in each period, \( \gamma_t L_t \) should be less than one, because \( r \) is positive and \( V_t \) is the value of lifetime resources.\(^3\)

Mason (1975) extended the model derived by Fisher (1956), and Modigliani and Ando (1957). His analysis is confined to the effect of household size on the fraction of household resources consumed over the entire childrearing period. Equation (2.4) is modified to circumvent the problem of the effect of age of children on household consumption. Therefore, he separates life-cycle consumption

\(^3\) This paragraph draws heavily from Mason (1975: 27–30).
into two successive periods: the childrearing period and the post childrearing period. He disaggregated the coefficient of the consumption function as

$$\gamma^t_r = \gamma_r [1 + b_1 + \sum_{a=0}^{a*} b_2(a) J_r(a)]$$

(2.7)

where $a*$ is the (average) age at departure from the household by children, and $J_r(a)$ is the number of children at time $r$ of age $a$. Substituting equation (2.7) into equation (2.1) and rearranging the terms, it will yield to

$$\frac{(V_0^0 - V_n^0)}{V_n^0} - \frac{RV_0^0}{V_n^0} = (\frac{b_2}{b_0}) m J$$

(2.8)

where $V_n^0 = (1 + r)^{-n} V_n$, $R = \sum_{t=0}^{n-1} (1 + r)^{-t} / \sum_{t=0}^{L} (1 + r)^{-t}$, $b_0 = (1 + b_1) \sum_{t=0}^{L} (1 + r)^{-t}$, $m J$ is the discounted number of children ever born, and $n$ is some time period, $t = n$, for which $J_t(a) = 0$ for $t$ greater than or equal to $T$, i.e., $T$ is greater than $(t_f + a*)$.

The right side of equation (2.8) is the consumption demands on initial lifetime household resources of children relative to adults. $b_2/b_0$ measures the effect of household size on relative consumption, where $b_0$ is the discounted fraction of total resources consumed by parents. Therefore the ratio of $b_2$ to $b_0$ can also be thought of as the relative equivalent adult scales of children’s consumption. The left hand side expression represents the proportion of total lifetime resources devoted to consumption. The first term on the left hand side is the initial value of lifetime resources devoted to consumption between periods 0 and $n - 1$ relative to resources devoted to consumption after period $n - 1$. The second term is the proportion of initial lifetime resources devoted to $(0, n - 1)$ consumption relative.

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4 For further detail see Mason (1975: 42-49).
to \((n, L)\) consumption were consumption evenly spread over the household's life. The sensitivity test of consumption using different rates of interest showed that household size has a small effect on consumption when the rate of interest is high; the constant term will be negative implying the over-estimation of the relative effect of child-consumption; and the higher absolute value of the constant term indicates that other important factors combined strongly affect household consumption rather than mere the number of children.

It is observed from the preceding studies that economists have analyzed the relationship between household size and life cycle consumption for a household as initiated by Fisher (1956). They have also reflected the effect of household size on consumption through \(\gamma^L\), the coefficient of the lifetime resources in the consumption function.

2.2.2 The Bequest Issue: An Unreconciled Debate

Although the life-cycle theory remains the leading microeconomic theory of consumption behavior, the assumption that there are no planned bequests is one of the most controversial assumptions underlying this model. The assumption that people save mainly for retirement and dissave out of accumulated wealth to finance their retirement has also been questioned by recent findings. These studies argue that people's actual planning horizon is longer than their full lifetime. According to this view, people intentionally leave bequests or make gifts, signifying that they derive satisfaction from the economic well being of future generations and have a multigenerational planning horizon (Barro, 1974; Becker, 1974; Kotlikoff and Summers, 1981; Hayashi, 1986; Kotlikoff, 1988).
Blinder (1976) included capital market constraints and bequests in the original life-cycle model. He concluded that, under uncertainty, the life-cycle hypothesis that the lifetime pattern of consumption is independent of the lifetime pattern of earnings is not true. Blinder et al. (1983) have incorporated the bequest motive, proxied by the number of children, to study the asset holdings of white American men near retirement age. Their results show that the life-cycle model has little ability to explain cross-sectional variability in asset holdings. Darby (1979) inferred longitudinal age-consumption and age-earnings profiles from the cross section profile and concluded that not more than 29 percent of U.S. private net worth is devoted to future consumption with the rest destined for intergenerational transfer. White (1978) used aggregate data on the age structure of the population, age earnings, and age consumption profiles along with a variety of parametric assumptions and she concludes that the life-cycle model can account for only about one-quarter of aggregate saving.

Some recent findings question the assumed motive for saving and the implication that people dissave their wealth when old. Friedman's (1957) theory of consumption, which is contemporary to the life-cycle theory, assumes infinite time horizon which could imply that people save not only for themselves but also for their descendants. Kotlikoff and Summers (1981) have shown that most saving is done to provide bequests rather than to provide for old-age consumption. Kotlikoff (1988) argues that there is strong evidence that intergenerational transfers play a very important and perhaps dominant role in wealth accumulation in the United States. He further asserts that altruistic concern for one's children is the first reason one thinks of for intergenerational transfers. This concern may be expressed mathematically as the parent having direct utility for the utility of
the child as in Barro (1974) and Becker (1974). They conclude that though the savings are for the consumption in retirement, people are saving mainly to pass wealth on to their descendants.

Modigliani (1986), however, takes issue with the calculations that underlie the Kotlikoff-Summers (1981) claim that most savings are for bequests. Kotlikoff and Summers (1986) subsequently identified an error in the treatment of durable goods. They indicated that a proper correction for durables raises the share of wealth accumulation in life-cycle saving to 21.9 percent from 18.9 percent they had reported in their 1981 paper.

Another study done by Danziger et al. (1982-83) shows that there is strong evidence contradicting the “textbook” version definition of the life-cycle hypothesis—that the elderly dissave out of accumulated wealth to finance the continuation of preretirement consumption levels after retirement. With a data set from the 1972-73 Consumer Expenditure Survey, they indicate that “… the elderly not only do not dissave to finance their consumption during retirement, they spend less on consumption goods and services (save significantly more) than the nonelderly at all levels of income. Moreover, the oldest of the elderly save the most at given levels of income” (p. 210). They do not support the central prediction that the aged dissave. This fact is inconsistent with the simple form of the life-cycle hypothesis set out at the first section of this chapter.

Hayashi’s (1986) analysis of savings of Japanese cohorts in the 1970s leads him to conclude that “mean asset holdings do not decline as cohorts age.” On a comment of Hayashi’s research on Japan as well as his own Ando states that the elderly typically move in and pool their wealth with their children. He also states that “… the apparent total lack of dissaving by older households in Japan
is clearly inconsistent with the life-cycle theory" (Ando and Kennickel, 1987). However, the data used for this analysis is not error-free because of sampling bias on elderly household head's dissaving. Households that deplete their resources and move in with their children are not included in the sample of elderly households. Hurd (1987) also found that the wealth of the elderly increases with age, suggesting that the life-cycle hypothesis of consumption should include a bequest motive. His findings, however, show no support for a bequest motive.

David and Menchik (1985) also examined the effects of social security on lifetime wealth accumulation and bequests. They were interested in determining the functional relationship between bequests and lifetime earnings. With a sample of 720 Wisconsin males born during 1890–1899, they show that bequests are nonlinear functions of lifetime earnings. They also find that people do not deplete their private assets in old age as is commonly assumed. All these studies raise further doubts about the ability of the life cycle hypothesis to explain the bulk of personal saving.

On the other hand, the conclusion that bequest process plays an important role in the process of national wealth accumulation has been seriously criticized and challenged. Estimates of the importance of purely bequest-motivated transfers have been obtained. Some evidence suggests that the pure bequest motive—the accumulation of wealth entirely for the purpose of being distributed to future generations and not for one's own consumption—affects a rather small number of households. Modigliani (1988) argues that the role of bequest motivated transfers seem to play an important role only in the very highest income and wealth brackets. Some portion of bequests, especially in lower income brackets, is not due to a pure bequest motive but rather to a precautionary motive reflecting uncertainty
about the length of life, although it is not possible to pinpoint the size of this component. He contends that many people do not intend to leave any bequests. Therefore, all the wealth seems to have saved for their own consumption.

Similarly, the finding of Projector and Weiss (1964) shows that only 3 percent of the respondents indicated that they were saving “to provide an estate for the family.” The bequest motive seems to be concentrated in the highest economic classes. This hypothesis is also supported by the findings of Menchik and David (1983). In response to White’s (1978) arguments, Evans (1984) shows that under plausible assumptions one obtains simulated values of the life-cycle rate of saving varying between 2 and up to 11 percent, which is consistent with a lot of room for bequests at one end or very little at the other. He dismisses White’s critique, and concludes that the life-cycle model cannot be discarded on the basis of simple theoretical tests of plausibility. Hurd (1986) also supports the hypothesis that the bequest motive is not important for the broad cross-section of households.

The differences over the planning horizon is personified by opposing views Kotlikoff-Summers on one hand and Modigliani on the other. Both parties agree that saving is governed by what is known as the law of 20/80. However, Modigliani attributes 80 percent of wealth accumulation to life-cycle saving and the remaining 20 percent to bequests, whereas Kotlikoff-Summers attribute 80 percent to bequest saving and the rest to life-cycle saving.

These arguments and counter arguments about the role of bequests in explaining the bulk of personal saving have led to an indecisive conclusion.\textsuperscript{5} None of these studies, however, attempt to apply this theory to the case of an extended

\textsuperscript{5} See Kotlikoff (1988) and Modigliani (1988) and the references therein for a more detailed discussion on this issue and the definitional differences on intergenerational transfers.
family system. This study is an attempt to examine the role of bequest motives, among others, on the life-cycle consumption behavior of households.

2.2.3 On Saving and Population Growth

Both Tobin’s (1967) micro-level simulation approach and Leff’s (1969) macro-level econometric approach have employed the life-cycle framework for modeling the relationship between saving and demographic factors. Both these approaches have then widely been applied to examine the link between saving and population growth. Changes in population growth affect both the consumption (hence, the saving) profile and the age distribution of households. A number of studies have concluded that high population growth depresses national saving rates, although many other studies have challenged the validity of this conclusion. Therefore, the net effect on saving of a change in population growth is inconclusive. This section briefly reviews some of the empirical studies on the relationship between saving and population growth.\(^6\)

Kim (1974) used the 1964–1972 Korean farm household saving data classified by farm size to examine the relationship between dependency ratio (ratio of employed members to total family size) and household saving. His findings provide no evidence that household saving is depressed by the dependency ratio. His analysis of per capita saving by urban households shows that average and marginal propensities to save are inversely related to household size. Similarly, Peek’s (1974) analysis of 1961, 1965, and 1971 data for the Philippines classified by region (rural, Manila, and other urban) and by income shows that, given

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\(^6\) For a more detailed discussion on saving and demographic factors, see Mason (1987a).
\(^7\) This section draws heavily from Mason (1991).
household income, an increase in household size reduces saving, but the number of children under age 18 has no significant impact on saving.

Mueller (1976) utilizes an extensive amount of data to construct earnings and consumption profiles of males and females over their life cycle in peasant agricultural societies—agricultural systems that primarily use traditional methods of cultivation, for example regions in South and Southeast Asia. In doing so, she establishes the importance of child earning, not just consumption. Her simulation results show, in general, that higher population growth results in a lower "potential" saving rate. Similarly, Lewis’ (1983) examination on the effect of declining childbearing on the consumption profile of households, and hence on the aggregate saving rate, shows that fertility decline contributed about one-quarter of the increase in U.S. saving rates observed from 1830 to 1900.

Kleinbaum and Mason’s (1987) econometric analysis, based on the 1984 Korean Consumer Expenditure Survey of 45,000 urban, non-farm households with at least two members, shows that except for females age 2 and under, an increase in the number of young members had a statistically significant adverse impact on household saving. Their results are based on the regression of household consumption ratio on the log of disposable income and its square, detailed characteristics of household head and household membership. The decline in the saving rate resulting from an additional member ranged from 1.2 percentage points for a teenage male to 0.55 percentage points for a male child aged 3 to 12.

Mason et al.'s forthcoming study of Thailand yields similar results. Their analysis, based on the 1981 Socio-Economic Survey data, shows that declines in child dependency should lead to higher saving in the future. They conclude that over the next fifteen years, given projected declines in fertility, the household
saving ratio is forecast to rise by 1.0 percentage point. As compared with Korea, a Thai teen had a smaller adverse impact on the saving rate. But the impact of an additional teenager in Thailand varies with the characteristics of the household.

Fry and Mason (1982) developed the variable rate-of-growth effect model, which distinguishes two population growth effects: the rate of growth effect and the dependency effect. According to this model, population growth leads to higher growth of aggregate income, saving increases with population growth. On the other hand, an increase in child dependency reduces saving. Therefore, the resultant effect of population growth on national saving depends upon the values of these two opposing effects.

Fry and Mason (1982), Fry (1984), and Collins (1988) model the impact of the dependency ratio on saving using a fully specified life-cycle model that incorporates variable rate-of-growth effect. These studies use pooled cross-section time series data, and find that life-cycle saving is affected by child dependency. This finding supports the hypothesis that, as fertility declines over the demographic transition, households shift some portion of their economic resources from child-rearing to activities pursued later in life. However, their findings regarding the estate effect of dependency are qualitatively different. Fry and Mason (1982) and Fry (1984) conclude that a decline in childbearing also increases estate saving reinforcing the impact of dependency on life-cycle saving, whereas Collins (1988) concludes that a decline in childbearing reduces estate saving diluting the impact of dependency on life-cycle saving.
2.3 Demographic Variables in Consumption Analysis

Demographic variables are incorporated into our consumption model. Therefore, we should be able to convert these variables into a measurable unit for empirical analysis.

There are two different ways to introduce demographic factors in systems of demand equations. One is to include additional demographic variables in the demand system. The advantage of this technique is that it allows explicit measurement of demographic effects across different groups of consumers. The other is to estimate separate demand equations for each group. This technique requires a large sample because there are many possible subgroups.

Economists (Pollak and Wales, 1981; Deaton and Muellbauer, 1986) have estimated different demand functions by incorporating demographic variables in the utility function of a household. The methodology employed by Pollak and Wales (1981) provides firm theoretical foundations for the use of demographic variables in expenditure systems. They have also shown that there are five different procedures in which we can incorporate demographic variables into complete demand systems. These procedures are: demographic scaling, demographic translating, Gorman specification, the reverse Gorman specification, and the "modified Prais-Houthakker procedure." These procedures are briefly discussed below.

Demographic scaling was first proposed by Barten (1964). This procedure first introduces \( n \) scaling parameters, \( (m_1, m_2, \ldots, m_n) \), into the original demand

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8 Leibenstein (1964, 1957) was the first economist to discuss the utility and cost of children within the framework of economic factors that determine family size. However, there is no attempt in his theory to explicitly derive a demand function from the utility function nor a well-defined budget constraint. He neither provides evidence to support the theory nor presents it in a form that is easily testable.
system and then postulates that these, and only these, newly introduced parameters depend on the demographic variables. Scaling factors, \( m_i \)'s, can be interpreted as "equivalent adults." Equivalence scale is a technique used to convert household composition into a standard unit of measurement. Muellbauer (1974), and Bojer (1977) have further explored Barten functions, both theoretically and empirically, to examine the effects of household composition on household demand. This procedure has proved to be better than other procedures and was, therefore, further extended by Deaton and Muellbauer (1986). Gronau (1988) has reexamined this method and shows that the definition and the measurement of this scale, however, depends crucially on the concept of welfare used.

Demographic translating, first employed by Pollak and Wales (1978), is a general procedure for incorporating demographic variables into classes of demand systems. It introduces \( n \) translating parameters, \( (d_1, d_2, \ldots, d_n) \), into the demand systems and then postulates that these parameters depend on demographic variables. Pollak and Wales (1979, 1980, 1981) contend that translating can often be interpreted as allowing "necessary" or "subsistence" parameters of a demand system. From the British household budget data, they conclude that scaling is better than translating, because scaling yields higher likelihood values than translating.\(^9\)

Gorman specification for equivalent scales is obtained from the original demand system by first scaling and then translating, whereas first translating and then scaling represents the reverse Gorman specification procedure (Gorman, 1978).\(^9\)

\(^9\) Pollak and Wales (1981) compared all these five procedures with two alternative specifications: a "pooled" specification, in which all the data from different households are combined, assuming that demographic variables do not affect household consumption patterns and an "unpooled" specification in which data from different households are treated separately assuming that demographic variables affect all demand system parameters. They also demonstrate that "unpooled specification" is better than "pooled specification" implying that consumption patterns are affected by the number of children.
Demographic scaling and demographic translating correspond to its special cases in which \( d \)'s are zero and \( m \)'s are unity respectively.

Prais and Houthakker (1955) proposed a technique for incorporating demographic variables into demand equations using a single income scale and a specific scale for each good. They estimated the effects of changes in demographic variables and expenditures (but not prices) on household consumption patterns. However, they never reconciled their technique with an overall budget constraint. To overcome this problem, Pollak and Wales (1981) introduced the "modified Prais-Houthakker procedure." This procedure replaces the income variable in the original demand system by the ratio of income to "income scale." The income scale is a function of all prices and expenditures as well as the demographic variables. They have also shown that the modified Prais-Houthakker procedure yields a theoretically plausible demand system if, and only if, the original demand system corresponds to an additive direct utility function. Muellbauer (1980) has also considered the implications of a proper understanding of the economic theory underlying the Prais-Houthakker model of equivalence scales for its estimations. He defines the income scale implicitly through the budget constraint.

Table 2.1 presents the summary of all of these modifications of demand systems by incorporating demographic variables.

It is obvious from the above discussion that many different theoretically sound variants of demand systems can be permuted. However, most procedures

\[ U = \sum f_i(z_i), \]  

where \( f_i \)'s are increasing functions of \( z_i \)'s. \( z_i \)'s denote the quantities of the commodities into consideration.

---

10 A utility function is additive if it can be written as \( U = \sum f_i(z_i) \), where \( f_i \)'s are increasing functions of \( z_i \)'s. \( z_i \)'s denote the quantities of the commodities into consideration.
Table 2.1
Modification of Demand Systems
by Incorporating Demographic Variables

<table>
<thead>
<tr>
<th>Incorporating Procedure</th>
<th>Modified Demand System</th>
<th>Modified Utility Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original System</td>
<td>$x_i = f_i(p, Y)$</td>
<td>$U(X)$</td>
</tr>
<tr>
<td>Demographic Scaling</td>
<td>$x_i = m_i f_i(p_1 m_1, \ldots, p_n m_n, Y)$</td>
<td>$U(X/M)$</td>
</tr>
<tr>
<td>Demographic Translating</td>
<td>$x_i = d_i + f_i(p, Y - \sum p_k d_k)$</td>
<td>$U(X - D)$</td>
</tr>
<tr>
<td>Gorman Specification</td>
<td>$x_i = d_i + m_i f_i(p_1 m_1, \ldots, p_n m_n, Y - \sum p_k d_k)$</td>
<td>$U((X - D)/M)$</td>
</tr>
<tr>
<td>Reverse Gorman Specification</td>
<td>$x_i = m_i [d_i + f_i(p_1 m_1, \ldots, p_n m_n, Y - \sum p_k m_k d_k)]$</td>
<td>$U((X/M) - D)$</td>
</tr>
<tr>
<td>Modified Prais-Houthakker Procedure</td>
<td>$x_i = s_i f_i(p, Y/s_0)$</td>
<td></td>
</tr>
</tbody>
</table>

where $X$, $D$, and $M$ are the vectors of $x$'s, $d$'s, and $m$'s respectively, and $s_i$'s are "specific scales" for commodities which depend on the demographic variables and $s_0$ is an 'income scale' implicitly defined by the budget constraint $\sum p_k s_k f_k(P, Y/s_0) = Y$.

The original demand systems, $x_i = f_i(p, Y)$, where $x$'s denote quantities, $p$'s prices, and $Y$ total expenditures, are theoretically plausible. In the modified demand systems, $d$'s and $m$'s are respectively translating and scaling parameters as used by Pollak and Wales (1981).

Where survey data provide insufficient variation in prices to identify price effects, as frequently is the case, many studies have typically employed a variant of Working's (1943) model (Leser, 1963; Deaton, 1982; Deaton and Case, 1987; Deaton et al., 1989). These studies employ the Engel curves (budget share equations) that best fit family budget data and are similar in specification to the form as follows:

\[ w_i = \alpha_i + \beta_{1i} \ln(y/n) + \beta_{2i} [\ln(y/n)]^2 + \sum_{j=1}^{J} \gamma_{ij} n_j + \delta \cdot z \]  

where \( n \) is the total number of family members, \( n_j \) is the number of family members in age-sex category \( j \), and \( z \) is a vector of control variables such as age of the head and the marker,\(^{11}\) their educational attainments, and employment of adults.

More reasonable specification, which do not require price variability for identification, are similar in form to equation (2.9). Such Engel curves have been recently estimated from Spanish survey data (Deaton et al., 1989), and from Sri Lankan and Indonesian expenditure surveys (Deaton and Muellbauer, 1986).

\(^{11}\) Marker is the spouse of household head; for single headed households, the head is also the marker.
2.4 Other Socioeconomic Studies

It is well known that children comprise a larger proportion of household members in larger families than they do in small families. The value of children to parents has an important social and psychological component. Indeed, the reasons for having large families may be primarily noneconomic. Many sociological and socioeconomic studies (for example, Leibenstein, 1954, 1957; Caldwell, 1976; and Mangen et al., 1988) have also been done to justify the reasons for larger family size and intergenerational relations. Still, the strictly economic analysis of large families deserves separate study because of its bearing on the pace of economic development.

With an objective of exploring approaches to measuring changes in family formation levels, Schnaiberg (1973) proposes a new micro-structural measure—"child-years-of-dependency" (CYD)—with an emphasis on childrearing. CYD is defined as one child present for one year equals one CYD, analogous to life table person-years-lived, and asserts that we can compute CYD for the life-cycle period of a family. He argues that the CYD measure stresses dependency, and it is closely allied to theorizing about cost–benefit decision making about children. He also provides some crude estimates for costs of raising children to age 18.

Household composition, rather than household size, has a significant effect on the consumption pattern of a household. All the models and studies discussed earlier in this chapter take into consideration only those households that have a finite life span, such as nuclear families. But the planning horizon need not be finite if we think of an extended family. No attempts appear to have been made so far to apply this theory to the case of an extended family system. The previous studies do not fill this gap because they fail to: (1) convert demographic
characteristics into a measurable unit for empirical analysis; (2) estimate the lifetime household composition specified in the theoretical model; and (3) measure the effect of the bequest motives on consumption patterns. This study makes an attempt to answer those questions. The solution to the first problem is to apply the concept of equivalence scale in our model; the solution to the second problem is to analyze the fertility behavior of each household as well as their living arrangements; and the solution to the third problem is to analyze the consumption behavior of extended families in an intertemporal framework by including bequests in the utility function and the budget constraint. Theoretical construct and model specification are discussed in the following chapter. Empirical findings are analyzed in Chapter 6.
CHAPTER 3
THEORETICAL CONSTRUCT AND MODEL SPECIFICATION

3.1 Theoretical Construct

The theory of demand for many goods is well developed. Much of the theory can be applied to the life-cycle hypothesis of consumption treating consumption in each period as a distinct good. According to the analysis of consumer demand theory, a consumer tries to maximize his utility subject to a given budget constraint. If he has a well defined quasi-concave utility function $U_h(X)$, where $X$ is the vector of $n$ commodities, or $X = (x_1, x_2, \ldots, x_n)$, where $x_i$ is the $i$th commodity available to him, and he has a fixed amount of income, $Y$, to spend on these $n$ commodities, then the objective of the consumer is to maximize

$$U_h(x_1, x_2, \ldots, x_n)$$

subject to $Y = \sum_{i=1}^{n} p_i x_i$, where $p_i$ is the price of $x_i$.

Applying the method of constrained optimization, we obtain the corresponding demand functions for all commodities.

If we take a household as a consumer unit, then the same methodology and procedure can be applied to determine the demand functions. This notion, however, implies that either we have a glued-together family having identical tastes, or the household decision function is dictatorial (despotic head). If so, there is no problem with (3.1). As a group, a household is a small closely knit collection
of individuals. Yet there is a problem that has to be handled when trying to find empirically applicable demand functions for a household. The problem is to converting demographic variables into a measurable unit. To overcome this problem this study applies the method of “equivalent adults.”

Let us define some of the terms that are used in this study. Head refers to the household head unless otherwise stated, and households are represented by their heads. Bequests are household assets left at the final period of the life span of the head. Similarly, inheritances are household assets that were inherited by the head from his predecessor(s).

We assume that our representative household has a well defined quasi-concave utility function. The budget of the household is constrained by its lifetime resources. The household will make its intertemporal consumption decisions based on the postulation that its utility function is maximized subject to the budget constraint.

Time preference is defined as the human desire for present consumption as opposed to future consumption. The desire is reflected by the price people are willing to pay for immediate consumption as opposed to the price they are willing to pay for future consumption. A positive rate of time preference indicates that current consumption is preferred to future consumption. The rate is negative if the converse is the case.

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2 Decease, abdication, retirement, or any other reason could be the cause of the end of the life span of the household headship.
3.1.1 The Utility Function

We assume that the utility function is additive and separable. We also assume that in extended family systems household heads derive utility from bequests and intend to bequeath some assets to their offspring. Therefore, bequests appear as an argument in the household utility function. Let \( u(B_L) \) be the utility derived from leaving \( B_L \) as bequests. Then the lifetime utility of the household (in terms of present value), which is the sum of all utilities derived throughout its life period, will be

\[
U = \int_T^L m_t f(c_t) e^{-\rho t} dt + u(B_L) \tag{3.2}
\]

where \( C_t \) and \( m_t \) are total consumption and number of equivalent adults respectively; \( c_t = (C_t/m_t) \) denotes anticipated consumption per equivalent adult; \( f(c_t) \) is the utility derived from it, all measured at time \( t \); and \( \rho \) denotes the rate of time preference. In this model the household is represented by the age of the household head, \( T + t \). The limits of integration \( T \) and \( L \) are the ages of the household head at the beginning of his planning horizon and his terminal age. Therefore, \( t \) refers to \( t \) period(s) later in the future.

Households seem to display a positive rate of time preference. That is, they tend to place a higher subjective value on consumption in the near future than on consumption in the more distant future. This rate also differs across socioeconomic classes. Lawrance (1991) argues that poor households are likely to possess relatively high rates of time preference and, consequently, relatively high

---

The additivity assumption implies that the marginal utility of consumption at any time period is independent of the consumption at any other period. The additive separability assumption allows us to treat different aspects of utility separately from each other.
marginal propensity to consume implying very different patterns of consumption over the life-cycle. If households have reason to believe that their income will increase over time, they could very logically conclude that giving up something now entails a larger subjective sacrifice than giving up quite a bit more of the same thing at a future date when they expect their income to be greater. Therefore, I have incorporated the concept of rate of time preference into my model.

3.1.2 The Budget Constraint

The budget constraint for intertemporal consumption can be expressed in terms of present value or future value. For this study, I will express the budget constraint in terms of present value.

The budget of a household is constrained by its lifetime resources, including inheritances. The present value of total lifetime resources of a household anticipated from his current age $T$, $V_T$, is

$$V_T = A_T + \int_T^L Y_t e^{-rt} dt$$

(3.3)

where $Y_t$ is the household income at time $t$, and $r$ is the rate of discount.

The first term of the right hand expression, $A_T$, is the value of the household’s initial holding of assets, including inheritances. The second term is the sum of all discounted future income, including the earnings of all household members. It is difficult to estimate accurately the value of this term; however, we can estimate it by following the technique prescribed in Modigliani and Brumberg (1954: 396). If $Y_t^e$ is the expected average annual discounted income at period $t$, then
where \( E_T = (L - T) \) is the remaining life span of the household. This is the head's life expectancy at age \( T \).

Or alternatively,

\[
\int_T^L Y_t e^{-rt} dt = E_T Y_t^e.
\]

If we further assume that the income grows annually at some constant rate, say \( g \), then

\[
Y_t^e = Y_T e^{gt}
\]

where \( Y_T \) is the current income of the household (income at age \( T \)). Then we have

\[
\int_T^L Y_t e^{-rt} dt = E_T Y_T e^{gt}.
\]

Substituting this value in (3.3), we get

\[
V_T = A_T + E_T Y_T e^{gt}.
\]  

(3.4)

If the values of \( A_T, E_T, Y_T, \) and \( g \) are known then the present value of lifetime resources (i.e., \( V_T \)) is also determined.

Given the household lifetime resources, the household has to make intertemporal consumption decisions that are affordable throughout its life-cycle. The household would spend some of these resources on its lifetime consumption and
plan to leave some of the resources as bequests. Therefore, the corresponding budget constraint is

\[ V_T = \int_T^L m_t \left( \frac{C_t}{m_t} \right) e^{-rt} dt + B_L e^{-rL} \]

(3.5)

\[ = \int_T^L m_t c_t e^{-rt} dt + B_L e^{-rL}. \]

(To simplify notation the limits of integration will no longer be indicated unless they are other than \( T \) and \( L \).) Under the assumption that the household can borrow and lend freely, maximization of (3.2) subject to (3.5), which is equivalent to setting up a Lagrangian function

\[ \mathcal{L} = \int m_t f(c_t)e^{-pt} dt + u(B_L) + \lambda \left( V_T - \int m_t c_t e^{-rt} dt - B_L e^{-rL} \right) \]

and maximize it with respect to \( c_t, B_L \) and \( \lambda \), yields the first order conditions:

\[
\begin{align*}
  m_t f'(c_t)e^{-pt} &= \lambda m_t e^{-rt} \\
  u'(B_L) &= \lambda e^{-rL} \\
  V_T &= \int m_t c_t e^{-rt} dt + B_L e^{-rL}
\end{align*}
\]

(3.6)

Here \( \lambda \) is the Lagrange multiplier, and \( f'(c_t) \) is the partial derivative of \( f(c_t) \) with respect to \( c_t \), i.e., marginal utility of consumption per equivalent adult. Similarly, \( u'(B_L) \) is the marginal utility of bequests. Equations in (3.6) need some economic interpretation as well.
Using the Envelope theorem, $\lambda$ can be interpreted as the derivative of $U$ with respect to $V_T$; therefore, $\lambda$ is the marginal utility of (discounted) resources. The first equation in (6.3) says that at every point along the optimal consumption path, the discounted marginal utility of per adult consumption equals the present value of an extra unit of resources. Similarly, the second equation says that this present value of an extra unit of resources should equal to the marginal utility of bequests. The third equation asserts that the budget constraint represented by (3.5) should always be satisfied at every point along the optimal consumption path. Solving the equations in (3.6) we can derive the corresponding consumption function.

3.2 Model Specification

3.2.1 Theoretical Model

If we know the specification of the household's utility function, we can obtain a clearer picture of the optimal consumption path. Since we can subject a utility function to any monotonically increasing transformation without affecting the nature of its demand functions but will simplify our problem,\footnote{See, for example, Silberberg (1990: 311) for the proof of this assertion.} we shall take the logarithm of this function. Therefore, let $f(c_t) = a \ln c_t$, and $u(B_L) = ab \ln B_L$. Here $a$ and $ab$ denote the elasticities of utility with respect to consumption and bequests respectively. Then the first order conditions for utility maximization, as shown by equation (3.6), can be written as
From (3.7) it is simple to show that

\[ c_t = c_0 e^{(r-\rho)t}. \]

Substituting \( c_t = C_t/m_t \), we get

\[ C_t = c_0 m_t e^{(r-\rho)t} \]
\[ = \left( \frac{a}{\lambda} \right) m_t e^{(r-\rho)t}. \]  

(3.8)

Equation (3.8) shows that consumption per equivalent adult grows at a constant rate \( r - \rho \), whereas total household consumption also depends on household composition. Comparing consumption at two different time periods \( i \) and \( j \), we have

\[ \frac{C_i}{C_j} = \frac{m_i}{m_j} e^{(r-\rho)(i-j)}. \]  

(3.9)

From (3.9) it also follows that

\[ C_t = C_0 (m_t/m_0) e^{(r-\rho)t}. \]  

(3.10)

This gives us the household consumption path over time. The rate of time preference, \( \rho \), together with the market rate of discount, \( r \), is needed to make
intertemporal consumption decisions. A comparative statics analysis shows that depending upon the values of \( p \) and \( r \) the household can reallocate its consumption over its life-cycle. If \( r \) is greater than \( p \), then future consumption (total as well as per equivalent adult) will be greater than present consumption, whereas the reverse will follow if \( r \) is less than \( p \). Equations (3.8) and (3.10) also show that the relative consumption paths (total and per equivalent adult) are independent of consumption elasticity and the bequest elasticity (\( a \) and \( ab \) respectively).

From (3.7) and (3.10) it follows that

\[
B_L = b(C_0/m_0)e^{rt}.
\]  

(3.11)

Substituting the values of \( C_t \) from (3.10) and \( B_L \) from (3.11) into (3.5), the budget constraint will be

\[
V_T = \int C_t e^{-rt} dt + B_L e^{-rL} = \left( \frac{a}{\lambda} \right) \left[ \int m_t e^{-\rho t} dt + b \right].
\]

Therefore,

\[
\frac{C_t}{V_T} = \frac{\left( \frac{a}{\lambda} \right) m_t e^{(r-\rho)t}}{\left( \frac{a}{\lambda} \right) \left[ \int m_t e^{-\rho t} dt + b \right]} = \frac{m_t e^{(r-\rho)t}}{\left[ \int m_t e^{-\rho t} dt + b \right]}.
\]  

(3.12)

Alternatively,

\[
C_t = \frac{m_t e^{(r-\rho)t}}{\left[ \int m_t e^{-\rho t} dt + b \right]} V_T.
\]  

(3.13)
This model shows that the fraction of lifetime resources consumed at any age of the household is approximately equal to the ratio of equivalent adults at that age to the sum of lifetime equivalent adults and the bequest motives. Put it differently, if the household can forecast lifetime resources, lifetime equivalent adults including the bequest parameter, then it will allocate consumption consistent with its demographic profile. Any change in the demographic profile, therefore, directly influences the pattern of consumption.

Equation (3.13) can be rewritten as

\[ C_t e^{-\rho T} = \frac{m_t e^{-\rho t}}{[\int m_t e^{-\rho t} dt + b]} V_T. \]  

(3.14)

This is a Fisher-type (1956) specification of consumption function. My specification differs from his in the sense that I have allowed for bequests in my model, whereas he has not. Fisher's specification is a special case of my specification when \( b = 0 \). This functional form needs some interpretation as well.

The left-hand side represents the household consumption at period \( t \) discounted to present time. Note that \( T \), the age of the household head, is the current time (or the initial period) in this analysis.

On the right-hand side, the numerator of the coefficient of \( V_T \) (i.e., \( m_t e^{-\rho t} \)) denotes the number of equivalent adults at time \( t \) (but discounted properly) to present time \( T \). Likewise, the denominator represents the total number of equivalent adults in the family's entire life-cycle, including bequests. It should be noted that \( b \) has the same unit (years of adult equivalent consumption) as \( m_t \) has. It can be interpreted as the number of equivalent adult years of consumption.
that an average family leaves as a bequest. Obviously, bequest does not appear as a variable in this model.

3.2.2 Econometric Model

Rearranging equation (3.13), we get

\[ C_t = e^{(r - \rho)t} \left( \frac{m_t}{M_t} \right) V_T \]

where \( M_t = \int m_t e^{-\rho t} dt + b \). Focusing the consumption on the current period \( T \) implies

\[ C = \left( \frac{m}{M} \right) V. \]  

(3.15)

The complete theoretical model is specified by substituting the value of \( V_T \) from equation (3.4) in equation (3.13) to obtain

\[ C = \left( \frac{m}{M} \right) [A + E(1 + g)Y] \]  

(3.16)

where expected income differs from unexpected income by a small fraction \( g \). Divide this equation by \( Y \) to get

\[ \frac{C}{Y} = \left( \frac{m}{M} \right) \left[ \frac{A}{Y} + E(1 + g) \right]. \]

Taking the natural logarithm of this equation yields

\[ \ln \left( \frac{C}{Y} \right) = \ln \left( \frac{m}{M} \right) + \ln \left[ \frac{A}{Y} + E(1 + g) \right]. \]  

(3.17)
If we switch from continuous to discrete formulation, then the fully specified econometric model for the empirical purposes can be written as

\[
\ln \left( \frac{C}{Y} \right) = \ln \left( \frac{k_1N_1 + k_2N_2 + k_3N_3 + k_4N_4}{k_1SN_1 + k_2SN_2 + k_3SN_3 + k_4SN_4 + b} \right) + \ln[k_5(\frac{A}{Y}) + k_6E]
\]  

(3.18)

where \( N_1, N_2, N_3, \) and \( N_4 \) are the numbers of children of ages 0–9, teenagers 10–19, adult males, and adult females respectively; \( SN_1, SN_2, SN_3, \) and \( SN_4 \) are their respective expected lifetime numbers discounted by the rates of time preference. If we constrain \( k_3 \) equal to one, then \( k_1, k_2, \) and \( k_4 \) can be interpreted as equivalent male adult consumption by children of ages 0–9, teenagers, and adult females; \( k_5 \) is the effect of the net assets-current income ratio on consumption; \( k_6 \) is the growth rate of future income measured as the effect of the household’s life expectancy on consumption; and \( b \) can be interpreted as the number of equivalent adult years of consumption that an average family leaves as bequests. Note that bequest does not appear as a variable in this model.

Equation (3.18) is the fully specified empirical model of life cycle consumption. The model shows that the consumption ratio, \( C/Y \), consists of two parts. The first part of the right hand side expression can be viewed as the demographic component of the consumption model, and the second part can be viewed as the economic component. The values of the variables \( C, A, Y, N_1, N_2, N_3, \) and \( N_4 \) are available from the household survey; \( E \) can be calculated from the age and the life expectancy of the head; and \( SN_1, SN_2, SN_3, \) and \( SN_4 \) are determined by the future household composition. Projection of future household composition is described in Chapter 5.
If we assume that $g = 0$ then theoretically $k_5$ and $k_6$ will have same parameter. Therefore, a separate model is estimated by constraining $k_5 = k_6$. The rationale for imposing this constraint is that, because we are assuming that $g$ is small, the hypothesis that $g = 0$ is tested by this constrained model.

The introduction of demographic factors modifies the model in such a way that the marginal propensity to consume depends upon the number of equivalent adults relative to future lifetime equivalent adults ($m/M$). It should be noted, however, that expected demographic profiles (lifetime equivalent adults, $M$) will be revised for each period to incorporate new information and to reflect the probability distribution of future household composition.
CHAPTER 4

HOUSEHOLD SURVEY

Empirical research is needed to fulfill our objectives and to estimate the equation specified in the preceding chapter. Accordingly, a data set on household composition, socioeconomic variables, income, and expenditures is required.

Choosing between a cross-section and a time-series study is the first problem for such a study. A cross-section study is the analysis of data collected from a population at a period in time, which purports to represent the state of affairs prevailing in the population at that moment. Time-series analysis is the statistical analysis of a series of repeated observations of the same variable, or, in the case of multiple time-series analysis, a set of variables.

Ideally, a life-cycle model requires a set of time-series data on household composition, consumption expenditures, lifetime income, savings, and net worth for a period covering the households' entire life span. Nepal is poor not only in material things but also in research data. It does not have a well-developed statistical system nor a long tradition of survey analysis. It is also very expensive to do panel studies. Since such data are not available for Nepal, a field study was conducted by me during the period of 1987–88 to collect data on the demographic and economic characteristics of households. This chapter presents the salient features of my field survey (Kanel, 1988), which is cited as Household Survey, 1987–88.
4.1 Location, and Method of Data Collection

Kathmandu was selected as the field location for this study. The criteria for selecting Kathmandu as the field site are fairly obvious. First, Kathmandu, the capital city of Nepal, is the most cosmopolitan city in Nepal. Therefore, it would not be difficult to include households with different socioeconomic characteristics in my sample. Second, Kathmandu has a more monetized economy than other areas of Nepal. Thus, it is easier to get information on income, assets, and expenditures. Third, because of a better transportation and communication system than elsewhere in the country, it is easier to work in or near Kathmandu. Government offices and organizations, research institutions, libraries, and academic intelligentsia cannot be better available elsewhere in Nepal than in Kathmandu.

Information was collected by both household survey as well as through secondary sources. The primary method of household survey was structured interviews. A pretested questionnaire translated into the Nepali language was taken to the field site. Information was collected on economic (income and expenditure patterns), demographic (family size and composition, information on nuptiality, and desired family size), and socioeconomic status (ethnicity, mother tongue, educational attainment, and occupation) of household head and its members. A questionnaire was designed to capture necessary information for this purpose. The Freedman and Mueller (1977) module was used as the basic guideline while designing the questionnaire. Nevertheless, several modifications and changes were made in the module to satisfy the data requirements for this study. The questionnaires were translated into the Nepali language and redesigned after a
pretest to avoid any ambiguity and obscurity in the questions.\(^1\) The questionnaire used in the field is attached as an Appendix to this dissertation. Data on national and district levels are taken from published sources.

Households are the units of analysis for this study. The main objective was to interview a sample of households of Kathmandu Valley. Since there was no complete up-to-data list of all households, it was necessary to draw a sample of all Kathmandu households. This was not possible because of financial and time constraints. Therefore, it was necessary to select a small sample.

Household survey was designed to obtain data on demographic and economic variables for a sample representing all non-institutional households in Kathmandu. The survey methodology as described in Palmore (1969) has been followed and employed as the basic guideline while conducting field survey.\(^2\) This section provides a brief description on the survey methodology.

The household survey is based on a sample of all non-institutional households in Kathmandu. The sample size was set to a reasonable level so that reliable estimates of population parameters could be made. This average level was set at about 700 households so that my sample would have 600 households at the minimum. Three enumerators were temporarily hired to help me interview the selected households.

In order to arrive at a sufficient sample of intensive interview with household heads, it was necessary to visit more households than the number of interviews wanted. Although the goal was to obtain about 700 interviews in total, 800 sample addresses were selected in the sample to allow for losses due to no-responses.

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\(^1\) I did a pretest of twenty households before the actual survey was conducted.

and incompletes. Even though there was no firm factual basis to support the initial estimate that a sample size of 800 would yield to a minimum of 600 interviews the survey yielded a total of 614 intensive interviews which was within the target range.³

To save time and travel costs during the field study, the sample space contained of a judgment sample of 40 blocks of 20 households each. These blocks, which included rural as well as urban households with different socioeconomic characteristics, were selected from different parts of the Kathmandu valley. The actual sample of households was drawn starting at a random point in a complete listing of all households in the sample blocks and a systematic random sample was taken from that point on.

Our interview basically concentrated on the household head or his spouse, who had better knowledge about household income and expenditures as well as household demographics. Sometimes, we could not find either of them. In such cases, we revisited the household for interviewing. If neither of them was available even on the second visit, we asked another adult member of the household to respond to our questions and collected information from that respondent. If that member could not answer all of the questions in the questionnaire, we omitted that household from our list and interviewed a neighboring household instead. On the average, each interview lasted about one hour and thirty minutes.

The survey was conducted from November 1987 to March 1988 in all three districts of the Kathmandu Valley.⁴ All households were interviewed personally and responses were recorded in structured questionnaires. Every effort was made

---
³ Incidentally, this number is 0.5 percent of the total households of Kathmandu Valley as of the 1981 census.
⁴ A district is an administrative unit, and there are 75 such districts in Nepal. Kathmandu, Lalitpur, and Bhaktapur—all in Kathmandu Valley—are three of them.
to interview all selected households living in each specified block. All completed questionnaires were checked, cross-checked, and scrutinized on the same day. The questionnaires with incomplete responses were taken back to the respondent household for completion. Most of the respondents helped complete the questionnaires. Discarding incomplete responses, the total number of completed questionnaires turned out to be 614.\(^5\)

<table>
<thead>
<tr>
<th>District</th>
<th>Household Survey Number</th>
<th>Percent</th>
<th>1981 Census Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kathmandu</td>
<td>514</td>
<td>83.71</td>
<td>67,933</td>
<td>55.26</td>
</tr>
<tr>
<td>Lalitpur</td>
<td>58</td>
<td>9.45</td>
<td>29,943</td>
<td>24.36</td>
</tr>
<tr>
<td>Bhaktapur</td>
<td>42</td>
<td>6.84</td>
<td>25,047</td>
<td>20.38</td>
</tr>
<tr>
<td>Total</td>
<td>614</td>
<td>100.00</td>
<td>122,923</td>
<td>100.00</td>
</tr>
</tbody>
</table>


Table 4.1 depicts the distribution of households in Kathmandu Valley. This table also shows that our sample is not representative of the district level households in Kathmandu Valley. Therefore, these numbers merit some explanation.

Kathmandu is the biggest among these three districts. It has been bigger because of the change in district boundaries since the census of 1981. Large immigrations in Kathmandu city has led to a higher growth rate of population and households in Kathmandu than in the adjoining districts. Therefore, Kathmandu is given more representation than its counterpart districts. Moreover, we are not

\(^5\) It was later discovered that one household did not provide enough information on income and expenditures; therefore, that household is excluded from the consumption analysis.
interested in doing any comparative analysis across districts; therefore, this distribution of surveyed households should not really matter. Otherwise, we could have calculated and used a proper weight to take care of the over-representation of Kathmandu and the under-representation of Lalitpur and Bhaktapur. The purpose of reporting this table is to present an overview of the household distribution in Kathmandu Valley.

<table>
<thead>
<tr>
<th>Age</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>1</td>
<td>0.16</td>
</tr>
<tr>
<td>20-24</td>
<td>11</td>
<td>1.79</td>
</tr>
<tr>
<td>25-29</td>
<td>37</td>
<td>6.03</td>
</tr>
<tr>
<td>30-34</td>
<td>72</td>
<td>11.73</td>
</tr>
<tr>
<td>35-39</td>
<td>57</td>
<td>9.28</td>
</tr>
<tr>
<td>40-44</td>
<td>83</td>
<td>13.52</td>
</tr>
<tr>
<td>45-49</td>
<td>59</td>
<td>9.61</td>
</tr>
<tr>
<td>50-54</td>
<td>85</td>
<td>13.84</td>
</tr>
<tr>
<td>55-59</td>
<td>66</td>
<td>10.75</td>
</tr>
<tr>
<td>60-64</td>
<td>56</td>
<td>9.12</td>
</tr>
<tr>
<td>65-69</td>
<td>29</td>
<td>4.72</td>
</tr>
<tr>
<td>70-74</td>
<td>25</td>
<td>4.07</td>
</tr>
<tr>
<td>70+</td>
<td>33</td>
<td>5.37</td>
</tr>
<tr>
<td>Total</td>
<td>614</td>
<td>100.00</td>
</tr>
</tbody>
</table>


Life-cycle analysis of household composition and family consumption behavior requires that the survey cover various ages of household heads. Table
4.2 presents a quinquennial sample distribution of age of heads. These numbers could not be compared with the national or district level numbers, because census or published figures on such data are not available.

4.2 Household Characteristics

Household characteristics include household type, and the size and composition of the household. It often includes education and occupation of the household members (including the head), and their relationship to the head. Differences in household characteristics affect the consumption pattern of a household over time and across households at a period in time. This section describes the characteristics that affect the household consumption decisions, although we have not explicitly included all of these factors into our model.

4.2.1 Household Types

Four types of households are distinguished: (1) intact households, households headed by a male with the spouse present; (2) single-headed households, households in which the head’s spouse is not present; (3) one-person households; and (4) primary-individual households, households consisting of unrelated members. The distribution of households according to their types is presented in Table 4.3.

Of the households sampled, 99.35 percent are family households (Table 4.3). Only four households in the sample are primary-individual households. Of the 610 family households, 298 (48.85 percent) are nuclear and 312 (51.15 percent) are extended. Households with no members other than a head, a spouse, unmarried children (including adopted children), or helpers/servants are defined as nuclear households. On the other hand, households where three or more generations live
Table 4.3
Distribution of Household Types

<table>
<thead>
<tr>
<th>Household Type</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Family households</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intact</td>
<td>501</td>
<td>81.60</td>
</tr>
<tr>
<td>Single-head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>48</td>
<td>7.82</td>
</tr>
<tr>
<td>Female</td>
<td>61</td>
<td>9.93</td>
</tr>
<tr>
<td>All family households</td>
<td>610</td>
<td>99.35</td>
</tr>
<tr>
<td><strong>Nonfamily households</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary-individuals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4</td>
<td>0.65</td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>One-person</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>All nonfamily households</td>
<td>4</td>
<td>0.65</td>
</tr>
<tr>
<td><strong>All households</strong></td>
<td>614</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>Sex of household head</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>553</td>
<td>90.07</td>
</tr>
<tr>
<td>Female</td>
<td>61</td>
<td>9.93</td>
</tr>
<tr>
<td><strong>All family households</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended</td>
<td>312</td>
<td>51.15</td>
</tr>
<tr>
<td>Nuclear</td>
<td>298</td>
<td>48.85</td>
</tr>
</tbody>
</table>


together are extended households. This category also includes households with joint families. Family households not otherwise included in nuclear households are also a component of extended family households. There are no one-person households in our sample.

As a typical household begins its life-cycle, its size will increase from two to more with births and adoptions. However, a new household formed out of an
extended and/or joint family household can begin with any number of members. New members will appear in the household, and the household will continue to grow until a member dies or departs from the household, or a split-up occurs in the household. Table 4.4 shows the distribution of household size in Kathmandu.

Table 4.4
Distribution of Household Size

<table>
<thead>
<tr>
<th>Persons</th>
<th>Household Survey</th>
<th>1981 Census</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>2.12</td>
</tr>
<tr>
<td>3</td>
<td>32</td>
<td>5.21</td>
</tr>
<tr>
<td>4</td>
<td>91</td>
<td>14.82</td>
</tr>
<tr>
<td>5</td>
<td>114</td>
<td>18.57</td>
</tr>
<tr>
<td>6</td>
<td>109</td>
<td>17.75</td>
</tr>
<tr>
<td>7</td>
<td>79</td>
<td>12.87</td>
</tr>
<tr>
<td>8</td>
<td>59</td>
<td>9.61</td>
</tr>
<tr>
<td>9</td>
<td>30</td>
<td>4.89</td>
</tr>
<tr>
<td>10</td>
<td>29</td>
<td>4.72</td>
</tr>
<tr>
<td>11+</td>
<td>58</td>
<td>9.44</td>
</tr>
<tr>
<td>Total</td>
<td>614</td>
<td>100.00</td>
</tr>
</tbody>
</table>


Table 4.4 reports a comparative distribution of household size as shown from the household survey and the 1981 census. The table shows that the survey data do not represent the household composition (household size and age–sex structure) of Kathmandu. Various remedial procedures are suggested to take care of such a situation when a sample seems to be non-representative of the population. One method is to assign proper weights on sample observations depending upon
specific characteristics of the observations provided that we have enough information on both the population and the sample regarding those characteristics. Using my sample and the 1981 census figures for the Kathmandu valley a new weight variable is calculated, following Kalton (1983), from the age distribution of household population and the distribution of household size. This weight is later used to analyze our data and draw statistical inferences therefrom.

My survey showed a total of 4,075 persons in 614 households. The average household size is 6.6 members with median 6 and mode 5. This indicates that the distribution is positively skewed, which is consistent with what one would expect in a growing population. The average household size for Kathmandu and Nepal, according to the 1981 census, are 6.3 and 5.8 respectively (CBS, Nepal, 1984).

<table>
<thead>
<tr>
<th>Status</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never been married</td>
<td>7</td>
<td>1.14</td>
</tr>
<tr>
<td>Currently married</td>
<td>501</td>
<td>81.60</td>
</tr>
<tr>
<td>Widow/Widower</td>
<td>97</td>
<td>15.80</td>
</tr>
<tr>
<td>Separated</td>
<td>1</td>
<td>0.16</td>
</tr>
<tr>
<td>Divorced</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>No Response</td>
<td>8</td>
<td>1.30</td>
</tr>
<tr>
<td>Total</td>
<td>614</td>
<td>100.00</td>
</tr>
</tbody>
</table>


Of the total 614 households, there are 501 (81.60 percent) intact households, where both the head and the spouse are present (Table 4.3). Sixty-one (9.93 percent) households are headed by single females (with no spouse present), and
48 (7.82 percent) households by single males. Table 4.5 shows the marital status of the heads of surveyed households. More than 80 percent of the heads are currently married.

Table 4.6
Average Number of Household Members by Their Relationship to the Household Head

<table>
<thead>
<tr>
<th>Relationship to Head</th>
<th>Average Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>1.00</td>
<td>15.07</td>
</tr>
<tr>
<td>Spouse</td>
<td>0.83</td>
<td>12.54</td>
</tr>
<tr>
<td>Children&lt;sup&gt;(a)&lt;/sup&gt;</td>
<td>2.76</td>
<td>41.64</td>
</tr>
<tr>
<td>Parents&lt;sup&gt;(a)&lt;/sup&gt;</td>
<td>0.08</td>
<td>1.23</td>
</tr>
<tr>
<td>Grandchildren</td>
<td>0.85</td>
<td>12.79</td>
</tr>
<tr>
<td>Daughters-in-law</td>
<td>0.44</td>
<td>6.70</td>
</tr>
<tr>
<td>Brothers and Sisters</td>
<td>0.18</td>
<td>2.67</td>
</tr>
<tr>
<td>Brothers/Sisters-in-law</td>
<td>0.04</td>
<td>0.66</td>
</tr>
<tr>
<td>Other Relatives&lt;sup&gt;(b)&lt;/sup&gt;</td>
<td>0.15</td>
<td>2.33</td>
</tr>
<tr>
<td>Others&lt;sup&gt;(c)&lt;/sup&gt;</td>
<td>0.22</td>
<td>3.36</td>
</tr>
<tr>
<td>No Response</td>
<td>0.07</td>
<td>1.01</td>
</tr>
<tr>
<td>Total</td>
<td>6.64</td>
<td>100.00</td>
</tr>
</tbody>
</table>


<sup>(a)</sup> Adopted children are included in children, and parents-in-law in parent categories.

<sup>(b)</sup> "Other relatives" includes all relatives excluding those that have otherwise been included.

<sup>(c)</sup> "Others" includes non-relatives such as friends, helpers and servants.

Table 4.6 depicts the family relationship among household members. Of the 6.64 persons per household, every household has one, and only one, head. The average number of spouses per household is 0.83. This is because some of the
heads do not have their spouses. The remaining members are children of the head (2.76), parents (0.08), grandchildren (0.85), daughters-in-law (0.44), brothers and sisters (0.18), brothers/sisters-in-law (0.04), other relatives (0.15), and others (0.22). Since "others" constitute a very small proportion of the household members, it also reconfirms that "household" and "family" can be taken as equivalents in Nepal.

4.2.2 Ethnicity and Mother Tongue of Heads

Nepal is the only Hindu country in the world. It consists of many ethnic groups, and different castes. Ethnicity, in the present context, is loosely defined and is associated more with caste. Some of the heads did not specify their caste, but gave only their religion as "Hindu". Hindu religion includes Brahmans, Chhetris, and many other ethnic groups.

There are many languages spoken in Nepal but Nepali is the only official and national language. It is spoken and understood by almost all people. However, different ethnic groups have their own mother tongue. Table 4.7 is a cross-tabulation that shows the ethnicity of households with their mother tongues.

Table 4.7 illustrates that there is a strong association between ethnicity and mother tongues. It also points some interesting features. Brahman and Chhetri's mother tongue is always Nepali (except for those two Chhetri households who told us during the interview that they had just in-migrated from the Terai where they used to speak Bhojpuri). The proportion of households having their mother

---

6 It should also be noted that some people in Nepal have more than one wife. There were 9 household heads in my sample who have two wives. In such cases, the wife whose age is most close to the husband's age is designated as wife, which will supposedly better explain the life-cycle behavior of the household, and the other wife is designated as "other relative".
Table 4.7
Ethnicity and Mother Tongue of Households

<table>
<thead>
<tr>
<th>Mother Ethnicity</th>
<th>Brahman</th>
<th>Chhetri</th>
<th>Newar</th>
<th>Hindu*</th>
<th>Others†</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nepali</td>
<td>222</td>
<td>166</td>
<td>21</td>
<td>40</td>
<td>28</td>
<td>477</td>
</tr>
<tr>
<td>Newari</td>
<td>0</td>
<td>0</td>
<td>119</td>
<td>0</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>Others†</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>222</td>
<td>168</td>
<td>140</td>
<td>43</td>
<td>41</td>
<td>614</td>
</tr>
</tbody>
</table>

(0.36) (0.27) (0.23) (0.07) (0.07) (1.00)

Note: Numbers in parentheses indicate the proportion of households in the given category.

* Those who preferred to call themselves Hindu.
† Includes Gurungs, Tamangs, lower castes, and Muslims.
‡ Includes Tamang, Maithili, Bhojpuri, and Urdu.

tongue other than Nepali and Newari is very small in Kathmandu. Newari is the mother tongue of Newars only. Only 3 percent of the households have a mother tongue other than Nepali or Newari. About 93 percent of the households belong to either the Brahman and Chhetri clan, the Newar group, or (as they chose to call themselves as) Hindu.

4.2.3 Educational Attainment of Heads

In Nepal, education falls into four general categories: primary (grade 1 to 5), lower secondary (middle school, grade 6-7), secondary (high school, grade 8-10), and higher education (college and university). The new education plan, which introduced vocational education at school level, was introduced in 1972.

7 In Nepal "school" implies until high school only. After that they are called colleges or universities.
Primary education is now compulsory, and tuition and books are free for grades 1 through 3. Beyond primary education, moderate tuition charges are levied in public lower secondary and secondary schools. The 1972 plan introduced an American-type of semester system (two semesters in one year) in the higher education level. In 1981 the semester system was replaced by British-type annual system.

The literacy rate of Nepal is only 23.5 percent, according to the 1981 census. The census also shows that literacy rate for Kathmandu is 49.0 percent, Lalitpur 36.3 percent, and Bhaktapur 32.0 percent. Recently this rate is increasing every year. Table 4.8 presents the years of schooling of all household members and heads under our present study.

<table>
<thead>
<tr>
<th>Years of Schooling</th>
<th>Heads</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Illiterate</td>
<td>103</td>
<td>16.78</td>
</tr>
<tr>
<td>Literate Only</td>
<td>172</td>
<td>28.01</td>
</tr>
<tr>
<td>0–4</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>5–7</td>
<td>9</td>
<td>1.47</td>
</tr>
<tr>
<td>8–10</td>
<td>92</td>
<td>14.98</td>
</tr>
<tr>
<td>11–14</td>
<td>142</td>
<td>23.12</td>
</tr>
<tr>
<td>15+</td>
<td>93</td>
<td>15.15</td>
</tr>
<tr>
<td>No Response</td>
<td>3</td>
<td>0.49</td>
</tr>
<tr>
<td>Total</td>
<td>614</td>
<td>100.00</td>
</tr>
</tbody>
</table>


* This includes children under school age.
Table 4.8 shows that proportionately more heads are literate and educated than is the case for the general population. This is a plausible observation because the total population includes small children and aged persons who are proportionately more illiterate than the young population. About 67 percent of the respondents are literate. This higher literacy rate could be because of an increase in the literacy rate of Kathmandu’s population, or due to a high proportion of urban population in our sample, or due to large in-migration of literate and educated population in Kathmandu, or any combination of the above factors. This increase in the literacy rate seems to be plausible.

4.2.4 Occupation of Heads

The occupation of a household head is the major type of work performed by the person at his/her principal job. The occupation of a head is recorded as answered by the respondent.

Unlike other capital cities, Kathmandu has a substantial proportion of its population engaged in agriculture. There are some special caste groups of people whose traditional occupation is agriculture. Households with little or no education and a very low opportunity cost engage in agriculture, producing especially vegetables. It is a very profitable business because of the soaring prices of green vegetables in Kathmandu.

Table 4.9 shows the distribution of occupations of household heads. Farmers constitute the second largest group after office employees. Civil servants and other employees in offices and institutes constitute 40.55 percent of the total heads. The proportion of the population in other professions (journalists, lawyers, engineers, and medical doctors) constitutes only 0.81 percent. Retirees
Table 4.9
Occupation of Household Heads

<table>
<thead>
<tr>
<th>Type of Occupation</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>106</td>
<td>17.26</td>
</tr>
<tr>
<td>Housewives</td>
<td>76</td>
<td>12.38</td>
</tr>
<tr>
<td>Wage-earners</td>
<td>6</td>
<td>0.98</td>
</tr>
<tr>
<td>Employees</td>
<td>249</td>
<td>40.55</td>
</tr>
<tr>
<td>Students</td>
<td>4</td>
<td>0.65</td>
</tr>
<tr>
<td>Business</td>
<td>90</td>
<td>14.66</td>
</tr>
<tr>
<td>Politics</td>
<td>8</td>
<td>1.30</td>
</tr>
<tr>
<td>Industry</td>
<td>6</td>
<td>0.98</td>
</tr>
<tr>
<td>Retired</td>
<td>21</td>
<td>3.42</td>
</tr>
<tr>
<td>Professionals*</td>
<td>5</td>
<td>0.81</td>
</tr>
<tr>
<td>Teaching</td>
<td>21</td>
<td>3.42</td>
</tr>
<tr>
<td>Unemployed</td>
<td>5</td>
<td>0.81</td>
</tr>
<tr>
<td>Others**</td>
<td>15</td>
<td>2.44</td>
</tr>
<tr>
<td>No Response</td>
<td>2</td>
<td>0.33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>614</td>
<td>100.00</td>
</tr>
</tbody>
</table>


* This includes journalists, lawyers, engineers, and medical doctors.

** This includes shoemakers, butchers, priests, tailors, drivers, masons, and blacksmiths.

and most female heads, accounting for 12.38 percent, stay home and take care of the children and the household.

4.3 Household Income, Expenditures, and Net Assets

Data were collected on household income, expenditures, and the net assets of all households. One household did not provide enough information on income.
and expenditures; therefore, the total number of households answering these questions is 613.

Household income is the sum of (1) wages and salaries, tips, bonuses, pensions, etc.; (2) net profits from farming and non-farming activities; (3) property income, such as land rent, house rent, royalties, interest, and dividends; (4) transfer payments received, such as assistance payments, scholarships, and grants; (5) income-in-kind — the value of goods and services received as part of pay, home produced and consumed (including the rental value of owner-occupied and free dwellings), or received free from other sources; and (6) other money receipts such as insurance proceeds, lottery winnings, and other windfall receipts. Household total disposable income is the total household income minus taxes paid.

Household expenditures are total household expenditures, which include (1) the amount spent to purchase goods and services used for living purposes; (2) the value of goods and services received as part of pay, home-produced and consumed (including rental value of owner-occupied and free dwellings), or received free from other sources; and (3) the amount spent for contribution, insurance premiums, lottery tickets, interest on debts, and other non-consumption items. Non-monetary income (such as children’s contribution and adults’ involvement in housework), the value of exchange labor, and the rental value of owner-occupied houses and free housing have also been taken care of by including them both in income and expenditures when calculating household income and expenditures. All incomes and expenditures are annual.

The net assets of a household are defined as the difference between total assets and total liabilities (debt). Therefore, unlike income and expenditures, it
is a stock variable. All tangible property including household durables are total assets. Any debt that a household might have to repay is the liability.

4.3.1 Household Income

Questions about household (or personal) income are very sensitive. People do not want to reveal their income. It is also very difficult to obtain accurate figures for countries like Nepal where the economy is not fully monetized, and some sort of barter system, in one form or another, still exists. Vegetables grown in the backyard for one’s own consumption, a poultry farm with a couple of birds only for the household consumption of eggs, and some unpaid work rendered by friends and relatives, for example, not only create a problem of valuation for such goods and services but also underestimate the income of the household, at the micro level, and the gross domestic product (GDP), at the macro level. We tried, however, to capture all sources of income by asking different questions, including the sources and valuations of non-monetary income and the subjective monetary valuation of the housework done by its members. Table 4.10 shows the annual income distribution of households.

4.3.2 Household Expenditures

Collecting accurate information on household expenditures is also very difficult especially because a high proportion of goods and services are non-monetized. People grow and consume their own food, and drink milk from their own buffaloes or cows and do not keep track of these items. Some households do not even know the exact volume or value of their production. As in the case of household income, however, we tried to capture all different forms of household expenditures. Table
Table 4.10
Income Distribution of Households

<table>
<thead>
<tr>
<th>Income Group (Rs. per year)</th>
<th>Number of Households</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10,000</td>
<td>16</td>
<td>2.62</td>
</tr>
<tr>
<td>10,001 – 25,000</td>
<td>62</td>
<td>10.11</td>
</tr>
<tr>
<td>25,001 – 50,000</td>
<td>151</td>
<td>24.63</td>
</tr>
<tr>
<td>50,001 – 100,000</td>
<td>202</td>
<td>32.95</td>
</tr>
<tr>
<td>100,001 – 500,000</td>
<td>174</td>
<td>28.38</td>
</tr>
<tr>
<td>500,001 and above</td>
<td>8</td>
<td>1.31</td>
</tr>
<tr>
<td>Total</td>
<td>613</td>
<td>100.00</td>
</tr>
</tbody>
</table>


Note: US$1 = Rs. 24.60; and Rs. = Nepali Rupees.

4.11 presents the mean distribution of annual household expenditures by type. From the household survey, total expenditures per household are estimated to be about 77,748 rupees (US$3,160). As is characteristic of a developing country, a high proportion of income (37.89 percent) is spent on food, followed by 29.21 percent on housing and household operation costs, 5.61 percent on clothing, and 11.12 percent on miscellaneous items.

Education’s share is about 6 percent of total expenditures. People are aware of the value of education as a means of upward social and financial status. Most households encourage their children to pursue an education at least to the high school level. The investment on education, therefore, is expected to rise over time. Other expenditures account for about 10 percent of total expenditures.
### Table 4.11
**Distribution of Annual Expenditures**
(Per Household)

<table>
<thead>
<tr>
<th>Items</th>
<th>Amount (Rs.)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food †</td>
<td>29,459</td>
<td>37.89</td>
</tr>
<tr>
<td>Housing and housing operating cost ‡</td>
<td>22,709</td>
<td>29.21</td>
</tr>
<tr>
<td>Education</td>
<td>4,647</td>
<td>5.98</td>
</tr>
<tr>
<td>Clothing</td>
<td>4,363</td>
<td>5.61</td>
</tr>
<tr>
<td>Medical care</td>
<td>1,709</td>
<td>2.20</td>
</tr>
<tr>
<td>Transportation</td>
<td>2,238</td>
<td>2.88</td>
</tr>
<tr>
<td>Entertainment and recreation</td>
<td>1,172</td>
<td>1.51</td>
</tr>
<tr>
<td>Tax</td>
<td>498</td>
<td>0.64</td>
</tr>
<tr>
<td>Social activities and religious ceremonies</td>
<td>2,309</td>
<td>2.97</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>8,645</td>
<td>11.12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>77,748</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>


† Food includes market and non-market transactions.
‡ Includes rental value of owner-occupied houses.

#### 4.3.3 Household Net Assets

Because many people do not want to reveal their income, any question regarding income and assets is sensitive. Therefore, data on household net assets may be unreliable.

Table 4.12 shows the distribution of the net assets of Kathmandu households. Land, houses, and household items are the major household assets. Of the households surveyed, about 52.69 percent have a net wealth of more than
Table 4.12
Household Net Assets

<table>
<thead>
<tr>
<th>Net Assets (in Rs.)</th>
<th>Number of Households</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10,000</td>
<td>53</td>
<td>8.65</td>
</tr>
<tr>
<td>10,001 - 25,000</td>
<td>15</td>
<td>2.45</td>
</tr>
<tr>
<td>25,001 - 50,000</td>
<td>28</td>
<td>4.56</td>
</tr>
<tr>
<td>50,001 - 100,000</td>
<td>29</td>
<td>4.73</td>
</tr>
<tr>
<td>100,001 - 500,000</td>
<td>165</td>
<td>26.92</td>
</tr>
<tr>
<td>500,001 - 1,000,000</td>
<td>131</td>
<td>21.37</td>
</tr>
<tr>
<td>1,000,001 and above</td>
<td>192</td>
<td>31.32</td>
</tr>
<tr>
<td>Total</td>
<td>613</td>
<td>100.00</td>
</tr>
</tbody>
</table>


500,000 rupees (US$20,325). The mean value of these net assets is about 950,000 rupees (US$38,617) per household.

Table 4.13 summarizes the average income, expenditures, assets, and savings of the surveyed households. The table shows that the average income per household is about 95,711 rupees (US$3,890) per year. Because the average number of persons per household is 6.6, the average annual income per capita for the surveyed households is 14,502 rupees (US$590). This is significantly higher than the GNP (Gross National Product) figure for 1989 of US$160 (World Bank, 1989: 164–165). This “high income” is probably the result of four factors. The first factor is that more rich people live in Kathmandu. The second factor is that more people live in urban areas and are employed, and therefore, earn a regular salary. The third factor is that people exaggerate their income and expenditures. The fourth factor is that the GNP is calculated in a somewhat different way. It

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8 The average exchange rate during the period of household survey was 24.60 rupees per US dollar.
comprises gross domestic product plus net factor income from abroad, which is the income residents receive from abroad for factor services (labor and capital) less similar payments made to nonresidents who contributed to the domestic economy. Of this total earnings, about 34.30 percent is from business profits, 31.31 percent from salaries and wages, 13.21 percent from agriculture, and 21.18 percent from other sources.

Average total expenditures per household are 77,748 rupees (US$3,160). The general tendency of the respondents, when asked about their income-expenditure amounts, was to overstate expenditures. Therefore, the amount of average expenditures seems to be high; and savings seems to be low. When asked directly about their savings or dissavings during the past 12 months, 289 household heads (47.07 percent) asserted an amount of dissavings and 294 heads (47.88 percent) said that their income and expenditures would just break-even. The calculation of their balance sheet showed some savings. It means people are either exaggerating their income, or they are just not being honest when answering the questions regarding income and expenditures.

4.4 Inheritances and Bequests

Inheritances and bequests are two different sides of the same coin. Inheritances are defined as the property and household assets received by a head from his predecessor, whereas bequests are the property and household assets left by a household head, at the time of death, to his successor. Whatever is inherited by recipients is the bequests of their bestowers. Inheritances and bequests occur almost universally in Nepal. According to the tradition and culture, sons inherit the property and wealth of their parents and grandparents, even though recent
Table 4.13
Average Income, Expenditures, and Assets

<table>
<thead>
<tr>
<th>Item</th>
<th>Value (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Income</td>
<td>95,711</td>
</tr>
<tr>
<td>Agriculture</td>
<td>12,641</td>
</tr>
<tr>
<td>Salary and wages</td>
<td>29,968</td>
</tr>
<tr>
<td>Business profits</td>
<td>32,827</td>
</tr>
<tr>
<td>Others</td>
<td>20,275</td>
</tr>
<tr>
<td>Total Expenditures</td>
<td>77,748</td>
</tr>
<tr>
<td>Savings†</td>
<td>17,963</td>
</tr>
<tr>
<td>Assets:</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>966,830</td>
</tr>
<tr>
<td>Debt</td>
<td>16,847</td>
</tr>
<tr>
<td>Net Assets</td>
<td>949,983</td>
</tr>
</tbody>
</table>

† Savings is defined as annual savings and loan repayment.

amendments in the 1962 civil code of Nepal has given a provision that daughters also can inherit their parents’ property.

4.4.1 Inheritances

Questions on the year and type of inheritances were asked to all respondents. Many people could not figure out the value of their inherited property except for cash and jewelry. However, they tried to evaluate it according to the value of their neighbor’s property.

Table 4.14 shows the responses of household heads regarding their inheritances from their progenitors. Of the total 614 households, 250 households (40.72 percent) inherited some sort of property from their predecessors. When asked about their subjective valuation on the fairness of their share of the inheritance,
Table 4.14
Inheritance by Household Heads

<table>
<thead>
<tr>
<th>Response</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did some inheritance</td>
<td>250</td>
<td>40.72</td>
</tr>
<tr>
<td>Equal share</td>
<td>234</td>
<td>38.11</td>
</tr>
<tr>
<td>Received more</td>
<td>6</td>
<td>0.98</td>
</tr>
<tr>
<td>Received less</td>
<td>10</td>
<td>1.63</td>
</tr>
<tr>
<td>Not applicable†</td>
<td>208</td>
<td>33.88</td>
</tr>
<tr>
<td>Not yet divided‡</td>
<td>1</td>
<td>0.63</td>
</tr>
<tr>
<td>Others*</td>
<td>155</td>
<td>25.24</td>
</tr>
<tr>
<td>Total</td>
<td>614</td>
<td>100.00</td>
</tr>
</tbody>
</table>


† Includes independently formed households, joint families, and all those households that have not yet split-up.
‡ Corresponds to those households which are split-up but they have not yet divided the “common” property.
* “Others” comprises of no responses and don’t knows.

234 replied that the distribution was equal, 6 said that they received more-than-equal, whereas 10 complained that they received less-than-equal share.

4.4.2 Bequests

Because it is very difficult to enunciate the amount of bequests, questions were asked regarding intended bequests. Respondents were asked the open-ended question: “What type of and/or how much of assets do you intend to bequeath to your descendants?” This question was designed to be open-ended in order to elicit more idiosyncratic perspectives on individual views, goals, and family household relations. It should be noted from Chapter 3 that bequest appears only as an argument, not as a variable, in my econometric model. However,
the purpose of collecting information on bequests and reporting them here is to illustrate household heads' views and goals regarding bequests.

Table 4.15
Intended Bequests of Household Heads

<table>
<thead>
<tr>
<th>Types of Bequests</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>187</td>
<td>30.46</td>
</tr>
<tr>
<td>Education + land/house</td>
<td>68</td>
<td>11.08</td>
</tr>
<tr>
<td>Whatever is left</td>
<td>47</td>
<td>7.66</td>
</tr>
<tr>
<td>Land and house equally</td>
<td>43</td>
<td>7.00</td>
</tr>
<tr>
<td>A house each</td>
<td>26</td>
<td>4.23</td>
</tr>
<tr>
<td>Medical doctor</td>
<td>14</td>
<td>2.28</td>
</tr>
<tr>
<td>Make them independent</td>
<td>14</td>
<td>2.28</td>
</tr>
<tr>
<td>Business</td>
<td>13</td>
<td>2.12</td>
</tr>
<tr>
<td>Education + land + house</td>
<td>13</td>
<td>2.12</td>
</tr>
<tr>
<td>Higher education</td>
<td>12</td>
<td>1.95</td>
</tr>
<tr>
<td>Others†</td>
<td>71</td>
<td>11.56</td>
</tr>
<tr>
<td>No response/Don't know</td>
<td>96</td>
<td>15.64</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6.64</td>
<td>100.00</td>
</tr>
</tbody>
</table>


† Includes multiple combinations of all types of responses.

Table 4.15 summarizes the intended bequests of the respondent households. About 85 percent of all respondents replied that they would like to bequeath different types of wealth to their children. The remaining 15 percent either did not respond to the question or just replied, “I do not know.” It is remarkable that none of the household heads wanted not to bequeath anything to his children. Most of the respondents expected to educate their children rather than bequeathing money and real estate. The response also varied according to the occupation of the respondent and the level of his education. Only three heads
out of 614 answered that they would like to bequeath a stated amount of money. (Apparently one of them was not even serious about his answer because he jokingly responded that he would like to bequeath 100 million rupees.)

Descriptive statistics of my household survey were discussed in this chapter. The following chapter is devoted to projecting future household composition from the information collected in the survey.
CHAPTER 5

PROJECTING FUTURE HOUSEHOLD COMPOSITION

In projecting future household size and composition over the family life-cycle, we regard the fertility behavior of household head and his spouse and the post-nuptial living arrangements of their children as the main determinants of future household size. The fertility behavior of the head and his spouse and the rules governing living arrangements over the life-cycle are determined from Household Survey (1987–88) as well as the 1981 census (CBS, Nepal, 1984). The household survey data have been standardized by assigning appropriate weights to make the sample data more representative.¹ The HOMES package is used to generate household composition paths corresponding to different fertility levels of the surveyed households.

5.1 Structure of Nepali Households

The traditional, as well as the modern, form of the family in Nepal, both rural and urban, is the extended family consisting of three or more generations. The extended family system is the result of the influence of tradition and economic conditions. As far as post-marital residence is concerned, married sons live with their parents in the same household, and elderly parents live with their son’s family in the same household. Married women go in their husbands’ houses. Nepali is a patrimonial, patriarchal, and patrilocal society. Socially it is not advisable in Nepal to live in the wife’s parental home. The high co-residence

¹ A weight variable was calculated from the age distribution of the household population and the distribution of household size.
rate—the proportion of the elderly over 65 who reside with their children or other relatives—is mainly due to the traditional values accorded to the family and household in Nepal.

According to the household survey 99.35 percent (610 out of 614) of all households are family households. The rest are households consisting of primary individuals (i.e., unrelated individuals). There are no one-person households in the sample.

Family households are categorized into three types: (1) intact households, where both the head and the spouse are present, (2) single-female headed households, and (3) single-male headed households. The second and the third types of household heads do not have their spouses present.

### Table 5.1
Average Number of Household Members by Their Relationship to the Household Head

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Intact</th>
<th></th>
<th>Single Female Head</th>
<th></th>
<th>Single Male Head</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Head</td>
<td>1.00</td>
<td>15.40</td>
<td>1.00</td>
<td>13.62</td>
<td>1.00</td>
<td>13.95</td>
</tr>
<tr>
<td>Spouse</td>
<td>1.00</td>
<td>15.40</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Child</td>
<td>2.94</td>
<td>45.24</td>
<td>2.30</td>
<td>31.25</td>
<td>1.77</td>
<td>24.71</td>
</tr>
<tr>
<td>Grandchild</td>
<td>0.54</td>
<td>8.36</td>
<td>2.39</td>
<td>32.59</td>
<td>2.15</td>
<td>29.94</td>
</tr>
<tr>
<td>Parent</td>
<td>0.09</td>
<td>1.44</td>
<td>—</td>
<td>—</td>
<td>0.06</td>
<td>0.87</td>
</tr>
<tr>
<td>Other Relatives</td>
<td>0.66</td>
<td>10.17</td>
<td>1.44</td>
<td>19.64</td>
<td>1.98</td>
<td>27.62</td>
</tr>
<tr>
<td>Others</td>
<td>0.26</td>
<td>4.00</td>
<td>0.21</td>
<td>2.90</td>
<td>0.21</td>
<td>2.91</td>
</tr>
<tr>
<td>Total</td>
<td>6.49</td>
<td>100.0</td>
<td>7.34</td>
<td>100.00</td>
<td>7.17</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 5.1 depicts the size and structure of family households. Single-female headed households are the largest, exceeding seven members per household. Intact households have the greatest number of children (approximately three) per household. Parents and grandchildren comprise less than 10 percent of total members in intact households. But single-headed households have a significant proportion of their members in the grandchild category. Other relatives comprise between two-thirds of a member to about two members per household.

The table also reports that the number of children and grandchildren dominates the variation in household size. More than half of family household members are either children or grandchildren of the household head. The number of children per family household varies from 1.77 in single-male headed households to about 3 in intact households. Single-headed households are mostly headed by widows and widowers; therefore, these household heads are relatively older than their intact household counterparts. Some of the children of such household heads might have already left their parental household to form their own household. In addition, such household heads are not at the risk of childbearing.\(^2\) Therefore, the number of children per single-headed household is smaller than per intact household. Moreover, some of the heads of single-male headed households are young and never been married. This number is still smaller for such households. Because single-headed household heads are relatively older than intact household heads, single-headed households have more grandchildren per household than intact households.

The number of parents per household is quite low—less than 1.5 percent of all members are parents. In a society of high co-residence rates, this number

\(^2\) Unmarried parenthood is very uncommon in Nepal.
seems rather inconsistent. But if we visualize a society with a high fertility rate, and high prevalence of the extended and joint family systems, these numbers seem quite logical. The higher the fertility rate the lower will be the probability that any parent will live with a particular son because there will be more average number of children per household. The extended family system implies that multigenerations live in together in the same household; whereas joint family system means there could be other relatives in that household. Moreover, a very important factor is the age structure of the population. Not more than 4.0 percent of the population in Nepal is 65 or older. Therefore, these factors lead to a lower proportion of parents in family households.

Single–female headed households do not have parents as members. There may be two reasons for this. The first is that such households have not been included in the sample. The second reason, which I think is also very plausible, is that single females who have a parent or parent-in-law in the household are not usually designated as the household head. The parent or the parent-in-law will be designated as the head.

5.2 The Household Life-cycle

The information presented in the preceding section emphasizes the demographic characteristics of a household at any point in time; but many decisions of the household depend on expectations about the household’s future composition.

\[3 \text{ According to the 1981 census, the proportion of population that is 65 or older is 3.6 percent in Kathmandu, 3.8 percent in Lalitpur, 4.0 percent in Bhaktapur, and 3.2 percent nationwide (CBS, Nepal, 1984). The survey shows that this proportion is 3.6 percent for Kathmandu Valley (Household Survey, 1987–88).} \]
Households in the family-building stage of their life-cycle base their decisions on expectations about eventual household size and the future needs of members.

As the household moves along the family life-cycle, its size and composition changes. Figure 5.1 illustrates how the size and composition of intact households vary with the age of spouse of the head. The number of children increases during the childbearing period and then declines when some children leave their households, mostly daughters after marriage. Most sons remain in the same household even after they get married and have their children. Therefore, the

---

4 Because we have only 501 intact households in our sample the graph has lost some of the smoothness normal with a larger sample.
relative number of grandchildren increases at later stage of the household life-cycle.

There are significant numbers of other relatives in intact households. These other relatives include brothers and sisters (including in-laws), nephews and nieces, cousins, great grandchildren, and multiple wives. The number of other relatives decreases in households where the head’s spouse is in the 30–44 age group, and then rises again. Such a fall and rise in the number of other relatives is unlikely, but not altogether impossible. One possible explanation for this decline and incline in the number of other relatives may be because of some of the brothers and sisters or nephews and nieces or cousins might move out to another household or form their own. As the household head gets older, the remaining other relatives might start having their own children, thus, increasing the number of other relatives again.

5.3 Projecting the Expected Number of Household Members

Estimation of my consumption model requires the expected number of household members over the life-cycle of the household. Limited information about the household life-cycle can be obtained from household projections data using a sample survey. The cross-section data are then interpreted as though they were time-series data as in cohort analysis. Future membership profiles are estimated with respect to different fertility scenarios against the age of the marker. I have used the HOMES package to calculate the present value of the expected number of members in selected age–sex categories.

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6 Nine intact household heads in the survey sample have two wives each.

6 In intact households, the marker is the head’s wife; for other households, the head.

7 The following two paragraphs draw heavily from Mason (1987b: 1–2).
HOMES, A Household Model for Economic and Social Studies, is a demographic model and computer package developed by Mason (1987b) to project the number and demographic characteristics of households. This model treats the living arrangements of other members of the household in a comprehensive fashion. HOMES calculates different set... of various “rates” and intergenerational weights to determine the entire household membership—including the head, the spouse, children, grandchildren, parents, and other household members—in a fashion consistent with underlying fertility and mortality trends. Household membership is classified by the type of household and the age of the marker.

HOMES has been developed to deal with the projection of household composition in the developing country context. It emphasizes the effects of demographic change on both the number and the composition of households. Therefore, it is particularly well-suited for application to countries like Nepal, where extended or multigenerational families are prevalent. This model has been applied to a number of East and Southeast Asian countries, including Republic of Korea, Taiwan, Indonesia, Malaysia, Thailand, and the Philippines. However, it has not yet been applied to any of the South Asian countries.

Data requirements for HOMES consist of population projections that include age-specific fertility rates, and a recent census or large, representative survey that includes a household roster with the age, sex, and relationship to the household head of each household member. For this study, data on population projections and age-specific fertility rates available from published sources and data on household membership, including the age, sex, and relationship to the

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* HOMES distinguishes households into four types: (1) intact households, (2) single-headed households, (3) primary-individual households, and (4) one-person households.
household head of each household member, available from the household survey are used.

Some basic assumptions while applying HOMES to constructing curves should be underlined beforehand. For the present study, I have assumed that:

1. Household living arrangements as depicted by the 1981 census and the 1987–88 household survey will continue into the future;

2. Expected survival rate can be described by historical survival rates as reported by previous censuses;

3. In three-generation households, the fertility of the first and second generations are the same;

4. Historically observed age-specific fertility rates are the basis for the age pattern of childbearing to any childbearing level.

Based on these assumptions, HOMES is used to simulate a series of curves corresponding to selected age-specific fertility rates by using published data and the 1987–88 household survey data as essential inputs. Selected total fertility rates and age-specific fertility rates, as shown in Table 5.2, are chosen to cover all fertility levels of surveyed households.

The person-years of household membership, \( SN_{gr} \), is calculated by

\[
SN_{gr} = \sum_{t=r}^{T} e^{-\alpha(t-r)} N_{gr} P(H_{at})
\]

(5.1)

where \( N_{gr} \) is the expected number of members in each age-sex category\(^\ast\) among surviving households, \( P(H_{at}) \) is the probability that the household will survive

\(^\ast\) Four age-sex categories have been distinguished: children 0–9, teenagers 10–19, adult males 20 and over, and adult females 20 and over.
Table 5.2
Age-Specific Fertility Rates

<table>
<thead>
<tr>
<th>Age Group</th>
<th>2.0</th>
<th>3.0</th>
<th>4.0</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>54.8</td>
<td>63.7</td>
<td>75.8</td>
<td>82.9</td>
<td>72.0</td>
<td>84.0</td>
</tr>
<tr>
<td>20-24</td>
<td>132.1</td>
<td>169.4</td>
<td>204.9</td>
<td>240.8</td>
<td>255.7</td>
<td>264.9</td>
</tr>
<tr>
<td>25-29</td>
<td>94.8</td>
<td>154.1</td>
<td>201.8</td>
<td>246.9</td>
<td>289.7</td>
<td>326.6</td>
</tr>
<tr>
<td>30-34</td>
<td>55.5</td>
<td>95.1</td>
<td>142.5</td>
<td>194.7</td>
<td>254.5</td>
<td>307.8</td>
</tr>
<tr>
<td>35-39</td>
<td>33.1</td>
<td>61.4</td>
<td>100.2</td>
<td>145.8</td>
<td>203.9</td>
<td>256.9</td>
</tr>
<tr>
<td>40-44</td>
<td>27.1</td>
<td>49.5</td>
<td>64.5</td>
<td>74.7</td>
<td>102.7</td>
<td>130.2</td>
</tr>
<tr>
<td>45-49</td>
<td>2.6</td>
<td>6.8</td>
<td>10.3</td>
<td>13.9</td>
<td>21.5</td>
<td>28.9</td>
</tr>
</tbody>
</table>


from period $a$ to $t$, and $\rho$ is the rate of discount assumed to be equal to 0.02 and 0.04.

The calculation of $SN_g$ requires the expected number of household members $N_{gr}$ in each future period conditional on the household existence and the probability that the household survives to each period. The calculation of these two components of $SN_g$ is discussed below.

5.3.1 Calculating Membership Profiles for Individual Households

The basic approach to calculating the expected number of household members is based on the life-cycle pattern of household membership that can be characterized by a family of curves varying with the age of the household marker and the level of childbearing. Based on the household survey data, age-specific fertility rates as shown in Table 5.2, and different sets of household membership rates simulated by using HOMES, HOMES is again applied to generate the numbers that show
the person-years of household membership varying with the age of the marker
and the level of childbearing.

Five sets of household membership profiles, one each for four age-sex cate-
gories and the fifth one for total membership, for a household are simulated on
the basis of the fertility behavior of the household. The first four sets of such
profiles are used for estimating the consumption model and the fifth set is used
to illustrate a family of such membership curves (Figure 5.2).

Figure 5.2
Average Members per Household

![Figure 5.2](image_url)

Note: TFR = Total Fertility Rate


Figure 5.2 is an example of a family of curves for the total household mem-
bership corresponding to different levels of fertility, which have a similar, but
unusual, pattern. The curves show a slight decline in the number of household members for age groups 30–44, but rises very sharply thereafter. The fall is due to the decline in the average number of “other members” for that age group, as explained for Figure 5.1. The subsequent rise is because of multigenerational households thereafter. These membership profiles show that there is a relatively constant difference in average household size across successive fertility rates. It means demographic transition in Nepal will not be leading to smaller family size only at a rather confined “childbearing” interval; rather, it will lead to smaller family size among households at all ages.

Once a set of household membership profiles is calculated for a particular category, the following procedure to calculate a family of membership numbers for an individual household corresponding to different levels of fertility and the age of the marker is repeated for the remaining categories.

The fertility level of a household is determined by using a combination of the total number of children and the age of the marker. Then by using the family of membership curves, the corresponding expected number of household members is interpolated from adjacent profiles. For the interpolation of expected members, the following equation is formulated:

$$X_i = \alpha Y_i + (1 - \alpha) Z_i$$  \hspace{1cm} (5.2)

where $X_i$ is the calculated number of members for the marker in age group $i$; $Y_i$ and $Z_i$ respectively refer to the number of members in the higher level of fertility and lower level of fertility for the marker in the $i$th age group from the standard profiles; $\alpha$ and $(1 - \alpha)$ are the coefficients representing the weights of $Y_i$ and $Z_i$ on $X_i$, respectively. This implies that $X_i$ is an arithmetic interpolation of $Y_i$ and $Z_i$.
These coefficients vary from one household to another, but are held constant within the same household.

The parameter value of \( \alpha \) is estimated for each household using equation (5.2). If, for example, the fertility level of a household is at point \( X \), which is somewhere in between level 5 and 6 as shown by Figure 5.2, then solving equation (5.2) we get the value of \( \alpha \) which is again substituted in the equation to determine the household membership profile of this household. The values are then discounted and cumulated for each member from the current age to the end of family life to determine the expected person-years.

5.3.2 Calculating Household Survival Ratios

Survival ratios are defined in two ages, and hence two time references, the initial age and date and the terminal age and date. In demography, it is the number of persons alive in an age group \( x + k \) to \( x + n + k \), divided by the number in the younger age group \( x \) to \( x + n, k \) years earlier. If the persons alive in these two cases are represented by the life table population, \( L \), this can be represented as:

\[
S_z^n = \frac{nL_{z+k}}{nL_z}.
\]

This can analogously be applied to determining household survival ratios. While calculating survival ratios, we use Bayes theorem of conditional probability. According to the definition of the family life-cycle, family life begins once two persons marry and form their own household, and ends when they cease to be designated as household head. Life span of a household will depend on the probability of the household surviving. Thus, the probability that a household will survive from age \( a \) to age \( t \) can be represented as
Table 5.3  
Household Survival Ratios

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Female Head</th>
<th>Male Head</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>1.0000</td>
<td>1.0000</td>
</tr>
<tr>
<td>20-24</td>
<td>0.9753</td>
<td>0.9815</td>
</tr>
<tr>
<td>25-29</td>
<td>0.9686</td>
<td>0.9738</td>
</tr>
<tr>
<td>30-34</td>
<td>0.9645</td>
<td>0.9715</td>
</tr>
<tr>
<td>35-39</td>
<td>0.9597</td>
<td>0.9674</td>
</tr>
<tr>
<td>40-44</td>
<td>0.9551</td>
<td>0.9609</td>
</tr>
<tr>
<td>45-49</td>
<td>0.9500</td>
<td>0.9509</td>
</tr>
<tr>
<td>50-54</td>
<td>0.9427</td>
<td>0.9375</td>
</tr>
<tr>
<td>55-59</td>
<td>0.9240</td>
<td>0.9153</td>
</tr>
<tr>
<td>60-64</td>
<td>0.8995</td>
<td>0.8855</td>
</tr>
<tr>
<td>65-69</td>
<td>0.8529</td>
<td>0.8374</td>
</tr>
<tr>
<td>70+</td>
<td>0.7940</td>
<td>0.7728</td>
</tr>
</tbody>
</table>

Source: Calculated from CBS, Nepal, 1984.

\[ P(H_{at}) = \frac{H(t)}{H(a)}. \]

Here \( H(t) \) and \( H(a) \) denote the total number of households whose ages are \( t \) and \( a \) respectively.

Similarly, the ratio \( H(t)/H(a) \) can further be decomposed and rewritten as

\[
\frac{H(t)}{H(a)} = \frac{H(0)}{H(a)} \cdot \frac{H(t)}{H(0)}.
\]

\[
= \frac{1}{P(H_{0a})} \cdot P(H_{0t}). \tag{5.3}
\]

This gives us the household survival ratio. Table 5.3 presents the household survival ratios based on equation (5.3). These values are later substituted in equation (5.1) to calculate the expected number of household members.
Once the survival ratios for households and the expected number of members in each age–sex category among surviving households are calculated, we can estimate our consumption model. The estimation of the consumption model is described in the following chapter.
In Chapter 3 we derived the specification of our nonlinear consumption function. To refresh our memory let us rewrite the expectation function one more time in abridged form as:

\[
\ln \left( \frac{C}{Y} \right) = \ln \left( \frac{N^C}{N^L} \right) + \ln[k_5 \left( \frac{A}{Y} \right) + k_6 E] + \epsilon
\]  

(6.1)

where \( N^C \), the current number of equivalent adults, is substituted for \( (k_1 N_1 + k_2 N_2 + k_3 N_3 + k_4 N_4) \) and \( N^L \), the lifetime number of equivalent adults, is substituted for \( (k_1 SN_1 + k_2 SN_2 + k_3 SN_3 + k_4 SN_4 + b) \). \( N_1, N_2, N_3, \) and \( N_4 \) are the numbers of children age 0–9, teenagers 10–19, adult males, and adult females respectively; \( SN_1, SN_2, SN_3, \) and \( SN_4 \) are their respective expected numbers but discounted by the rates of time preference over the life-cycle; \( C, Y, \) and \( A \) are respectively the household total expenditures, total income, and household net assets; and \( E \) is the remaining life span of the household.

According to the life-cycle hypothesis, an important factor in determining household consumption is lifetime resources of the household. In a perfect capital market, we simply assume that lifetime income is a function of the remaining life span, net wealth and current income. As discussed in Chapter 3, the first part of the right hand side of equation (6.1) is the demographic component of the consumption function, that measures the fraction of lifetime resources consumed at each household life-cycle stage. Similarly, the second part of the right hand side of the same equation is the economic component of the consumption function,
that measures the fraction of lifetime resources consumed at a given level of net assets and future income (proxied by the life expectancy of the household head). Table 6.1 summarizes the mean values of life-cycle household composition, lifetime equivalent adults, and income profiles.

The age variable in the first column refers to the age of the household head. $N_1, N_2, N_3,$ and $N_4$ in the table are the mean values of the corresponding variables broken down by the age of the head. $SN_iP_j$ refers to the number of $N_i$ discounted by $j$ percent annually. Two discount rates, 2 percent and 4 percent, are used for the analytical purposes. The values are negatively related to the discount rates since they are measured in terms of expected units. The total number of household members increases with the age of the household head up to a certain age before it begins to decline. In contrast to the demographic variables, household net assets, current income, and consumption steadily increase with the age of the household.

Because equation (6.1) is nonlinear in the parameters, not in the variables, the model cannot be handled in a linear model (Ordinary Least Squares) framework. To estimate the unknown parameters, an objective function is specified and an optimal value of the unknown coefficient vector is computed as the estimate. However, as in the Ordinary Least Squares method, we still have to estimate the coefficient parameters that minimize the sum of squared errors of a nonlinear statistical model. But the problems with nonlinear models are that a system of nonlinear normal equations has to be solved to find the solution of the optimization problem, and a closed form expression of the resulting estimator cannot usually be given. Therefore, its normal equations cannot usually be solved analytically, and there may be multiple solutions not all corresponding
Table 6.1
Mean Values of Demographic and Economic Variables

<table>
<thead>
<tr>
<th>AGE</th>
<th>N1</th>
<th>N2</th>
<th>N3</th>
<th>N4</th>
<th>SN1P2</th>
<th>SN2P2</th>
<th>SN3P2</th>
<th>SN4P2</th>
<th>SN1P4</th>
<th>SN2P4</th>
<th>SN3P4</th>
<th>SN4P4</th>
<th>A</th>
<th>Y</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–19</td>
<td>0.500</td>
<td>1.167</td>
<td>1.000</td>
<td>0.333</td>
<td>5.720</td>
<td>6.162</td>
<td>12.191</td>
<td>6.771</td>
<td>5.180</td>
<td>5.594</td>
<td>11.113</td>
<td>6.030</td>
<td>241202</td>
<td>65740</td>
<td>28152</td>
</tr>
<tr>
<td>20–24</td>
<td>1.300</td>
<td>0.675</td>
<td>1.400</td>
<td>1.100</td>
<td>5.103</td>
<td>8.155</td>
<td>11.249</td>
<td>9.925</td>
<td>4.627</td>
<td>7.341</td>
<td>10.926</td>
<td>8.763</td>
<td>418900</td>
<td>62989</td>
<td>43455</td>
</tr>
<tr>
<td>65–70</td>
<td>2.000</td>
<td>1.500</td>
<td>2.944</td>
<td>2.500</td>
<td>4.528</td>
<td>5.586</td>
<td>10.144</td>
<td>8.615</td>
<td>4.488</td>
<td>5.520</td>
<td>10.029</td>
<td>8.518</td>
<td>871220</td>
<td>75838</td>
<td>66433</td>
</tr>
<tr>
<td>70+</td>
<td>1.076</td>
<td>1.700</td>
<td>2.625</td>
<td>2.428</td>
<td>2.609</td>
<td>4.126</td>
<td>6.371</td>
<td>5.888</td>
<td>2.609</td>
<td>4.126</td>
<td>6.371</td>
<td>5.886</td>
<td>156433</td>
<td>160013</td>
<td>76727</td>
</tr>
</tbody>
</table>

Note: AGE refers to the age of the household marker;  
N1 refers to the number of children aged 0–9;  
N2 refers to the number of teenagers aged 10–19;  
N3 refers to the number of adult males (aged 20 and above);  
N4 refers to the number of adult females (aged 20 and above);  
SNiPj refers to the expected number of Ni discounted by j percent annually;  
A, Y and C denote total assets, income and consumption respectively.
to the global minimum of the sum of squares functions. Maximum likelihood method, whose great advantage is that under a broad set of conditions, parameter estimators are both consistent and (for large samples) asymptotically efficient, is employed to estimate the model as specified by equation (6.1).

6.1 Estimation Procedure

Many econometric textbooks (for example, Pindyck and Rubinfeld, 1991; Intriligator, 1978) have dealt with the discussion of nonlinear estimation. A more rigorous treatment of nonlinear estimation can be found in Judge et al. (1985, 1988) which has mainly been followed for this analysis.

If we specify our model in matrix notations as

\[ y(t) = f[X(t), \beta] + \epsilon(t) \]  

(6.2)

where \( y \) is a \((T \times 1)\) vector of observed sample values of the dependent variable; \( X \) is a \((T \times K)\) matrix of known values of the explanatory variables; \( \beta \) is a \((K \times 1)\) vector of unknown coefficients; and \( \epsilon \) is an unobservable \((T \times 1)\) vector of real random variables with mean zero and variance \( \sigma^2 \).

To apply the maximum likelihood method for estimation we assume that all the required derivatives of \( f(\cdot) \) exist and are continuous, and the error terms \( \epsilon \) are independent, identically and normally distributed \((i.i.d.)\) with mean zero and variance \( \sigma^2 \). Mathematically it can be written as

\[ \epsilon \sim N(0, \sigma^2) \]
Based on assumption (6.3), the parameter vector $\beta$ is estimated by maximizing the likelihood function

$$l(\beta, \sigma^2) = \frac{1}{(2\pi \sigma^2)^{T/2}} e \left\{ \frac{-|\mathbf{y} - f(X, \beta)|^2}{2\sigma^2} \right\}$$

$$= \frac{1}{(2\pi \sigma^2)^{T/2}} e \left\{ -\frac{S(\beta)}{2\sigma^2} \right\}$$

(6.4)

where $S(\beta) = [Y - f(X, \beta)]^T [Y - f(X, \beta)]$ is the sum of the square of error terms.

Maximizing this function is equivalent to minimizing

$$L(\beta, \sigma^2) = -2 \ln l(\beta, \sigma^2)$$

$$= T \ln(2\pi \sigma^2) + \frac{S(\beta)}{\sigma^2}$$

(6.5)

Equation (6.4) is maximum when $S(\beta)$ is minimum.\(^1\)

To estimate the parameter vector $\beta$ which minimizes equation (6.5), which in turn maximizes our likelihood function, we will use a three-step procedure known as iterative minimization procedure, as described below.

1. A set of estimates, for example $\beta_0 = (\beta_{01}, \beta_{02}, \ldots, \beta_{0k})$, is initially assumed, and the corresponding value of the likelihood function, as represented by equation (6.4), and the sum of squared errors, $\frac{S(\beta)}{\sigma^2}$, are calculated.

2. The preceding step is repeated with a different set of $\beta$ estimates with $(\beta_0 + \Delta)$. If $S(\beta_0 + \Delta) < S(\beta)$ then the revised estimate of $\beta$ is set equal to

\(^1\) This follows that maximum likelihood estimators of the parameters $\hat{\beta}$ are identically equal to the least squares estimators.
(\beta_0 + \Delta). Otherwise a \( \lambda \), where \( 0 < \lambda < 1 \), is found such that \( S(\beta + \Delta \times \lambda) < S(\beta_0) \), and \( \beta_1 \) is set equal to \( (\beta + \Delta \times \lambda) \), provided that such a \( \lambda \) exists. According to the gradient method, \( \lambda \) and \( \Delta \) refer respectively to a step direction and step length, both of which are used to obtain the minimum value of the sum of squared residuals.

3. Steps 1 and 2 are repeated and the iterative method is continued until the values of \( \beta \) on successive iterations stabilize. This can be measured by the size of each parameter increment relative to the previous parameter value, which is the basis for one of the common criteria used to declare convergence.

When the parameter vector is estimated we can also estimate the variance-covariance matrix. On the assumption laid down on equation (6.2), the asymptotic variance-covariance matrix of \( \hat{\beta} \) is estimated by

\[
V(\beta) = \left\{ \frac{S(\beta)}{N} \right\} \times \left\{ \sum_{i=1}^{N} Z_i Z_i^t \right\}^{-1}
\]

where \( Z_i = \partial f(\beta_i, X_i)/\partial(\hat{\beta}_i) \) are evaluated at \( \beta \); and \( N \) is the number of observations.

The SHAZAM computer package (White et al., 1990) has been used to estimate the nonlinear parameter vector.\(^2\) Nonlinear estimation in SHAZAM applies the gradient method (also known as the quasi-Newton method) as its algorithm to obtain estimates that maximize the likelihood function. Various sets of starting values have been tried to confirm that a global minimum has probably been achieved.

\(^2\) The LimDep, SAS, and SHAZAM programs were used to test their relative efficiency (in terms of time) for estimating nonlinear parameter vector. The experiment showed SHAZAM to be more efficient than any of the other two programs. Hence, the SHAZAM program has been used throughout the analysis.
6.2 Statistical Tests

Only asymptotic properties of the parameter estimators for nonlinear models are generally available. Therefore the usual interval estimators or confidence regions are also only approximately or asymptotically correct and justifiable. Inferences are drawn by estimating and testing the coefficient parameters, where the estimators have variance-covariance matrix as specified by equation (6.6).

6.2.1 Testing Hypotheses

In order to test the hypothesis

\[ H_0 : \beta_i^* = c \quad \text{against} \quad H_a : \beta_i^* \neq c \quad (6.7) \]

where \( \beta \) is a vector of \( k \) parameters and \( c \) is a vector of \( k \) constants, the asymptotic normality of the maximum likelihood is used. Null hypotheses are tested at a prespecified level of significance.

Various methods of hypothesis testing, such as the Wald Test, Lagrange Multiplier Test, and Likelihood Ratio Test, have been suggested. In this study, however, I use the likelihood ratio test to test the null hypothesis (6.7). This test statistically compares constrained estimators with the unconstrained ones. If, for example, \( \beta_{UR} \) and \( \beta_R \) are the respective maximum likelihood estimators of unconstrained and constrained \( \beta \)'s when the null hypothesis (6.7) is imposed, then the null hypothesis is rejected if

\[ A = 2 \left[ \ln L(\beta_{UR}) - \ln L(\beta_R) \right] \quad (6.8) \]
exceeds $\chi^2(J, \alpha)$ for a prespecified significance level $\alpha$ with $J$ degrees of freedom.\(^3\) The degrees of freedom are determined by the number of additional restrictions imposed in the restricted model as compared to the unrestricted model.

### 6.2.2 Testing the Model’s Specification

The objective of testing a model’s specification is to examine the validity of the model and the variables therein. In our analysis testing the model’s specification is to investigate whether demographic variables are significant determinants of household consumption as specified by equation (6.1).

To answer this question we compare the life-cycle consumption model (6.1) with a simple model without demographic variables. The modified specification is written as

$$
\ln \left( \frac{C}{Y} \right) = k_0 \ln \left( \frac{N^C}{N_L} \right) + \ln[k_5(A) + k_6E] \quad (6.9)
$$

where $k_0$ reflects the validity of the specified life cycle consumption model.\(^4\) If $k_0$ is positive and statistically significant then we can infer that the demographic

---

\(^3\) The Lagrange Multiplier test is based only on the restricted maximum likelihood (ML) estimator, while the Wald test is based only on the unrestricted ML estimator. The likelihood ratio test uses both the restricted and unrestricted estimators as shown by (6.8). Because it requires both restricted and unrestricted estimates, the likelihood ratio test is likely to be computationally more demanding than the Wald test or the Lagrange Multiplier test.

\(^4\) An immediate query may arise here that whatever is good for the goose should be good for the gander, indicating that if we are to test the validity of demographic variables we should also simultaneously test the validity of economic variables in similar fashion. Therefore, I set up an alternate function by respecifying the model as

$$
\ln \left( \frac{C}{Y} \right) = k_0 \ln \left( \frac{N^C}{N_L} \right) + k_\omega \ln[k_5(A) + k_6E].
$$

However, such a function could not be estimated because of continuous error messages from the computer program.
variables influence household consumption. If not, household consumption is solely determined by assets and income under the linear specification.

6.3 Estimated Functions and Discussion

Table 6.2 presents parameter estimates and their asymptotic standard errors for four versions of the life-cycle consumption model. The estimates show that all variables except the ratio of net assets to current income and the $b$ parameter are significantly different from zero.

First, we assume that the demographic variables do affect household consumption; thus, $k_0$ is set to unity. Second, two different versions of the full model with rate of time preference equal to 0.02 and 0.04 have been estimated. Third, since the ratio of net assets to current income does not seem to be a significant variable in either of these two models, we constrain the parameter estimate for this variable equal to $k_5$ to estimate Models 3 and 4.

All of the models show that $k_3$ is constrained to equal 1. By imposing this condition as the standard adult scale for adult male, the estimates of $k_1$, $k_2$, $k_3$, and $k_4$ are interpreted in terms of relative equivalent adult males.

Recall that the parameters have the following interpretations:

$k_1$ is the relative weight of children age 0–9,

$k_2$ is the relative weight of teenagers age 10–19,

$k_3$ is set equal to 1, the standard adult scale,

$k_4$ is the relative weight of adult females,

$k_5$ is the effect of the net assets–current income ratio on consumption,

---

6 This assumption will be tested later.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Model 1 $\rho=2%$</th>
<th>Model 2 $\rho=4%$</th>
<th>Model 3 $\rho=2%$</th>
<th>Model 4 $\rho=4%$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b$</td>
<td>58.785 (45.868)</td>
<td>49.723 (40.787)</td>
<td>0.0000*</td>
<td>0.0000*</td>
</tr>
<tr>
<td>$k_1$</td>
<td>0.9457 (0.2999)</td>
<td>0.9379 (0.2918)</td>
<td>2.7100 (1.0368)</td>
<td>2.5439 (0.9118)</td>
</tr>
<tr>
<td>$k_2$</td>
<td>1.4665 (0.3776)</td>
<td>1.4604 (0.3621)</td>
<td>3.3619 (1.2550)</td>
<td>3.1053 (1.0533)</td>
</tr>
<tr>
<td>$k_3$</td>
<td>1.0000*</td>
<td>1.0000*</td>
<td>1.0000*</td>
<td>1.0000*</td>
</tr>
<tr>
<td>$k_4$</td>
<td>0.9222 (0.4383)</td>
<td>0.9233 (0.4371)</td>
<td>0.5132 (0.6160)</td>
<td>0.5494 (0.5714)</td>
</tr>
<tr>
<td>$k_5$</td>
<td>0.1377 (0.0897)</td>
<td>0.1204 (0.0798)</td>
<td>0.0667$\diamond$ (0.0027)</td>
<td>0.0643$\diamond$ (0.0025)</td>
</tr>
<tr>
<td>$k_6$</td>
<td>0.4194 (0.2123)</td>
<td>0.3656 (0.1900)</td>
<td>0.0667$\diamond$ (0.0027)</td>
<td>0.0643$\diamond$ (0.0025)</td>
</tr>
<tr>
<td>$\hat{\sigma}^2$</td>
<td>0.8104</td>
<td>0.8105</td>
<td>0.9520</td>
<td>0.9395</td>
</tr>
<tr>
<td>$LLF$</td>
<td>-805.38</td>
<td>-805.44</td>
<td>-854.74</td>
<td>-850.69</td>
</tr>
<tr>
<td>$SSE$</td>
<td>496.79</td>
<td>496.89</td>
<td>583.60</td>
<td>575.94</td>
</tr>
<tr>
<td>$N$</td>
<td>613</td>
<td>613</td>
<td>613</td>
<td>613</td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses are asymptotic standard errors. $LLF, SSE$ and $N$ respectively denote log-likelihood function, sum of squared residuals and number of observations.

* An asterisk indicates that the parameter is constrained to equal the shown value.

$\diamond$ A diamond indicates that $k_5$ and $k_6$ are constrained to be equal.
$k_6$ is the growth rate of future income measured as the effect of head's life expectancy on consumption,

$b$ is the number of equivalent adult years of consumption that an average family leaves as bequests.

Let us take a look at Table 6.2 where Model 1 and Model 2 represent the full model. The estimated coefficients (equivalent adult units) for children, teenagers and adult females are respectively 0.94, 1.46, and 0.92, assuming that the equivalent adult unit of an adult male is one. These large values of the equivalent units suggest that children have a stronger effect in Nepal than typically found in the literature. However, given the asymptotic standard errors, we cannot reject the hypotheses that $k_1, k_2, k_4 = 1$. Hence the values of 0.92 or more cannot be distinguished from unity. Because this study is limited by a small sample size, no firm conclusions could be drawn.

Two factors may account for the teenage coefficients. First, the dependent variable is $C/Y$, not $C$. Thus, while children may account for less consumption than adults, they bring in no income, which causes their presence in the household to yield a higher $C/Y$ than for an adult male. Second, even in absolute terms, Nepali families living in Kathmandu with school children may well spend more on them than on a typical adult because primary to high schooling is very expensive. Though the public schools are free until third grade and nominal tuitions are charged thereafter up to high school, private schools are much more expensive than colleges or the university. To keep up with other households, most of the parents would like to enroll their children in private schools. Therefore, heavy outlay for tuitions, fees, and school supplies make teenagers more expensive to
raise them than anybody else. However, given the asymptotic standard errors, we cannot reject the hypotheses that \( k_2 = 1 \).

The estimated equivalent adults from Table 6.2 are individually not significantly different from one, implying that age and sex do not matter in determining household consumption. To test this hypothesis, I constrained \( k_1, k_2, k_3, \) and \( k_4 \) to be equal to 1 in the restricted model and compare the results with those of the unrestricted model.\(^6\) Table 6.3 compares the parameter results of the two models.

From the likelihood ratio test we cannot reject the null hypothesis that the equivalent adult units of household members are not different from unity at the 5 percent level of significance. The demographic variables are jointly, but not individually, significant. In other words, household consumption depends on household size but there is no evidence that it varies with age and sex of household members. However the null hypothesis is rejected at the 10 percent level of significance.

The positive coefficients for the ratio of net assets to current income on consumption show that consumption ratio increases with net assets. However, these coefficients are not statistically significant. From hypothesis testing we cannot reject the null hypothesis that \( k_5 \) is equal to zero at the 0.05 level of significance. This could have occurred for two reasons. First, the net assets may not be an adequate variable for differentiating income from wealth. Second, there could be some error in the measurement of the net assets.

The growth rate of current income is captured by \( k_6 \). It measures the effect of the household head's life expectancy (a proxy for future income) on the household

---

\(^6\) Model 1 in Table 6.2.
Table 6.3
Testing the Effect of Age and Sex on Consumption

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unrestricted model</th>
<th>Restricted model</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b$</td>
<td>58.785</td>
<td>62.284</td>
</tr>
<tr>
<td></td>
<td>(45.868)</td>
<td>(44.926)</td>
</tr>
<tr>
<td>$k_1$</td>
<td>0.9457</td>
<td>1.0000*</td>
</tr>
<tr>
<td></td>
<td>(0.2999)</td>
<td></td>
</tr>
<tr>
<td>$k_2$</td>
<td>1.4665</td>
<td>1.0000*</td>
</tr>
<tr>
<td></td>
<td>(0.3776)</td>
<td></td>
</tr>
<tr>
<td>$k_3$</td>
<td>1.0000*</td>
<td>1.0000*</td>
</tr>
<tr>
<td>$k_4$</td>
<td>0.9222</td>
<td>1.0000*</td>
</tr>
<tr>
<td></td>
<td>(0.4383)</td>
<td></td>
</tr>
<tr>
<td>$k_5$</td>
<td>0.1377</td>
<td>0.1513</td>
</tr>
<tr>
<td></td>
<td>(0.0897)</td>
<td>(0.1004)</td>
</tr>
<tr>
<td>$k_6$</td>
<td>0.4194</td>
<td>0.4685</td>
</tr>
<tr>
<td></td>
<td>(0.2123)</td>
<td>(0.2377)</td>
</tr>
<tr>
<td>$\sigma^2$</td>
<td>0.8104</td>
<td>0.8200</td>
</tr>
<tr>
<td>$LLF$</td>
<td>-805.38</td>
<td>-808.98</td>
</tr>
<tr>
<td>$SSE$</td>
<td>496.79</td>
<td>502.66</td>
</tr>
<tr>
<td>$N$</td>
<td>613</td>
<td>613</td>
</tr>
</tbody>
</table>

Note: The rate of time preference is assumed to be 0.02.
Numbers in parentheses are asymptotic standard errors.
$LLF$, $SSE$ and $N$ respectively denote log-likelihood function, sum of squared residuals, and number of observations.
* An asterisk indicates that the parameter is constrained to equal the shown value.
consumption ratio. On average, a unit increase in the head’s life expectancy (a proxy for lifetime income relative to current income) will increase a household’s consumption ratio by 0.40. Its value is negatively related to the discount rates since it is measured in terms of expected units.

Models 1 and 2 in Table 6.2 show that the estimated values of $b$ are about 59 and 50 respectively. $b$ can be interpreted as the number of equivalent years of consumption that an average family leaves (or plans to leave) as bequests. As explained during my model development, $b$ is a parameter of bequest elasticity. However, we do not see that $b \neq 0$ because this value is not significantly different from zero, indicating that households seem to be consuming all of their resources during their lifetime. In other words, there is no evidence for strong bequest motives.

According to the 1981 census, the life expectancies at birth of a Nepali male and a Nepali female are 50.88 and 48.10 years, respectively (CBS, Nepal, 1987: 352–353). Ignoring some minor details, these values of $b$, 59 and 50, denote almost the whole life span of a person throughout his life-cycle. Despite such large values of $b$, it is statistically insignificant because of large values of its standard errors. These large values of standard errors could have occurred for one or more of the following reasons, such as the choice of wrong discount rates, underconsumption by households, the heads are not certain about their life expectancy and want to save more for future.

Models 3 and 4 in Table 6.2 show the parameter estimates when we constrain the parameter estimates of the nondemographic variables, e.g., net assets/income.
ratio and head’s life expectancy, to be equal.\(^7\) The rationale for imposing this constraint is that, because we assumed in Chapter 3 that \(g\) (the growth rate of income) is small, the hypothesis that \(g = 0\) is tested by this constraint model. These models, however, show very different results as compared to the results shown by preceding models. The coefficients for children and teenagers are greater here than 1 while the coefficients for adult females are less than 1. In these models all the coefficients except those for adult females are found to be significantly different from zero at the 5 percent level. However, none of these estimates for demographic variables are significantly different from 1 (except for teenagers in Model 4).

In section 6.2.2 I brought up the issue of testing the model specification. I now discuss the results estimated from the specification given by equation (6.9). As assumed, \(k_0\) reflects the validity of incorporating demographic variables in the household consumption function specified by the original nonlinear equation (3.24). The coefficient estimates and their standard errors for equation (6.9) are shown in Table 6.4. The table shows that all equivalent adult units (excluding the adult male scale which is the reference scale) are greater than 1. But the test shows that none of them is significantly different from 1. The values of \(R^2\) and the log–likelihood function are higher for the unrestricted model than for the restricted model.\(^8\) Using the likelihood ratio test, one can infer that the age

---

\(^7\) Note that \(k_0\) is also constrained to equal zero in Models 3 and 4. These models could not be estimated with an unconstrained value of \(k_0\). Various sets of starting values were tried, but any such attempt was fruitless until I constrained \(k_0\) equal to zero because otherwise the results showed very wild values. In addition, Models 1 and 2 showed that \(b = 0\) cannot be rejected.

\(^8\) The restricted model here completely ignores demographic variables, treating all equivalent adult scales equal zero. Therefore, this model represents the original life-cycle model where consumption depends only upon household assets and life expectancy. Alternative specifications such as one with an intercept term, and another with an intercept and a multiplicative terms were also estimated. But the results showed that the present specification would be the “best” fit of all.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unrestricted model</th>
<th>Restricted model</th>
</tr>
</thead>
<tbody>
<tr>
<td>$k_0$</td>
<td>0.3833</td>
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</tr>
<tr>
<td></td>
<td>(0.0526)</td>
<td></td>
</tr>
<tr>
<td>$b$</td>
<td>-3.5156</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(1.7109)</td>
<td></td>
</tr>
<tr>
<td>$k_1$</td>
<td>1.2929</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(0.3089)</td>
<td></td>
</tr>
<tr>
<td>$k_2$</td>
<td>1.7594</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(0.4902)</td>
<td></td>
</tr>
<tr>
<td>$k_3$</td>
<td>1.0000*</td>
<td>—</td>
</tr>
<tr>
<td>$k_4$</td>
<td>1.1798</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(0.6079)</td>
<td></td>
</tr>
<tr>
<td>$k_5$</td>
<td>0.0184</td>
<td>0.0178</td>
</tr>
<tr>
<td></td>
<td>(0.0032)</td>
<td>(0.0019)</td>
</tr>
<tr>
<td>$k_6$</td>
<td>0.0604</td>
<td>0.0324</td>
</tr>
<tr>
<td></td>
<td>(0.0069)</td>
<td>(0.0015)</td>
</tr>
<tr>
<td>$\hat{\sigma}^2$</td>
<td>0.6895</td>
<td>0.7617</td>
</tr>
<tr>
<td>$LLF$</td>
<td>-755.86</td>
<td>-786.39</td>
</tr>
<tr>
<td>$SSE$</td>
<td>422.67</td>
<td>466.93</td>
</tr>
<tr>
<td>$N$</td>
<td>613</td>
<td>613</td>
</tr>
</tbody>
</table>

Note: The rate of time preference is assumed to be 0.02. Numbers in parentheses are asymptotic standard errors. $LLF$, $SSE$ and $N$ respectively denote log-likelihood function, sum of squared residuals, and number of observations. * An asterisk indicates that the parameter is constrained to equal the shown value.
and sex composition do have a significant effect on household consumption at the 0.05 confidence region.

One can clearly draw two major inferences from this table. First, $k_0$ is significantly different from zero indicating that exclusion of demographic variables would misspecify our model. The hypothesis that $k_0$ is equal to one as specified by our general model is also rejected because $k_0$ is significantly different from 1.\(^9\) That $k_0$ is less than 1 implies that the relationship between demographic variables and household consumption is not that simple as specified by the general model. It means the general model is assigning inappropriate weight to the demographic component of the consumption model. This model shows that the role of demographic variables is overemphasized in the general model as compared to the economic component. Second, the parameter $b$ is found to be significantly different from zero. As explained earlier, $b$ is a bequest parameter. Therefore, if we allow $k_0$ to vary, we reject $b = 0$, indicating that bequests also plays a significant role in explaining the household consumption patterns.

The inferences drawn so far confirm that demographic factors positively affect the household consumption ratio. Similarly, the results also show that lifetime income profile, which has been proxied by the household net assets and the life expectancy of the head, has a positive effect on the household consumption ratio. Nevertheless, the model does not tell us anything about the sensitivity of the demographic factors to the variation in equivalent adult parameters.

To test the sensitivity of the demographic factors to the variation in equivalent adult parameters, one can generate various sets of numbers that show the

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\(^9\) A slightly variant specification for equation (6.9) was also estimated by treating $k_0$ as an intercept rather than an multiplicative factor. The results, however, showed that the current specification would yield a "better" fit than the alternate one.
proportions of current to lifetime equivalent adults varying with the age of the head and set of equivalent adult parameters, and analyze them. For this study six different sets of adult parameters, $k_1$ to $k_4$, are chosen to calculate these proportions of life-cycle equivalent adults. These proportions are then plotted to construct a family of curves that show the household head’s age along the x-axis and the life-cycle equivalent adults along the y-axis.

Figure 6.1 is an illustration of the life-cycle equivalent adults profiles, the proportion of current to lifetime equivalent adults, which are estimated with respect to different adult parameters against the age of the head. The age of the

head and the values of demographic variables are taken from Table 6.1. If we
denote the values of $k_i$'s as a vector, then Model 1 through Model 6 in Figure 6.1
denote the equivalent adult vectors $[0.5, 0.5, 1.0, 1.0], [0.9, 1.5, 1.0, 0.9], [0.5, 1.4,
1.0, 0.9], [1.2, 1.3, 1.0, 0.9], [1.0, 1.0, 1.0, 1.0]$, and $[0.9, 1.4, 1.0, 0.9]$ respectively.

The figure shows that demographic factors are very insensitive to the variation in equivalent adult parameters. The values of the equivalent adult parameters cover a wide range of values. However, the graph shows that these simulated curves have little variation. This could be because of Nepal's demographic characteristics (a young population and high fertility), living arrangements, and/or the relatively small sample size used in this study. The finding that demographic factors are be very insensitive to the variation in equivalent adult parameters could have resulted to infer from the alternative specification of our consumption model that the general model overemphasizes the role of demographic variables in explaining the household consumption behavior.

6.4 Summary

The basic concept underlying the life-cycle model is that a household bases its current consumption decisions upon lifetime expectations about income and family composition. The model developed during the course of this study seems to be quite appropriate for examining the effect of demographic variables. Results here show that a model with classified age-sex categories explains the effect of demographic variables because the estimated coefficients are significantly different from zero. Statistical testing of the model has produced some evidence that demographic variables in addition to lifetime resources do influence household consumption decisions.
CHAPTER 7

CONCLUSIONS AND POLICY IMPLICATIONS

The empirical analysis based on the theoretical model developed for this study shows the extent to which household composition affects the consumption behavior of households. A distinction between household size and household composition is made. A life-cycle path of household composition is formulated by projecting the lifetime membership profiles of households. HOMES has been used to construct these household membership profiles. The empirical results confirm the hypotheses that the magnitude and direction of demographic variables influence household consumption behavior. The following section reviews the major results and the policy implications that can be drawn from these findings. Finally, some of the limitations of the present study are identified and suggestions regarding future research are outlined.

7.1 Major Results and Policy Implications

This study extended the life-cycle consumption model (Modigliani and Brumberg, 1954; Fisher, 1956; Modigliani and Ando, 1957; Ando and Modigliani, 1963) to account for the effects of demographic variables (changing household composition) on household consumption behavior. Primary data collected from a field survey during 1987–88 in Kathmandu (Household Survey, 1987–88) and the 1981 census data of Nepal (CBS, Nepal, 1984) have been used to estimate future household membership profiles and the consumption function. A nonlinear
regression analysis method has been applied to estimate the parameter coefficients. Hypotheses have been tested to draw statistical inferences regarding the estimated parameter coefficients.

The findings provide ample evidence that changing household composition does significantly affect household consumption patterns. A restricted model, where demographic variables do not have any effect on consumption patterns is also estimated. The log-likelihood ratio test regarding the comparison of the restricted model and the unrestricted model indicates that the restricted model should be rejected because demographic variables do have a significant effect on household consumption.

In addition, equivalence scales have been estimated to measure the weight of the age–sex structure of household members on household consumption. Adult males, males age 20 or above, have been standardized to a scale of 1 and corresponding scales for other age–sex categories have been estimated. The results show that the estimate coefficients for teenagers are greater than 1, and the coefficients for other age–sex categories are close to 1. These greater-than-one coefficients for teenagers occur for mainly of two reasons. First, teenagers bring in no income into the household. Therefore, their presence in the household causes a higher $C/Y$ than for an adult male. Second, education in Kathmandu, particularly primary to high school, is very expensive. Heavy outlays for tuitions, fees, and school supplies makes teenagers more expensive to raise than anybody else. However, we cannot reject the hypotheses that equivalent adult units are all equal to 1. The value of 0.92 for adult females or more cannot be distinguished from unity.
Testing our general model's specification to examine the validity of the model and variables therein show that the relationship between demographic variables and consumption is not linear as specified by the model. In addition, the parameter $b$ is found to be significantly different from zero. It should be noted that $b$ is a parameter of bequest elasticity. Therefore, if we allow the coefficient of demographic effect to vary, we reject $b = 0$, indicating that households do not seem to be consuming all of their resources during their lifetime.

It should be noted that besides demonstrating the importance of demographic variables, analysis of consumption data provides additional support for the inclusion of population growth as a major factor affecting household consumption patterns. Any change in fertility behavior and/or mortality will affect population growth in one way or another. For example, holding mortality and migration constant, a sudden decline in the fertility level would decrease the national population growth rate, and there will be fewer-than-expected members in existing households as well, especially in lower age categories. One policy implication that can be drawn from this is that decline in fertility lowers the consumption propensity of a household. But if we look at the expenditures on education this might not always be true. Lower fertility increases expenditures on children's education implying a demand for better quality children.

In this study a family of household membership curves with respect to different fertility levels is also shown. Based on these curves, a life-cycle household consumption function can be derived for different time periods and discount rates. The evidence suggests that the addition of a member in the household increases the amount of household consumption.
7.2 Limitations of the Study and Suggestions for Future Research

Despite the conclusions drawn from the findings and interpretations of our results during the course of this study, this analysis is not perfect and has its own limitations. This study also explores some prospects for future research related to this field. Some of the limitations and suggestions for future research are:

First, the use of a sample household survey taken only from Kathmandu Valley is not representative of the national population. Thus, these results cannot be generalized to the national level. These sample data are standardized to the Kathmandu population distribution so as to make them reflect the national demographic structure. Though it may reflect the national demographic distribution, household composition, and living arrangements, it does not reflect nationwide consumption patterns. About 93 percent of the Nepali population lives in rural areas. But these sample data are taken from Kathmandu. The living arrangements in Kathmandu do not necessarily reflect the living arrangements in rural Nepal.

Nonetheless, even though there are some differences in the living arrangements between rural and urban areas, they still have many things in common. The social and cultural values that guide and order living arrangements are the same throughout the country. They may not be the exactly same from place to place, but if they differ, it is only insignificantly.

Second, the model derived in this study is a long-run comparative-static one. A short-run dynamic model of household composition and consumption behavior may be needed when fertility levels and the social norm about nuclear households are changing rapidly.
Third, this study looks broadly into the relationship between household composition and the aggregate household consumption propensity. There are other macroeconomic variables that should be taken into account in future research. For instance, parents may perceive differently the effects of schooling of daughters and sons. The education of a son, who will stay with his parents in their old age, may influence consumption differently than that of a daughter, who leaves after her marriage. In addition to the differences in sex, whether people live in urban or rural areas may affect the aggregate consumption propensity. The larger the proportion of people living in urban areas, the more important the nuclear family might be. The breakdown of the extended family may lead to a decline in the importance of investment in the schooling of children. Consequently, the consumption propensity changes.

Fourth, in rural areas, it is difficult to measure household income and expenditures because most of their income is in kind and the economy is poorly monetized. Rural people use exchange labor as well as their own household labor, which is sometimes intermittent, and sometimes dawn to dusk. The monetary valuation of children’s contribution to household income and older generations’ contribution to household income, management, and child care are also difficult to calculate and measure. We can only approximate them.

A very important topic for future research from this survey data would be an analysis of consumer expenditures based on the extended consumer expenditure approach developed by Deaton (1982) and applied by many other researchers. Analysis using this data set could lead to production of a research paper with interesting results.

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1 See, for example, Deaton and Muellbauer (1986).
The HOMES model of the household sector of the economy could be used to assess how general economic conditions and demographic change will affect various dimensions of the household sector and, in turn, to determine how key aspects of the general economy will be affected by changes in the household sector. The household sector can be taken to include (1) the supply of labor, (2) school enrollment and educational attainment, (3) household saving, (4) household expenditure, (5) housing demand, (6) health-care utilization, and (7) contraceptive use.

There will be a population census of Nepal in June 1991. An extension of this study to the forthcoming census could be a timely and appropriate topic for future research. These 1991 census data can be used to formulate the future development planning of the country. HOMES can be applied to project the size and composition of Nepali households and population, so that the government formed under a new political system and spirit could utilize the information to lay out its future development plans based on projections on demand for housing, the labor force situation, and the national saving rate. My model is a microeconomic model with macroeconomic implications and could contribute concrete macroeconomic policy guidance to the government.

7.3 Conclusions

Household fertility behavior and its expenditure pattern are important in economic development because capital and population are major factors contributing to economic growth. The theory developed so far provides a framework to analyze the relationship between changing household composition and its consumption behavior. In making decisions of how much to spend on household
consumption and how much to save (or dissave), households base their decisions on two objectives: (1) to maximize the utility from household consumption, and (2) to achieve a desired distribution of wealth. In addition, the size and composition of a household may be an important factor in determining household time preference and tastes, which, in turn, affect the consumption propensity.

The importance of household composition in increasing economic growth has been shown in many studies. This study shows the life-cycle consumption of Kathmandu households in a changing household composition pattern. HOMES, A Household Model for Economic and Social studies, is applied to project a family of curves projecting future household membership. This information is used to estimate a life-cycle consumption function, and equivalence scales have been estimated to measure the effect of household age-sex composition on consumption. The findings show the importance of demographic variables in estimating consumption functions. It is seen that teenagers consume more than adult males, but the difference is statistically insignificant. The difference between adult male and adult female scaling factors are also not significantly different.

The effect of demographic variables is not only through the existing age–sex composition of the household but also through the expected lifetime composition. The findings suggest a greater role of household composition in consumption, which in turn affects saving and economic development.
APPENDIX

QUESTIONNAIRE

Namaste!*

How are you? My name is ____________________________. I came here to see you and ask a few questions about the composition and the income–expenditure pattern of your household. This is a research study on “Life-Cycle Analysis of Household Composition and Family Consumption Behavior” being conducted by Nav Raj Kanel for his Ph.D. in Economics. I know you are very busy, but I would appreciate it very much if you could help us by answering the questions asked in this questionnaire.

We would like to assure you that this work is not associated with any government office or any organization, and your answers to these questions will be kept confidential and used for research purposes only.

Thank you.

Interviewer (Name):
Date:
Time (Interview started):
Time (Interview completed):

* Namate is a Nepali greeting word.
A. HOUSEHOLD ROSTER

[Note: Use extra sheet if the household size is more than six.]

A1. Could you please supply the following information of all the people who live here and eat together in this household? (Please write the name of the head at column 1.)

<table>
<thead>
<tr>
<th>Person No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Date of birth</td>
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<tr>
<td>Occupation</td>
<td></td>
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</tr>
<tr>
<td>Relationship to the head of the household</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ethnicity:</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>What language is most commonly spoken in this household?</td>
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</tr>
</tbody>
</table>

(For age 6 and above only)

A2. What is the highest level (year) of schooling he/she has completed?

Currently enrolled at school?

If only literate, please specify so.

A3. What is the marital status of each of the household members?

(a) single
(b) married
(c) widowed
(d) divorced
(e) separated

What was the age at marriage?
A4. How long was he/she present in this household during the past 12 months?
   (a) less than six months
   (b) about six months
   (c) more than six months
   If not 12 months, purpose of absence:

A5. How long has he/she lived continuously in his household?
   (Please specify the time period)

B. FERTILITY INFORMATION

   * Note: Ask to all ever-married women.

<table>
<thead>
<tr>
<th>Person No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of the woman</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of live births</td>
<td></td>
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</tbody>
</table>

B1. How many living sons and daughters do you have?
   (Identify with person number)

B2. How many of your sons and daughters live elsewhere other than this household?

B3. At what age did they leave this household?

B4. Do you expect to have any more children?
   (1) No (2) Yes (3) Uncertain
   If Yes, how many additional children do you think you are likely to have?
B5. For a couple in your economic circumstances, what is the best number of living sons and daughters?

B6a. Do you know of any methods couples use to keep from having more children than they want?

( ) No ( ) Yes

b. Are you or your spouse using any such method(s)?

( ) No ( ) Yes

If Yes, which method(s)?

c. If No, do you plan to one in the future?

( ) No ( ) Yes

If Yes, which method(s)?

C. ASSETS AND INCOME (Nepali Rupees as the monetary unit)

Respondent's Name:
Respondent's Person Number (From the household Roster):
Residence

C1. Is this house owned by someone who lives here in this household, or is it rented, or you live here free?

(1) Own (2) Rent (3) Free (4) Other (please specify):

If rented, what is the rent per month?

Otherwise, how much would it cost you to pay rent for this housing? Rents per month:

C2. How many rooms do you have in this household for the exclusive use of this household? Number of rooms:

C3. Does this household have electricity? ( ) No ( ) Yes
Household Items

C4. How many, if any, of the following items do you have in this household?

<table>
<thead>
<tr>
<th>Items</th>
<th>Number</th>
<th>Value (or cost and date of purchase)</th>
<th>Business Use?</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) electric fan</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(b) electric iron</td>
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<td></td>
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<tr>
<td>(c) TV</td>
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<td></td>
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<tr>
<td>(d) refrigerator</td>
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<td></td>
<td></td>
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<tr>
<td>(e) radio</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(f) car</td>
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<td></td>
<td></td>
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<tr>
<td>(g) telephone</td>
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<td></td>
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<tr>
<td>(h) wrist watch</td>
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<tr>
<td>(i) bicycle</td>
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<td></td>
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<tr>
<td>(j) motorcycle</td>
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<td>(k) ...</td>
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<td>(l) ...</td>
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<tr>
<td>(m) ...</td>
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</tbody>
</table>

Land

C5. Does this household own any agricultural land?

( ) No  ( ) Yes

If Yes, total land area (in Ropani):

Please give the description of your land on the following table.

<table>
<thead>
<tr>
<th>Plot Size</th>
<th>Type of land</th>
<th>Rented or private</th>
<th>Production per year</th>
<th>Principal Net earnings for the last 12 months</th>
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</table>

C6. Do you use any power equipment (tractor etc.) on your farm?

( ) No  ( ) Yes

If Yes, type of equipment(s):

Is this your own equipment, or borrowed, or rented?
**Agricultural sources of earnings**

C7. Do you have any other sources of income like poultry, animal husbandry, wood, fishing, hunting or so?

( ) No  ( ) Yes

If Yes, how much was the net earnings during the last 12 months from it? (Please include rentals and animal products also.)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Net Earnings (in Rupees)</th>
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</table>

**Nonagricultural sources of earnings**

C8. Do any of the household members work for some office or organization or so?

( ) No  ( ) Yes

If Yes, please specify the name (or the person number) and monthly income.

<table>
<thead>
<tr>
<th>Name</th>
<th>Type of employment</th>
<th>Wage earnings per month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

C9. Do you or other household members have some other nonagricultural source of earnings like business, seasonal wage earning, cottage industry etc.?

(Note: Question on employment is already asked as C8.)

( ) No  ( ) Yes
If Yes, what is that?

<table>
<thead>
<tr>
<th>Source of of earning</th>
<th>Hours of work/week</th>
<th>Value of the assets</th>
<th>Profit/month</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**Unearned Income**

C10. Did anyone in this household receive any earnings from the following sources during the last 12 months which have not yet been included?

(a) Money contributed by children or relatives (amount: )

(b) Bonus, other allowances, or extra pay (amount: )

(c) Income from interest, and other properties (amount: )

(d) Estimate of the non-monetary components of income such as

  - cooking ( ),
  - caring children ( ),
  - collecting wood ( ),
  - collecting fodder ( ),
  - grazing cattle ( ),
  - fetching water ( ),
  - washing dishes ( ),
  - laundry ( ),
  - children's contribution in the household work ( ), and
  - others (please specify ).

C11. During the last 12 months did anyone do any exchange labor or unpaid work in this household?

( ) No ( ) Yes
If Yes,

<table>
<thead>
<tr>
<th>Type of work</th>
<th>Number of days</th>
<th>Market value of the work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Assets data**

C12. **Net financial assets:**
- All bank account balances:
- Cash:
- Market value of stocks:
- Bonds:
- Life insurance: and other assets:

C13. **Net value of real estates:**
- Market value of your house(s):
- Any other real estates:

C14. **Pensions:**
- Current pension (per annum):

**Debts**

C15. **Do you have any debt?**
- () No  () Yes

If Yes,

<table>
<thead>
<tr>
<th>Type of loan</th>
<th>Amount</th>
<th>Purpose</th>
<th>Interest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

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D. HOUSEHOLD EXPENDITURES (Nepali Rupees as the monetary unit)

D1. How much did the household spend last week (or month) in the following categories?

(a) Food consumption per week or month (please specify the unit)

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooking oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
<td></td>
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<td>...</td>
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<tr>
<td>...</td>
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<td>...</td>
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</tr>
</tbody>
</table>

(b) Housing expenses per month

[Note: Rents, if any, should be taken from the answer that was asked as question # C1.]

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depreciation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(repairing cost)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rents</td>
<td></td>
<td></td>
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<tr>
<td>...</td>
<td></td>
<td></td>
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</tbody>
</table>

(c) Household operation costs per month

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td></td>
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<tr>
<td>...</td>
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</tr>
</tbody>
</table>

(d) Household supplies per month

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking utensils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detergent</td>
<td></td>
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<td>...</td>
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<td></td>
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</tbody>
</table>

(e) Expenditures on education per month or year

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uniform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Books &amp; Supplies</td>
<td></td>
<td></td>
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<tr>
<td>...</td>
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</tr>
</tbody>
</table>

(f) Clothing per month (or per season)

(g) Medical expenses per year

(h) Transportation per week or month (include vehicle fuel and maintenance costs too)

(i) Taxes per year
(j) Recreation, entertainment, and travelling expenses per year

(k) Major purchases in last 12 months (not included above) and their prices:

1. ... ... 2. ... ... 3. ... ... 4. ... ... 5. ... ... 6. ... ...

D2. Any other expenditures not included in the preceding categories (e.g., money given to relatives, charity, etc.) during the last 12 months:

1.
2.
3.
4.

D3. For a household in your economic circumstances, do you think that you are spending above average, just right, or below average?

D4. About how much did you save (or dissave) during the past 12 months?

E. INFORMATION ON WEALTH FLOWS

[Note: Ask to the respondent household.]

Genealogical chart:

E1. This question is about the information on the head of the dynasty. (The head of the dynasty could be alive or dead.)

   a. Head of the dynasty (If household head is male, this is his father; if it is female, this is her father-in-law): 

   b. His educational attainment:

   c. His occupation:
d. Was he alive or dead when the household was split-up?

( ) Alive  ( ) Dead

e. How many households were formed from that household?

f. Who became heads of the new households after they split-up?

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

g. Relationship to the household head to the head of the dynasty:

h. What types and how much wealth did this household inherit from the head of the dynasty?

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Quality</th>
<th>Approximate Value</th>
<th>Year of Inheritance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Houses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gold</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other jewelry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td></td>
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<td>Debt</td>
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</table>

i. What type of and/or how much assets do you intend to bequeath to your descendants?

E2. This section is about the information on non-respondent households.

[Note: Ask to the respondent household about other households which were split-up with this household from the same dynasty-head as this household was. If there were more than two households, use another sheet of this page of the questionnaire to ask this question for each of the households.]
a. Name of the nonrespondent household head:

b. Relationship to the head of this household:

c. What is his/her age now?

d. His/Her educational attainment:

e. How many children, if any, has he/she now?

f. Bequest information: (Year of inheritance: )

<table>
<thead>
<tr>
<th></th>
<th>Quantity</th>
<th>Quality</th>
<th>Improvement</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Land</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Houses</td>
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<tr>
<td>Gold</td>
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<tr>
<td>Other jewelry</td>
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<td>Cash</td>
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</tbody>
</table>

g. How much wealth was inherited from the predecessor?

( ) More than equal ( ) About equal ( ) Less than equal

F. BALANCE SHEET

Prepare a balance sheet showing income, expenditure, and savings (or dis­savings), and pin down different forms of savings (such as gold, jewelry, real estate, bank balances, loans etc.).
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Kalton, G.


Kim, Kwang Suk


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Leff, Nathaniel H.

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Mason, A.

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Olson, M.


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Peek, Peter


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Pressat, Roland

Projector, Dorothy, and Gertrude S. Weiss

Schnaiberg, Allan

Short, Kathleen S.

Silberberg, Eugene

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